Final Draft

ENVIRONMENTAL IMPACT ASSESSMENT

SOUTHEAST REGIONAL MEDICAL (INFECTIOUS) WASTE TREATMENT FACILITY

Submitted to:

MINISTRY OF HEALTH

2-4 Kings Street

Kingston

Prepared by:

CL ENVIRONMENTAL

Taking Care of You and Your Environment.

JULY 2007

FINAL DRAFT REPORT

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C.L. ENVIRONMENTAL

Townhouse 21, Perkins Estate

1 Perkins Boulevard

Kingston 19

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CL Environmental Co. Ltd.
clenviro@cwjamaica.com

CL Environmental Co. Ltd.
clenviro@cwjamaica.com

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LIST OF ACRONYMS

DAFOR	Dominant, Abundant, Frequent, Occasional and Rare Rating
dBA	Decibels measured on the A-scale
EIA	Environmental Impact Assessment
IGPD	Imperial Gallons Per Day
LPD	Litres Per Day
MOH	Ministry of Health
NEPA	National Environment and Planning Agency
NRCA	Natural Resources Conservation Authority
PIF	Project Information Form
TCPA	Town and Country Planning Authority
TPD	Town Planning Department

1.0 EXECUTIVE SUMMARY

BACKGROUND

This document constitutes the Final Draft Environmental Impact Assessment Report for the proposed Southeast Regional Medical (Infectious) Waste Treatment Facility.

The Ministry of Health proposes to establish a central Medical Waste Treatment Facility for the Southeast Health Region (St. Thomas, St. Catherine, Kingston and St. Andrew). The proposed project location includes the portion of land located on Princess Street east of the Kingston Public and Victoria Jubilee Hospital. The area identified for the establishment of the facility is approximate 2,500 square meters in size; a perimeter dimension of 50 meters by 50 meters. The area is currently being used as parking facility and as a storage area for waste (domestic) receptacles for the Kingston Public and Victoria Jubilee Hospital. The boundary definition is as follows:

- Northern Boundary runs along Drummond Street - approximately 50 meters.
- Western boundary runs along Princess Street – approximately 50 meters.
- Southern boundary will be formed by a perimeter fence (running parallel to North Street) that will separate the facility from the car park – approximately 50 meters.
- Eastern Boundary runs along Luke Lane – approximately 50 meters.

Medical Waste is generated during the diagnosis, treatment and immunization of humans or animals and is capable of producing infectious diseases and includes sharps (e.g. used needles and blades), infectious, and pathological waste containing HIV and other blood-borne pathogens, as well as hazardous chemical, pharmaceutical, genotoxic and radioactive wastes. Eighty-three (83%) of the total medical waste is generated by public healthcare facilities, while the remaining 17% is generated by private healthcare facilities.

At present, there are no environmentally sound medical waste treatment systems at public (or private) healthcare facilities. Most healthcare facilities treat their medical waste with on-site incinerator or 'burn box'. Majority (26 of 29) of the existing incinerators in public healthcare facilities are not fit for the treatment of medical waste. They are very old (over 20 years), poorly maintained, and are not in compliance with the Natural Resources Conservation Authority (NRCA) operating standards for medical waste incinerators. Notwithstanding, on numerous occasions, waste is either burnt and/or dumped illegally at municipal disposal sites, in gullies, or on vacant land, especially when the incinerators are out of service. Over the years, there have been several negative media reports and community concerns highlighting the problems, and placing the institutions under tremendous pressure to address the problem.

Against this background, the Government is investing in appropriate technology for the treatment of medical waste, since over 83% of total medical waste is generated by public health

care facilities and the cost of the negative effects of improper handling and disposal practices is a burden on the public purse.

The establishment of Regional Medical Waste Treatment Facilities will be implemented in two phases; phase 1 being the Southeast Health Region and phase 2 being the other health regions. The proposal to Cabinet is for the implementation of these regional treatment facilities with the steam sterilization treatment technology.

The southeast regional medical waste treatment and collection project is being implemented under the National HIV/AIDS Prevention and Control Project. The project also includes:

- Drafting of the National Medical Waste Management Policy, Regulations, Standards, and Guidelines;
- Standardize waste management procedures in all healthcare facilities;
- Waste segregation and minimization strategies;
- Training of healthcare staff in proper waste management.

It will therefore seek to:

- improve the storage, collection and treatment of medical waste in the region;
- improve the efficiency in the management of medical waste; and,
- reduce accidental exposure to blood and blood products.

Health care workers at all levels, patients and visitors at healthcare facilitators and the general public are the expected beneficiaries from this critical activity.

The number of public healthcare facilities to be serviced in the Southeast Health Region includes;

- 9 hospitals (with a bed complement of 1,626 in the year 2004)
- 30 Health Centres (of types 3, 4 & 5 status)
- 1 National Public Health Laboratory and Blood Bank

The treatment facility will replace approximately 10 malfunctioning incinerators currently in operation at public healthcare facilities within the Southeast Health Region.

On the basis of the clinical waste generated at public healthcare facilities within the Southeast Health Region (including sharps waste from other types of health centres), the proposed medical waste treatment facility will process approximately 1,885 kilogram per day or 490 tonnes annually. This is expected to increase to approximately 492 tonnes in the year 2017.

THE PROPOSED TECHNOLOGY

The MOH proposes to use the patented T-2000 ECODAS steam sterilization and shredding technology from France, which is a hybrid design of existing static autoclave technology (advance autoclave). The ECODAS treatment technology is a vertical autoclave that is fully automated with an internal shredding/maceration system at the start of the treatment cycle. The pre-shredding/maceration of infectious and pathological waste exposes greater surface area and allows easy and effective waste treatment with direct pressurized heated steam all in one enclosed system to achieve complete sterilization of infectious materials, with no harmful air or liquid emissions.

The ECODAS system achieves a volume reduction of 80% and allows the decontamination of the whole inside, including the shredder, during each cycle. Additionally, it allows for the shredder to be decontaminated throughout the normal course of the cycle, should the need arise for service. The final treated waste is harmless, unrecognizable, unusable, and is safe for disposal, just like ordinary municipal waste in a controlled sanitary landfill.

The T-2000 Ecodas equipment ensures microbial inactivation of up to 8 log10. This is above the maximum efficiency level (Level IV) defined by the State and Territorial Association on Alternative Treatment Technology (STAATT), USA: "Inactivation of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacteria, and B. stearothermophilus spores at a 6 log10 reduction or greater".

The system is made of stainless steel and is certified up to 9 bars, while the operating pressure if below 4 bars. The ECODAS Company is certified ISO 9001:2000 and carry the Conformité Européenne (CE) approval. The technology has extensive history with installations in many parts of the world including the Caribbean.

The T2000 ECODAS machine is fitted with an automated system for the loading of the waste to be treated, able to accommodate 770 litres plastic wheeled bins. This loading system, combined with a high treatment capacity, ensures absolute minimal handling for a maximum security of the operators.

Treatment Cycle

The treatment cycle of the ECODAS system involves the following steps:

1. Loading
2. Shredding
3. Heating
4. Sterilisation
5. Cooling
6. Draining
7. Vacuum
8. Unloading

Water and Wastewater

Water supply and wastewater disposal will be provided by the National Water Commission (NWC).

Water Requirements

Water will be required for both personal hygiene (domestic/foul sewage) and for facilitating the facility's operation (trade effluent). The overall water requirements for the project are estimated to be 7,800 litres (2,026 gallons) per day.

Wastewater

Two types of wastewater streams are expected from the facility. These are:

- Domestic/foul sewage (1,274 litres per day)
- A relative small amount of trade effluent/industrial effluent wastewater (6,526 litres per day)

Wastewater effluent includes:

a. Sterile residual steam

b. Low risk cooling water of the treatment equipment

c. Discharge waters from the cleaning and disinfecting of the waste containers, trucks and the treatment area

These liquid effluents will be drained into a common tank before final discharge to the sewage system. This buffer tank will be sized at 1 cubic meter and will allow cooling down the water temperature between 2 cycles (2 hours). That is, the low risk cooling water which is usually at temperatures of 65°C – 70°C will be cooled down to 26 °C – 28 °C prior to being discharged.

The cooling water is generated as water is sprayed onto the outside wall of the inner chamber of the sterilization unit to cool down the system at the end of the treatment cycle. This water **never** comes into contact with the waste, either treated or untreated and is therefore not contaminated in any way. Effluent from toilets, washing rooms etc. will be directly discharge into sewer drain.

BASELINE DESCRIPTION

Data on the existing environment were collected for Climatology, Meteorology and Air Quality, Physiography, Geology and Structure, Natural Hazards, Biological Resources, Water Quality, Noise, Land Use, Historical and Cultural Resources and Socioeconomics.

Climate and Meteorology

The temperature, relative humidity and rainfall are typical of a tropical country and are similar to the National averages.

Air Quality

Both the levels for PM10 (range from 13.89 -187.37 $\mu g/m^3$) with an annual average of 27.24 $\mu g/m^3$ and the Total Suspended Solids (TSP) (range from 13.89-111.16 $\mu g/m^3$) with an annual average of 38.22 $\mu g/m^3$ complied with the NEPA annual average standards of 50 $\mu g/m^3$ and 60 $\mu g/m^3$ respectively.

Temperature ranged from 30.9 – 31.8 ^oC and relative humidity varied from 64.2 – 69.0 %. Carbon dioxide levels at the boundaries to the proposed site ranged from 538 – 581 ppm. This is within the expected range for outdoor carbon dioxide. The levels of nitrogen dioxide and sulphur dioxide were all below the detection limits.

Physiography, Geology and Structure

The site of interest lies on the lower part of the Liguanea Plain, an alluvial fan deposit that slopes gently from an altitude at its apex of 220 m to sea level at the northern edge of Kingston Harbour. This is an old fan, originally deposited by a predecessor of the present Hope River, but now in a state of degradation being eroded by the gully systems that traverse the fan. The altitude of the site is about 26 m above sea level.

The Liguanea fan is made up of semi-consolidated and unconsolidated sediments of the Liguanea Formation of Pleistocene age (less than 2 million years old). These are sands and gravels with up to cobble and small boulder-sized debris, interbedded near the coast with silty and clayey layers. The surface of the fan is weathered to form soils belonging to the Maverly Loam of the Soil and Land Use survey (Vernon & Jones, 1959), but these have been built over and disturbed by construction over the past two or three hundred years in the lower Kingston area.

The sediments of the Liguanea fan overlie Tertiary limestones and rocks of the Coastal Group at depth. These have been extensively faulted with the youngest faults post-dating most of the Coastal Group (Late Miocene to early Pleistocene perhaps as young as 1 million years old), but the extent of faulting affecting the Liguanea fan is not known.

Natural Hazards

Hurricanes

Jamaica lies in an area in the Atlantic which experiences hurricanes. Hurricanes and tropical storms are frequently accompanied by heavy rainfall. It has also been widely suggested that the Atlantic-Caribbean region is moving, even has already moved, into a cycle of wetter and more severe tropical disturbances (IPCC, 2001). Hurricanes produce heavy rainfall and high winds which have the potential to cause damage and dislocation at the proposed Medical Waste Treatment Plant.

Earthquake

The relative frequency of seismic events in different parts of Jamaica, indicates that > 20 events greater than intensity MM VI occur per century occur in the Kingston area (Proposed location). The intensity of seismic shaking depends largely on the quality and thickness of the

unconsolidated or semi-consolidated sediments overlying the bedrock. Shallow (less than 50 m) thicknesses transmit short period motions to best effect. Longer period motions are transmitted best by thicknesses up to about 100 m (Aspinall & Shepherd, 1978).

Extreme Rainfall Events

The proposed project will be subjected to inclement rainfall events. The rainfall duration-frequency curve for Norman Manley Internal Airport indicates that the 5 minute 5 Year return period rainfall event is approximately 160 mm in one hour.

Drainage Features

The only immediately observable drainage feature in the area was a set of drop inlets on the main road on the western boundary of the project area. The area is apparently served by a network of sub-surface storm water sewer pipes. There were no reports of frequent flooding in the immediate area during heavy rainfall.

Biological Resources

Terrestrial Flora

The proposed site for the South-east Regional Medical Waste Treatment Facility is currently used as the Visitor's parking facility for the Kingston Public Hospital (KPH). The area is paved and the vegetation observed on the site was limited to the periphery and found in pockets. The trees were represented by solitary species of *Cassia fistula* (Golden Shower Tree), *Leucaena leucocephala* (Lead Tree), *Albizia lebbeck* (Woman's Tongue Tree) and *Cordia alba* (Duppy Cherry).

The vegetative pockets observed were mainly of Grass, interspersed with *Calotropis procera* (French Cotton), *Ricinus communis* (Oil Nut), *Tribulus cistoides* (Kingston Buttercup) and *Ludwigia octovalvis* (Ludwigia). The twiner, *Passiflora maliformis* (Sweet Cup) was observed in abundance on the left fence, facing the Hospital.

In total, twelve species were observed on the site and the vegetation found on the proposed site are not rare, endangered or endemic and as such the potential negative impact from the proposed development is insignificant.

Terrestrial Fauna

The disturbed nature of the proposed site (car park) and the limited vegetation resulted in no fauna being present on the site.

Land Use

Study Area

The Kingston Development Order of 1966 has developed the Kingston Development Area Land Use Zoning map. Existing land use in the study area is industrial, commercial, residential, recreational (open spaces) and offices. The built environment dominates the existing land use of

the study area. It accounts for approximately 80% of the land use of the Social Impact Area (SIA).

Proposed Site

The proposed site currently used as the public/visitors parking lot is active. However, the area is not properly designed with demarcated parking lots. In addition, the KPH hospital uses the site for storage of domestic waste. This site is also used for informal dumping of domestic waste by residents in the neighbouring communities.

Twelve (12) stalls were observed, one (1) within the car park area along the southern boundary and eleven (11) along the outside perimeter of the car park along the south and west boundary in the vicinity of the North Street United Church. Of the eleven, one stall was for "pan" chicken, one was a cook shop/ mobile restaurant and nine were variety stalls, selling snack items, fruits, drinks and juices and alcohol.

Future Land Use

The area located south of the existing parking lot will be upgraded to a car park to replace the area that will be lost due to the proposed development. The vacant lot located to the north of the existing parking lot (proposed project site), is proposed to be the site of the new Public Morgue. A section of the southern section of the realigned visitors' parking lot will be used to accommodate a compactor to store the domestic garbage that is currently being stored at the northern section of the proposed project site.

Both the proposed project site as well as the realigned parking lot will be secured with a perimeter fence.

An aerial access ramp linking KPH/VJH to the realigned parking lot and treatment facility will be constructed.

Noise

Baseline noise measurements were taken at eight (8) locations using a Quest SoundPro DLX sound level meter.

The average noise levels at all stations were not compliant with the NEPA guidelines for silence zone (50 dBA – daytimes and 40 nighttimes). A silence zone is defined as areas up to 100 metres around such premises as hospitals, educational institutions and courts. Octave band analysis shows that the noise at the stations was in the low frequency band centred around the geometric mean frequency of 63 Hz.

Historical and Cultural Resources

The Jamaica National Heritage Trust (JNHT) have listed buildings, places and monuments that are of historic of cultural significance in close proximity to the proposed Medical Waste Treatment Facility.

These include;

Buildings of Architectural and Historic Interest

- 40 Harbour Street,
- Headquarters House,
- Duke Street,
- Kingston Railway Station, Barry Street.

Churches, Cemeteries and Tombs

- Coke Methodist Church, East Parade,
- Negro Aroused,
- Kingston Parish Church, South Parade.

Statues and Other Memorials

- The Bust of General Antonio Maceo, National Heroes Park (NHP),
- The Cenotaph (NHP),
- Negro Aroused, Ocean Boulevard,
- The Monument to Rt. Excellent Alexander Bustamante (NHP),
- The Monument to Rt. Excellencies George William Gordon and Paul Bogle, (NHP),
- The Monument to Rt. Excellent Marcus Garvey (NHP),

- The Monument to Rt. Excellent Norman Manley (NHP),
- The Monument to Rt. Excellent Sam Sharp (NHP),
- The Monument to Rt. Excellent Nanny of the Maroons (NHP),
- Monument to the Rt. Excellent Sam Sharpe,
- National Heroes Park, The Monument to Rt. Hon. Donald Sangster (NHP),
- The Statue of Queen Victoria, St. William Grant Park (SWGP),
- The Statue of Father Joseph Dupont (SWGP),
- The Statue of Hon. Edward Jordan (SWGP),
- The Statue of Sir Charles Metcalfe (SWGP),
- The Statue of Rt. Excellent Alexander Bustamante (SWGP).

Historic Sites

- Liberty Hall, 76 King Street

Public Buildings

- Ward Theatre, North Parade,
- George William Gordon House, Duke Street which is protected.

Another area of cultural/social interest is Sabina Park, which upon recently was the only international recognised cricket field in Jamaica to which many a generations have come to watch and enjoy both test match and one day cricket.

Socioeconomics

Demography

Regionally the population of Kingston was 96,016 persons, St. Andrew was 555,726 persons, St. Catherine was 482,265 persons and St. Thomas was 91,597 persons. During the last intercensal period (1991 –2001), St. Kingston, St. Andrew, St. Catherine and St. Thomas had annual growth rates of -0.38%, 0.29%, 2.36% and 0.70% respectively.

The study area (SIA) had a population of approximately 97,301 persons in 2001. At the time the study was conducted, the estimated population was 96,791 persons, calculated at an annual growth rate of -0.38 and 0.29 % for Kingston and St. Andrew respectively (1991-2001 intercensal period). It is expected that the population will reduce to 95,105 persons over the next 25 years if the current population growth rate is maintained.

Within the SIA in 2001, the 15-64 years age category accounted for 59.7% of the population, with the age 0-14 years (35.4%) and the age 65 and over category accounting for 4.9%. The segment of a population that is considered more vulnerable are the young (children less than five years old) and the elderly (65 years and over). In this population, approximately 11.9% were in the young category and 4.9% were in the 65 years and older category.

Population Densities

The land area within the SIA was calculated to be approximately 11.47 km^2. With a population of approximately 97,301 persons the overall population density was calculated to be ≈ 8,483 person/km^2. This population density is higher than National figure (238 persons/ km^2) by at least fourfold. The population density of the SIA is considered high.

Employment and Income

The main employment within Kingston rely heavily on the Services, Commerce and Industry sectors including the Wholesale and Retail Trade, whilst in the parishes of St. Andrew and St. Catherine Community Social and Personal Services provide most of the employment. Unemployment rate for the four parishes in which the Southeast Medical Region fall, having varying unemployment rates over the five year period (1998 – 2002). In 2002, St. Andrew (11.5%) had the lowest unemployment rate whilst St. Thomas had the highest (22.3%). Within the Southeast Health Region in 2002, St. Catherine (6.2%) had the lowest incidence of poverty and St. Thomas (28.7%) had the highest.

During construction of the proposed development it is anticipated that approximately twenty eight (28) persons will be employed. This is broken up into 16 skilled workers and 12 unskilled labourers. It is anticipated that during the operation of the facility the staffing requirement will be approximately 14 persons.

Land Tenure

In 2001, 8% of the households in the SIA owned the land on which they lived. Approximately, 13.7% rented the land on which they were, 10.5%, lived rent free, 65.2% did not report the type of ownership arrangements they had, probably due to informal arrangements ("squatting"), to which they did not want to admit to, 1% "squatted" 0.9% had other arrangements and 0.7 leased.

Housing

Approximately sixty five percent (65.1 %) and 81.5% of the housing units in 2001 in Kinston and St. Andrew respectively were of the separate detached type, 30.6 % and 16.7 % attached type, 2.0 % and 0.4 % part of commercial building, and 0.3 % and 0.1 % improvised housing, 0.6 % and 0.1 % other and 1.3 % each not stated.

In 2001, there were approximately 13,388 housing units, 28,832 private dwellings and 29,708 households the study area. The average dwelling in each housing unit was 2.15 and the average household to each dwelling was 1.03. The average household size was 3.27 persons/household.

Separate housing accounted for 57.8 % of the housing units in the SIA in 2001. Approximately thirty eight percent (37.8%) was attached housing and 2.1 % part of a commercial building, 1.4% did not state the type of housing unit, 0.6% other, and 0.3% improvished housing.

With the exception of the attached category which was higher in the SIA, and higher St. Andrew data for detached housing and generally lower percentages for the other categories the other categories were either similar or lower to what obtained in the parishes.

Infrastructure

Electricity

The proposed development is estimated to consume approximately 1,033.62 kilowatts per day.

Other Services

Fire Station

There are two (2) fire stations within the SIA. They are York Park and Trench Town. York Park is located approximately 500m (≈ 0.3 miles) north northeast of the proposed development site. Trench Town is located approximately 1.5 km (≈ 0.9 miles) north west of the proposed site.

York Park fire station would be responsible for responding to any fires at the proposed Southeast Regional Medical Waste Treatment Facility. The proposed development will have its own fire control system with a series of fire extinguishers, and smoke detectors and alarms.

Police Station

There are five (5) police stations within the SIA. These are West Street, Kingston West (Denham Town), Elleston Road. Kingston Central and Cross Roads. The Denham Town police station is responsible for policing the proposed site area.

Community Perception

Luke Lane

Nine households were interviewed on Luke Lane on June 22, 2007. The nine households represented the majority of the households.

Of these nine households, 78% of the respondents were aware that an incinerator was present at Kingston Public Hospitals and Victoria Jubilee Hospitals and/or the National Laboratory and Blood Bank. Of the seventy eight-percent, 43% of the respondents indicated that they were affected by the presence/use of the incinerator. They said that they were affected mainly by smoke which blows across to Luke Lane. The respondents indicated that the impact of the smoke from the incinerator was most noticeable in the mornings and in the evening specifically 4:00 and 5:00pm. During the time the field team administered the questionnaire within the community, a black plume of smoke was observed at approximately 7:50 am, in the direction of the incinerator at KPH/VJH, although it at the time it did not blow in the direction of Luke Lane.

On the issue of garbage being disposed of at the proposed site, the respondents indicated that waste was from Luke Lane and KPH/VJH. The residents indicated that the location is not ideal for waste disposal, but they dispose of their garbage at the site because the garbage truck does not drive along their street to collect waste, therefore they take it to the nearest place that the garbage truck collects

from. They were also cognizant of the associated health risks (such as vermin infestation) caused by improper garbage disposal. They also stated that children play in the garbage and the stench and smoke from burning the garbage was causing some impact.

Of the households interviewed, only one respondent (11%) was aware of the proposed Medical Waste Treatment Facility project and indicated that information was received through the news.

Regarding the possible effect of the proposed waste treatment facility, respondents indicated that they did not think the facility would affect them. While one respondent indicated no impact, he continued by explaining that the facility will improve the area especially as it related to public health.

Other general comments received were:

- Sometimes children play with syringe and pills from the KPH waste.
- Better garbage collection needed.
- Containers put on North Street are too small for the volume of garbage generated on Luke Lane.
- Better housing solutions needed. Option to relocate to a better area or upgrade existing housing infrastructure to make homes more habitable.
- Wastewater is a problem, gray water runs on to roadway from yard not into a sewer.
- Children will not have the car park as a play area.
- Area has a crime problem.

General Observations:

- Elderly persons were observed rummaging through the garbage for food.
- Pedestrian traffic through the site is moderate.

Other Communities

All persons interviewed from the surrounding communities were aware of the existing incinerator at the Kingston Public Hospitals and Victoria Jubilee Hospitals and/or the National Laboratory and Blood Bank. Of this, 68% commented that they were affected by the presence of the incinerator and in particular the smoke, black soot, odour and health effects. 78% of interviewees indicated that the effects are most noticeable at a specific time of day. Times given included midday, morning and evening hours.

About 52% of persons interviewed believed that the car park is an ideal location for the disposal of garbage, whilst 41% believed it was unsuitable and 6% did not respond. Those that did not believe the location was ideal commented that the disposal of garbage at the car park is unhealthy and an eyesore.

Only 22% of those interviewed were aware that the MOH is proposing to construct a medical waste treatment facility at the existing car park area and indicated that this was via the news and word of mouth from friends. 83% did not believe that the proposed facility would affect them, whilst 11% thought that the facility would affect them negatively and 6% were not sure. Odour, health effects and noise were stated as potential negative effects.

Other comments received included:

- Crime and violence in the area.
- More employment needed, especially for youth.
- Desire for development of housing.
- Need for more frequent collection of garbage.

KPH Staff

The main concerns from the senior management of KPH were;

- Who will manage the facility?
- Where will they dispose or store their domestic/general waste since the proposed development is going to take away their present storage area?
- Security of the facility and car park.
- Lighting of the area.
- Traffic flow for the ambulances wanting to get to the hospitals.
- Back-up water supply for the proposed facility as they say they experience water lock offs.
- Parking, as the proposed Medical Waste Treatment Facility will take away a section of the existing park for both visitors and staff.

The medium to long term plans for the KPH as it relates to expansion and the increase in services offered.

ENVIRONMENTAL IMPACTS

Sensitive issues have been identified and appropriate mitigative steps have been outlined. Some of these issues relate to the noise pollution, emergency response, waste and waster water disposal.

ALTERNATIVES

Alternatives to the proposed development were explored including the "No Action Alternative". Other alternatives explored were the proposed Development as described in the EIA but at another location west (Bumper Hall) of the proposed site, Using an incinerator to treat the medical waste collected and Using an alternative technology such as Mechanical/Chemical Disinfection,

Microwave and Irradiation to treat the medical waste collected. Based on the above, the most environmentally and economically sound alternative is the development as proposed in the EIA.

ENVIRONMENTAL ACTION PLAN

An Environmental Action Plan, the reporting requirements and costs were outlined.

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Background

An Environmental Impact Assessment (EIA) is "a structured approach for obtaining and evaluating environmental information prior to its use in decision-making in the development process. This information consists, basically, of predictions of how the environment is expected to change if certain alternative actions are implemented and advice on how best to manage environmental changes if one alternative is selected and implemented" (Bisset, 1996).

The basis of EIAs has been summarised as follows[1]:

- Beyond preparation of technical reports, EIA is a means to a larger end - the protection and improvement of the environmental quality of life.
- It is a procedure to discover and evaluate the effects of activities on the environment - natural and social. It is not a single specific analytic method or technique, but uses many approaches as appropriate to the problem.
- It is not a science but uses many sciences in an integrated inter-disciplinary manner, evaluating relationships as they occur in the real world.
- It should not be treated as an appendage, or add-on, to a project, but regarded as an integral part of project planning. Its costs should be calculated as a part of adequate planning and not regarded as something extra.
- EIA does not 'make' decisions, but its findings should be considered in policy - and decision-making and should be reflected in final choices. Thus it should be part of decision-making processes.

[1] Wood, C., "Environmental Impact Assessment: A Comparative Review" p. 2. (from Caldwell, 1989, p.9)

- The findings of EIA should focus on the important or critical issues, explaining why they are important and estimating probabilities in language that affords a basis for policy decisions.

2.2 Environmental Review and Permitting Process

The Environmental Permit and License System (P&L), introduced in 1997, is a mechanism to ensure that all new developments in Jamaica meet required standards in order to minimize negative environmental impacts. The P&L System is administered by the National Environment and Planning Agency (NEPA, formerly the Natural Resources Conservation Authority, NRCA) and allows NEPA the right to issue permits for new developments and request EIA studies where necessary. Under the NRCA Act of 1991, the NRCA/NEPA is authorized to issue, suspend and revoke permits and licences if facilities are not in compliance with the environmental standards and conditions of approval stipulated.

Permits are required by persons undertaking new developments which fall within a prescribed category; 'Hazardous waste storage or treatment or disposal facilities' require such a permit. A Project Information Form (PIF) and a Permit Application (PA) must be completed and submitted to NEPA with the required application fee. NEPA will then determine if an EIA is required and provide a Guideline Terms of Reference for carrying out the EIA.

The Southeast Regional Medical Infectious Waste Treatment Facility falls within the prescribed category of 'Hazardous waste storage or treatment or disposal facilities'. A Project Information Form and Project Application Form were submitted to NEPA and an EIA for the project was requested. CL Environmental Co. Ltd. was contracted to undertake the EIA for this project; this document comprises the EIA report.

2.3 National Legislation

Legislation exists within the Ministry of Health that indirectly governs some aspects of medical waste management. However, many of the existing national policies and legislation directly relate to medical waste management and their jurisdiction is the responsibility of various regulatory agencies other than the Ministry of Health.

The following list indicates the legislation that has direct and indirect relevance to medical waste management.

- The Natural Resources Conservation Act, 1991
- The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996
- The Natural Resources Conservation (Permits and Licences) Regulations, 1996
- The Natural Resources Conservation (Air Quality) Regulations, 2002 (Draft)
- The Natural Resources Conservation, (Ambient Air Quality Standards) Regulations, 1996
- National Solid Waste Management Act 2001
- The Clean Air Act, 1964
- The Public Health Act, 1985
- The Public Health (Nuisance) Regulations, 1995

The relevant policies are:

- The Medical Waste Management Policy for Jamaica (Draft) 2006
- Health Facilities Infection Control Policies and Procedures Manual

- The Solid Waste Management Policy, 2000
- The Draft Hazardous Wastes and Substances Policy

The above-mentioned Acts and policies are described briefly in the following sections, as well as additional legislation relevant to any new development.

2.3.1 Direct and Indirect Relevance to Medical Waste Management

Natural Resources Conservation Act (1991)

The Natural Resources Conservation Act (NRCA) may be considered Jamaica's umbrella environmental law. The purpose of the Act is to provide for the management, conservation and protection of the natural resources of Jamaica. This Act was passed in the Jamaican Parliament in 1991 and subsequent to this; the Natural Resources Conservation Authority (NRCA) was established with the function of taking necessary steps to ensure the sustainable development of Jamaica through the protection and management of Jamaica's physical environment. The NRCA Act, under Sections 9 and 10 specifies that an Environmental Impact Assessment (EIA) is required from an applicant for a permit for undertaking any new construction, enterprise or development.

The NEPA (NRCA), in performing its functions may formulate standards and codes of practice to be observed for the improvement and maintenance of the quality of the environment generally, including the release of substances into the environment in connection with any works, activity or undertaking. Thus, the management of medical waste as it relates to the potential adverse effect it could have on the environment falls within the jurisdiction of the NRCA.

The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order (1996)

Section 9 of the NRCA Act declare the entire island and the territorial sea a 'prescribed area', in which specified activities require a permit, and for which activities an environmental impact assessment may be required. The Natural Resources (Prescribed Areas) (Prohibition of Categories of

Enterprise, Construction and Development) Order (1996) and the Permits & Licensing Regulations (Section 2.2) was passed as a result of section 9 of the NRCA Act.

Hazardous waste storage, treatment and disposal facilities are included in a category listed in this Order as requiring a permit from NEPA. Since medical waste comprises some hazardous and toxic waste streams, the establishment of facilities to treat and dispose of medical waste will require a Permit from NEPA. In cases where the treatment/disposal option for medical waste results in air emissions from point sources such as incinerators or effluent discharge, a licence would also be required.

The Natural Resources Conservation (Permits and Licences) Regulations, 1996

These regulations were mentioned previously in section 2.2, wherein a Permit Application and a Project Information Form are to be submitted to NEPA in accordance with the Natural Resources Conservation (Permits and Licences) Regulations, 1996 for the construction and operation of new developments, and in this case, hazardous waste storage, treatment and disposal facilities. An Environmental Impact Assessment (EIA) may be requested by NEPA for the proposed activity. This regulation is applicable to medical waste treatment and disposal facilities.

The Natural Resources Conservation Authority (Air Quality) Regulations, 2002

Under section 38 of the NRCA Act, regulations pertaining to air quality in Jamaica are stipulated. The National standards, known as the National Ambient Air Quality Standards (NAAQS), are categorized into two groups. In one group, there are the primary standards, designed to protect human health and in the other, there are the secondary standards designed to protect the environment and limit property damage.

In cases where the treatment and disposal option will require the release of air emissions from point sources, these regulations would apply. These regulations require industrial sources (with emissions greater than a specified amount) to obtain air pollutant discharge licences. It also establishes stack emission standards for new sources and ambient air quality guideline concentrations for a wide range of toxic air pollutants. These regulations complement the National Ambient Air Quality Standards for common air pollutants.

The Natural Resources Conservation, (Ambient Air Quality Standards) Regulations, 1996

The Natural Resources Conservation, (Ambient Air Quality Standards) Regulations, 1996 set the acceptable limits for common air pollutants in ambient air. Since the treatment of medical waste has the potential to result in the emission of air pollutants, this regulation would be applicable to ensure that controls are in place to prevent emissions from adversely impacting the ambient air quality.

Water Quality Standards

The NRCA has primary responsibility for control of water pollution in Jamaica. National Standards for industrial and sewage discharge into rivers and streams, in addition to standards for ambient freshwater exist. For drinking water, WHO Standards are utilized and these are regulated by the National Water Commission (NWC).

The National Solid Waste Management Authority Act (2001)

The National Solid Waste Management Authority Act of 2001 is "an act to provide for the regulation and management of solid waste; to establish a body to be called the National Solid Waste Management Authority and for matters connected therewith or incidental thereto". The National Solid Waste Management Authority (NSWMA) was established in April 2002 as a result of this Act to effectively manage and regulate the collection and disposal of solid waste in Jamaica. As such, the NSWMA aims to safeguard public health and the environment by ensuring that domestic waste is collected, sorted, transported, recycled, reused or disposed of in an environmentally sound manner. In addition, public awareness and education is a part of their responsibilities. The NSWMA would therefore have to be satisfied that the management of medical waste meets their required operational standards for segregation, storage, collection, treatment and disposal.

The establishment of operational standards to ensure the safety of persons collecting garbage and working at disposal sites, and for vehicles transporting waste is the mandate of the NSWMA. Operational standards in these areas as they relate to medical waste management will be developed through a collaborative approach between the NSWMA and the Ministry of Health.

Additionally, standards and procedures for the handling of residues from treated medical waste such as ash from incinerators and shredded autoclaved residues are to be established by the NSWMA to ensure safe handling and disposal of these wastes at disposal sites. Disposal of parts from decommissioned medical waste treatment and disposal facilities would also be an operational aspect that would come under the purview of the NSWMA.

Closely linked to this Act, is the National Solid Waste Management Policy (2000) that indicates that the Ministry of Health has responsibility for establishing policy for the management of medical waste. It also indicates that the Ministry of Health will collaborate with the National Solid Waste Management Authority (NSWMA) on the operational aspects governing the management of medical waste to ensure the best use of the Government's scarce resources.

Clean Air Act

The Clean Air Act, 1964 enables the Ministry of Health's inspectorate to regulate gas emissions such as smoke, fumes, other gases or dust. Under this Act an inspector, upon verification of his authority if so required, may enter any affected premises at any time while work is being carried on there, or while there is any discharge of smoke or fumes, gases or dust into the air from any part of such premises and inspect and examine the premises or any part thereof and may make enquiries, conduct tests and take samples of any substance, smoke, fumes, gas or dust as he considers necessary or proper for the performance of his duties.

As such, healthcare facilities should ensure that emissions associated with on-site medical waste treatment facilities are not in breach of Section 5 of this Act.

Public Health Act

The Ministry of Health (MOH) has jurisdiction over waste management under the Public Health Act (1975) and its 1976 amendment particularly as it relates to impact on public health. The establishment of the policy governing the management of medical waste and the enactment of legislation and management plans for its implementation is the responsibility of the MOH. In addition, the MOH also has responsibility for public hospitals, clinics and laboratories and must ensure that waste from these facilities is disposed of in an appropriate manner.

Under section 20 (1) of the Public Health Act, 1985 a Medical Officer (Health) or any other person authorised in writing by the Minister of Health, a Local Board, or the Medical Officer may at all reasonable times enter any premises for the purpose of ensuring compliance with the provisions of this Act, or any associated regulations and shall, if required to do so by the person in charge of the premises, produce his authority for entering to such person.

The main purpose of this act does not directly relate to the management of medical waste, however it's relevance to medical waste management lies within the fact that the waste being managed by healthcare facilities is infectious and toxic, thereby posing a potential hazard to staff, waste handlers and the wider public if it is not disposed of appropriately.

The Public Health (Nuisance) Regulations, 1995

Under the Public Health (Nuisance) Regulations, 1995, a nuisance is stipulated to be any nuisance specified in the schedule to the Regulations and can include dust, smoke, fumes, gases or deposits of solid waste from any manufacturing process or caused by carrying on any trade or business or otherwise by the action of any person.

No person shall cause or permit a nuisance on any premises owned or occupied by him or aid and abet any other person to cause or permit nuisance on any premises. Under the Act the Local Board, on receipt of a report, may institute legal proceedings against a person for non-compliance with a notice to cease the activity causing a nuisance or authorise in writing any person to enter the premises to take the necessary actions to abate or prevent a recurrence of the nuisance.

This regulation controls any nuisances that may arise from treatment and disposal of medical waste; however it does not grant the Ministry of Health direct jurisdiction over medical waste.

2.3.2 Relevant Policies

Medical Waste Management Policy for Jamaica (Draft) 2006

The draft medical waste management policy was developed in 2006 out of the increased health and environmental concerns about the handling, treatment and disposal of medical waste in Jamaica as well as the numerous options available for treatment and disposal.

[2]The policy covers the management of medical waste that is generated by healthcare, pharmaceutical and veterinary facilities hereinafter referred to as healthcare facilities. It outlines the regulatory and operational requirements to manage waste in a manner that ensures:

- a safe and healthy environment for employees, patients and visitors
- compliance with national policies and regulations which govern waste management
- protection of surrounding communities from potential harm that may be associated with inappropriate handling, treatment and disposal of medical waste
- that legal liability associated with the improper management of medical infectious waste is avoided

The Policy stipulates that "medical waste management is the responsibility of the person in charge of the healthcare facility from generation through to safe treatment and disposal. As waste generators, managers and owners of healthcare facilities must ensure that systems are in place for proper management of medical waste.

The policy recognizes that the existing legislation under the jurisdiction of the Ministry of Health is weak, outdated and not specific to medical waste management. While NEPA, the Ministry of Health and the NSWMA are able to regulate some aspects of medical waste management based on

[2] Adapted from the draft Medical Waste Management Policy for Jamaica, 2006.

their legislation, there are issues specific to medical waste that are not covered. To address these deficiencies, the Ministry of Health will develop legislation specifically applicable to the sector and the Environmental Health Unit in the Ministry of Health will be responsible for enforcing the legislation. The new legislation will be developed in accordance with this policy to establish enforceable standards and operational criteria that will lead to acceptable management of medical waste.

The Ministry of Health in collaboration with the NSWMA will develop a licencing regime for waste haulage service providers and haulage vehicles operating within the healthcare sector. The Ministry will define the health and infection control criteria and the NSWMA will address the operational requirements. The administration of this licencing regime will be the responsibility of the NSWMA since they already have the operational, administrative and legislative systems for licencing garbage collectors.

New legislation will have provisions for:

- The Ministry of Health and healthcare facilities to develop Medical Waste Management Plans

- The Ministry of Health through the Environmental Health Unit and the Public Health Inspectorate to monitor healthcare facilities on their adherence to the Medical Waste Management Policy and the implementation of Medical Waste Management Plans.

- The Minister of Health to identify and appoint an independent auditor (to avoid a conflict where the Ministry regulates itself) to assess on at least an annual basis the public sector's adherence to the Medical Waste Management Policy and implementation of Medical Waste Management Plans.

- Copies of the auditor's reports to be submitted to the National Solid Waste Management Authority and the National Environment and Planning Agency for their review.

The new legislation will be complementary to other Ministry of Health legislation; the National Solid Waste Management Act and associated regulations; the Natural Resources Conservation Authority

Act and its regulations including those related to hazardous waste and the Occupational Safety and Health Act being developed by the Ministry of Labour.

In addition to legislation to regulate activities within the sector, the Ministry will develop and utilize Codes of Practice and Guidelines where applicable to support the policy goals and objectives.

Health Facilities Infection Control Policies and Procedures Manual

The Health Facilities Infection Control Policies and Procedures Manual is intended to guide healthcare workers in the overall management of an "Infection Control Programme". Furthermore, the manual is utilised by the Ministry of Health as a basis for conducting audits of health facilities. It outlines waste management techniques to prevent the transmission of infections within the healthcare sector. For maximum effectiveness, it is advised that the manual be used in conjunction with the policy for the management of medical wastes.

The National Solid Waste Management Policy (2000)

This policy indicates that the Ministry of Health has responsibility for establishing policy for the management of medical waste. It also indicates that the Ministry of Health will collaborate with the National Solid Waste Management Authority (NSWMA) on the operational aspects governing the management of medical waste to ensure the best use of the Government's scarce resources.

2.3.3 Other Legislation

Wild Life Protection Act (1945)

The Wild Life Protection Act of 1945 is mainly concerned with the protection of specified faunal species. Under this Act, the removal, sale or possession of protected animals; use of dynamite, poisons or other noxious material to kill or injure fish; and the discharge of trade effluent or industrial waste into harbours, lagoons, estuaries and streams are prohibited. In addition, this Act protects several rare and endangered faunal species including six species of sea turtle, one land mammal, one butterfly, three reptiles and a number of game birds. The establishment of Game Sanctuaries and Reserves is authorized under this Act.

The Endangered Species Act (2000)

The Endangered Species (Protection, Conservation and Regulation of Trade) Act was created in 2000 in order to ensure the codification of Jamaica's obligations under the Convention for the International Trade in Endangered Species of Wild Fauna and Flora. This Act governs international and domestic trade in endangered species in and from Jamaica. Under this act, the functions of NEPA include the grant of permits and certificates for the purpose of international trade, the determination of national quotas and the monitoring of the trade in endangered species.

Water Resources Act (1995)

The Water Resources Act (1995) was promulgated in the Jamaican Parliament in September 1995 and ratified in April 1996. This Act established the Water Resources Authority (WRA), which is authorized to regulate, allocate, conserve and manage the water resources of the island. The WRA is also responsible for water quality control; as stipulated under Section 4 of the Act the WRA is responsible for providing any department or agency of Government, technical assistance for any projects, programmes or activities relating to development, conservation and the use of water resources.

Section 25 advises that a proposed user will have to obtain planning permission, if this is a requirement, under the Town and Country Planning Act. In addition, under Section 21 it states that if the water to be used will result in the discharge of effluents, an application for a license to discharge effluents will have to be made to the Natural Resources Conservation Authority or any other relevant body as indicated by the Minister.

Country Fires Act (1942)

The Country Fires Act of 1942 prohibits the setting of fire to garbage without prior notice being given to the nearest police station and the occupiers of all adjoining lands (Section 4). In addition, a space of at least 15 feet in width must be cleared around all trash to be burnt and all inflammable material removed from the area. Under section 6 of the Act, the Minister may prohibit, as may be necessary, the setting of fire to trash without a permit.

Offences against this Act include:

- Setting fire to trash between the hours of 6.00 p.m. and 6.00 a.m. (Section 5a)
- Leaving open-air fires unattended before they have been completely extinguished (Section 5b)
- Setting fires without a permit and contrary to the provisions outlined in Section 6 (Section 8)
- Negligent use or management of a fire which could result in damage to property (Section 13a)
- Smoking a pipe, cigar or cigarette on the grounds of a plantation which could result in damage to property (Section 13b)

Noise Standards

The Noise Abatement Act of 1997 was created in order to regulate noise caused by amplified sound and other specified equipment. This act has been said to address "some concerns but is too narrow in scope and relies on a subjective criterion" (McTavish[3]). Given this, McTavish conducted a study to recommend wider and more objective criteria in accordance with international trends and standards, but tailored to Jamaica's conditions and culture.

To date, apart from the Noise Abetment Act (1997), Jamaica has no other National legislation for noise.

Town and Country Planning Act (1958)

The Town and Country Planning Act of 1958 authorizes the Town and Country Planning Authority to prepare, after consultation with any local authority, the provisional development orders required

[3] A Review of Jamaican and International Noise Standards, Prepared for National Resources Conservation Authority, by Dr. J.L. McTavish, consultant.

for any land in the urban or rural areas. The purpose of these orders is to control the development of land in the defined area. In this way, the Authority will then be able to coordinate the development of roads and public services, whilst conserving the resources in the area. The proposed development (Southeast Regional Medical (Infectious) Waste Treatment Facility) falls within the area that is guided by the Kingston Development Order of 1966. This area is zoned for Government Purposes and Statutory Undertakings.

Any person may, under Section 6 of the Act, object to any development order on the grounds that it is:

- Impractical and unnecessary;
- Against the interests of the economic welfare of the locality.

However, if the Minister is of the belief that the implementation of the provisional development order is likely to be in the public interest, he may, under Section 7 (2) of the Act, confirm it with or without modification by publishing a notice in the Gazette. Section 8 of the Act also gives the Minister the authority to amend a confirmed development order.

Under Section 10 of the Act, it is stipulated that a development order must include:

- Clearly defined details of the area to be developed;
- Regulations regarding the development of the land in the area specified;
- Formal granting of permission for the development of land in the area.

If the provisions of section 9A of the NRCA Act apply to the development, the application can only be approved by the Planning Authority after NEPA has granted a permit for the development. The Authority may impose a "tree preservation order" under Section 25 of the Act if it considers it important to make provision for the preservation of trees and woodlands in the area of the development. This order may:

- Prohibit the cutting down, topping, lopping or willful destruction of trees;

- Secure the replanting of any section of the woodland area in which trees were felled during the forestry operations permitted under the order.

The tree preservation order is not applicable to the cutting down of trees which were already dead, dying or had become dangerous and the order can take effect only after it has been confirmed by the Minister. The Minister can, under Section 26 of the Act, make regulations to restrict and regulate the display of advertisements in any area to be developed if he considers this to be in the interest of public safety. Section 28 of the Act empowers the local authority to require the owner or occupier of land in the development area to take the steps necessary to ensure its proper maintenance.

Jamaica National Heritage Trust Act (1985)

The Jamaica National Heritage Trust Act established the Jamaica National Heritage Trust (JNHT). Section 4 of this 1985 Act outlines the functions of the JNHT and includes the following:

- To promote the preservation of national monuments and anything designated as protected national heritage for the benefit of the island;
- To carry out such development as it considers necessary for the preservation of any national monument or anything designated as protected national heritage;
- To record any precious objects or works of art to be preserved and to identify and record any species of botanical or animal life to be protected.

Under Section 17 it is stipulated that it is considered an offence for any individual to:

- Wilfully deface, damage or destroy any national monument or protected national heritage or to deface, damage, destroy, conceal or remove any mark affixed to a national monument or protected national heritage;
- Alter any national monument or mark without the written permission of the Trust;
- Remove or cause to be removed any national monument or protected national heritage to a place outside of Jamaica.

Registration of Titles Act (1989)

The Registration of Titles Act of 1989 is the legal basis for land registration in Jamaica. A modified Torrens System (Centre for Property Studies, 1998) is used as the fundamental tool for this and under this system, land registration is not compulsory, although once a property is entered in the registry system the title is continued through any transfer of ownership.

2.4 International Legislative and Regulatory Considerations

2.4.1 Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) (1983)

Adopted in March 1983 in Cartagena, Colombia, the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, more commonly referred to as the Cartagena Convention, is the sole legally binding environmental treaty for the Wider Caribbean. The Convention came into force in October 1996 as a legal instrument for the implementation of the Caribbean Action Plan and represents a commitment by the participating countries to protect, develop and manage their common waters individually and jointly. The Convention was ratified by twenty (20) countries and acts as a framework agreement that sets out the political and legal foundations for actions to be developed. The operational Protocols, which direct these actions, are designed to address special issues and to initiate concrete actions. The Convention is currently supported by three Protocols as follows:

- *The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region* (The Oil Spills Protocol), which was adopted and entered into force at the same time as the Cartagena Convention;

- *The Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region* (The SPAW Protocol), which was adopted in two stages, the text in January 1990 and its Annexes in June 1991. The Protocol entered into force in 2000;

- *The Protocol Concerning Pollution from Land-based Sources and Activities in the Wider Caribbean Region* (LBS Protocol), which was adopted in October, 1999.

2.4.2 The Convention on Biological Diversity

Signed by 150 government leaders at the 1992 Rio Earth Summit, the Convention on Biological Diversity (CBD) is committed to promoting sustainable development. The CBD is regarded as a means of translating the principles of Agenda 21 into reality and recognizes that "biological diversity is about more than plants, animals and micro organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live".

The CBD may be considered the first global, comprehensive agreement which focuses on all aspects of biodiversity, to include genetic resources, species and ecosystems. In order to achieve its main goal of sustainable development, signatories are required to:

- Develop plans for protecting habitat and species.
- Provide funds and technology to help developing countries provide protection.
- Ensure commercial access to biological resources for development.
- Share revenues fairly among source countries and developers.
- Establish safe regulations and liability for risks associated with biotechnology development.

Jamaica's Green Paper Number 3/01, 'Towards a National Strategy and Action Plan on Biological Diversity in Jamaica', is evidence of Jamaica's continuing commitment to its obligations as a signatory to the Convention.

2.5 EIA Process

The EIA Process is described below:

- The NRCA permit and licence procedure is initiated by the submission of the Project Information Form (PIF) to the Authority. The PIF screening form is reviewed to determine whether an EIA is required and to begin determining areas of environmental significance, especially in waste discharge.

- Based on the review of the PIF, NEPA advised that an EIA would be required for the Southeast Regional Medical Waste Facility. The consultant then liaises with the NRCA to determine the scope of the EIA through proposed Terms of Reference (TORs). The TORs are proposed by the consultant using NRCA guidelines and are approved by the NRCA. Appendix A has the approved TORs for this project.

- The EIA is then prepared by a multi-disciplinary team of professionals (see Appendix B for the team used in this assessment). The NRCA requires that the EIA include the following:

    - A description of the present environment, i.e. physical, biological and social environment. This includes, for example, consideration of economic situations, cultural heritage and ecological preservation.

    - A description of the significant impacts the environmental professionals expect the development to have on the environment, compared to the environment that would remain if there were no development. This will include indirect and cumulative impacts.

    - An analysis of alternatives that were considered in order to consider means of minimising or eliminating the impacts identified above.

    - An Environmental Management Plan, which includes a Monitoring & Hazard Management Plan and an Auditing schedule.

- The NRCA guidance on EIAs states that this process "should involve some level of stakeholder consultation in either focus groups or using structured questionnaires." A draft EIA is submitted to the developer to solicit the proponents' input into the description of the project (to check for accuracy of statements, and to enter into realistic discussions on the analysis of alternatives, as well as to inform the proponents of any other relevant legislation with which they must comply).

- Ten (10) hardcopies of the finalised draft and an electronic copy are then submitted to NEPA, two to the client, and the consultant keeps one (13 in all are produced). NEPA distributes these to various other public sector institutions who sit on the Technical Committee (e.g. WRA, ECD, JNHT etc.) for their comments. Typically this depends on the nature of the project.

- As deemed necessary by the NRCA, Public Meetings are then held, following the deposition of the Draft EIA at Parish Libraries (by the NRCA). A verbatim report of the public meetings is required, as well as a summary report of the main stakeholder responses which emerged.

- The comments of the NRCA, the other GOJ interests and the public are compiled and submitted in writing to the consultant not only for finalisation of the report but for incorporation into the development's design.

- The NRCA then reviews this report again, and if further clarifications are needed, these are again requested. Once the NRCA is satisfied, the EIA is submitted to the Technical Committee of the NRCA Board for final approval. If the EIA is not approved, the proponents may appeal to the Minister of Land and the Environment.

Public Participation in EIAs

There are usually two forms of public involvement in the environmental impact assessment (EIA) process. The first is direct involvement of the affected public or community in public consultations during EIA study. These consultations allow the developer to provide information to the public

about the project and to determine what issues the public wishes to see addressed. The extent and results of these consultations are included in the documented EIA report.

The second level of involvement is at the discretion of the NRCA and takes place after the EIA report and addendum, if any, have been prepared after the applicant has provided the information needed for adequate review by NRCA and the public.

3.0 PROJECT DESCRIPTION

3.1 Background and Overview

Medical Waste is generated during the diagnosis, treatment and immunization of humans or animals and is capable of producing infectious diseases and includes sharps (e.g. used needles and blades), infectious, and pathological waste containing HIV and other blood-borne pathogens, as well as hazardous chemical, pharmaceutical, genotoxic and radioactive wastes.

[4]It is estimated that the health sector generates approximately 1,596 tonnes of medical/clinical waste annually. This represents approximately 20% of the total waste stream from healthcare facilities. The remaining 80% is non-risk or "general" healthcare waste with similar characteristics to domestic waste such as uncontaminated items including paper, packaging materials and food waste. Eighty-three (83%) of the total medical waste is generated by public healthcare facilities, while the remaining 17% is generated by private healthcare facilities.

At present, there are no environmentally sound medical waste treatment systems at public (or private) healthcare facilities. Most healthcare facilities treat their medical waste with on-site incinerator or 'burn box'. Majority (26 of 29) of the existing incinerators in public healthcare facilities are not fit for the treatment of medical waste. They are very old (over 20 years), poorly maintained, and are not in compliance with the Natural Resources Conservation Authority (NRCA) operating standards for medical waste incinerators. Notwithstanding, on numerous occasions, waste is either burnt and/or dumped illegally at municipal disposal sites, in gullies, or on vacant land, especially when the incinerators are out of service. Over the years, there have been several negative media reports and community concerns highlighting the problems, and placing the institutions under tremendous pressure to address the problem.

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[4] Ministry of Health, "*Medical Waste Management: Technical Brief on Hazardous Healthcare Waste Generation and Treatment Capacity Requirement"*, June 2005.

Against this background, the Government is investing in appropriate technology for the treatment of medical waste, since over 83% of total medical waste is generated by public health care facilities and the cost of the negative effects of improper handling and disposal practices is a burden on the public purse.

The implementation of the southeast regional medical waste treatment facility emanates from the March 2006 Cabinet approval of Project Number 848/1 for the implementation of Regional Medical Waste Treatment and Collection Systems in Jamaica, aimed at improving the overall management of medical waste in all health regions. The establishment of Regional Medical Waste Treatment Facilities will be implemented in two phases; phase 1 being the Southeast Health Region and phase 2 being the other health regions. The proposal to Cabinet for the implementation of these regional treatment facilities with the steam sterilization treatment technology was reviewed and endorsed by all the relevant stakeholders, including the National Solid Waste Management Authority, the National Environment & Planning Agency and the Ministry of Local Government and Environment.

The southeast regional medical waste treatment and collection project is being implemented under the National HIV/AIDS Prevention and Control Project. The project also includes:

- Drafting of the National Medical Waste Management Policy, Regulations, Standards, and Guidelines;
- Standardize waste management procedures in all healthcare facilities;
- Waste segregation and minimization strategies;
- Training of healthcare staff in proper waste management.

It will therefore seek to:

- improve the storage, collection and treatment of medical waste in the region;
- improve the efficiency in the management of medical waste; and,
- reduce accidental exposure to blood and blood products.

Health care workers at all levels, patients and visitors at healthcare facilitators and the general public are the expected beneficiaries from this critical activity.

3.2 Project Location

The proposed location is situated approximately 450 metres north northwest of the Saint William Grant Park in downtown Kingston.

The proposed project location includes the portion of land located on Princess Street east of the Kingston Public and Victoria Jubilee Hospital, a general and maternity hospital with a capacity of 668 beds (Figure 3.1).

The area identified for the establishment of the facility is approximate 2,500 square meters in size; a perimeter dimension of 50 meters by 50 meters. The area is currently being used as parking facility and as a storage area for waste (domestic) receptacles for the Kingston Public and Victoria Jubilee Hospital. The boundary definition is as follows:

- Northern Boundary runs along Drummond Street - approximately 50 meters.
- Western boundary runs along Princess Street – approximately 50 meters.
- Southern boundary will be formed by a perimeter fence (running parallel to North Street) that will separate the facility from the car park – approximately 50 meters.
- Eastern Boundary runs along Luke Lane – approximately 50 meters.

The adjoining vacant land to the south (bordered by North Street) will be developed and used for the expansion of the exiting car park once the treatment facility is constructed.

The site has a relatively flat terrain of gentle gradient (southerly) and alluvial soil type (stiff and stable gravely clay loam texture). The site is located approximately 26 meters above mean sea level.

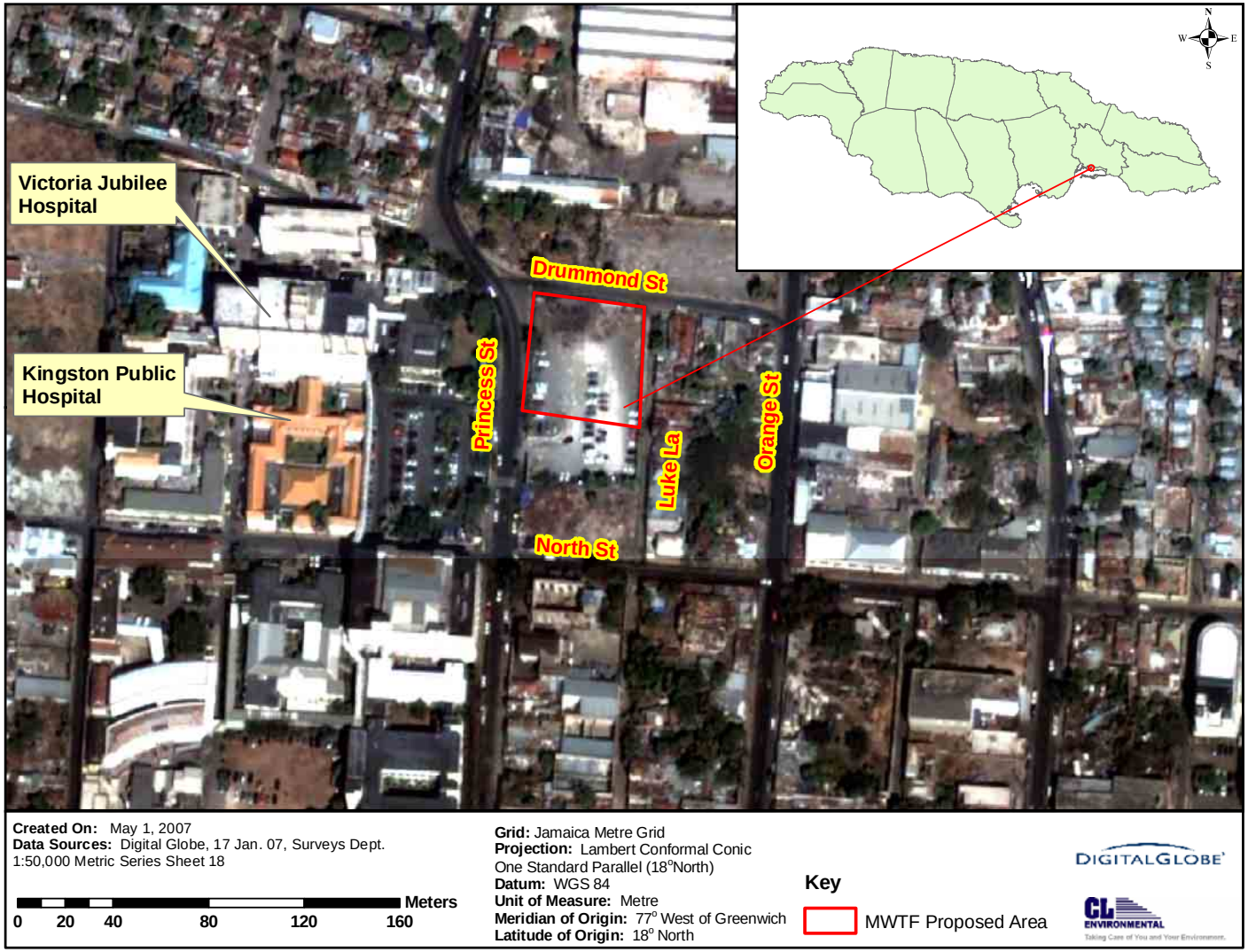


Figure 3-1 Proposed location of the Medical Waste Treatment Facility (MWTF)

CL Environmental Co. Ltd.
clenviro@cwjamaica.com

3.3 Categories of Medical Waste

The main waste streams from hospitals and healthcare establishments are categorized into the following three categories for management purposes[5]:

1. **General/Non-Clinical Waste** – includes waste generated from administrative activities, general cleaning, food preparation and ward areas, provided that they are separated at the point of generation from the waste classified as medical and special waste. These wastes do not pose a special handling problem or hazard to human health or the environment and their characteristics are similar to those of common domestic waste. Examples include

    a. Wrappers and packaging materials/containers, food waste and leftovers, cleaning materials;
    b. Office materials and equipment including paper, newspaper, cardboard, plastic, glass disposable containers, hand towels, timber, metal;
    c. Used disposable bed pan liners, urine and specimen containers, faeces, incontinence pads and stoma bags;
    d. Used personal hygiene products;
    e. Non-infectious animal bedding;
    f. Waste that come into contact with patients through routine examination of patient care but are not soiled or saturated with fluid blood, body fluids, excretions, exudates or secretions example gloves, caps, gowns, drapes, disposable sheets, gauzes, cotton balls and dressings;
    g. Garbage generated by patients, workers and visitors;
    h. Waste material that have been sterilized.

[5] Health Facilities Infection Control Policies and Procedures Manual, Ministry of Health (Revised 2007)

2. **Medical/Clinical Waste** – includes wastes generated during the different stages of health care (diagnosis, treatment, immunizations, research, etc.) that contains pathogens which are capable of producing an infectious disease. These wastes represent different levels of potential danger according to the degree of exposure of infectious agents.

3. **Special Waste** – includes wastes generated during auxiliary activities that constitute a health risks due to their aggressive characteristics, such as Corrosivity, Reactivity, Inflammability, Toxicity, Explosivity and Radioactivity.

Examples and description of the different types of Medical and Special Wastes are presented in Table 3.1.

Table 3-1 Categories of Medical Waste

WASTE CATEGORY	*DESCRIPTION AND EXAMPLES*
INFECTIOUS WASTE	
Infectious waste	Waste suspected of containing pathogens e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients or animals; excreta
Anatomical/Pathological waste	Human or animal tissues or fluids e.g. body parts; blood and other body fluids; foetuses (including waste from mortuary and autopsy centres)
Sharps	Sharp waste e.g. needles; infusion sets; scalpels; knives; blades; broken glass
SPECIAL WASTE	
Pharmaceutical waste	Waste containing pharmaceuticals e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes)
Genotoxic waste [6]	Waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy); genotoxic chemicals (The most common genotoxic products used in healthcare are listed at Appendix 1)
Chemical waste	Waste containing chemical substances e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents
Wastes with high content of heavy metals	Batteries; broken thermometers; blood-pressure gauges; etc.

[6] Genotoxic waste includes cytotoxic drugs used in cancer treatment and their metabolites and outdated materials, vomitus, faeces or urine from patients treated with cytotoxic drugs or chemicals, and materials such as syringes and vials contaminated from the preparation and administration of such drugs; they are highly hazardous, mutagenic, teratogenic or carcinogenic.

WASTE CATEGORY	*DESCRIPTION AND EXAMPLES*
Pressurized containers	Gas cylinders; gas cartridges; aerosol cans
Radioactive waste	Waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources

(Adapted from the Draft Medical Waste Management Policy for Jamaica, 2006)

The establishment of the proposed treatment facility seeks to provide a more environmentally friendly option for the treatment of the medical/clinical waste category generated within the Southeast Health Region.

The proposed treatment facility will treat the following types of medical (infectious) waste:

- cultures and stocks of infectious agents
- sharps (needles, syringes, scalpels, blades)
- pathological waste including tissues, organs and body parts
- human blood waste and blood products
- isolation and surgery wastes
- laboratory wastes (excluding chemical waste)
- soft wastes (contaminated gauze, bandages, drapes, gowns, beddings, etc. from patience and animal care)
- discarded materials contaminated with blood and body fluids, excretion, exudates or secretion from human and animals
- animal wastes

3.3.1 Scope of Service and Waste Quantification

The proposed treatment facility will provide service to all public healthcare facilities the South East Health Region which includes the parishes of St. Catherine, St. Thomas, Kingston and St. Andrew (Figure 3.2).

The number of public healthcare facilities to be serviced in the Southeast Health Region includes (Figure 3.3).

- 9 hospitals (with a bed complement of 1,626 in the year 2004)
- 30 Health Centres (of types 3, 4 & 5 status)
- 1 National Public Health Laboratory and Blood Bank

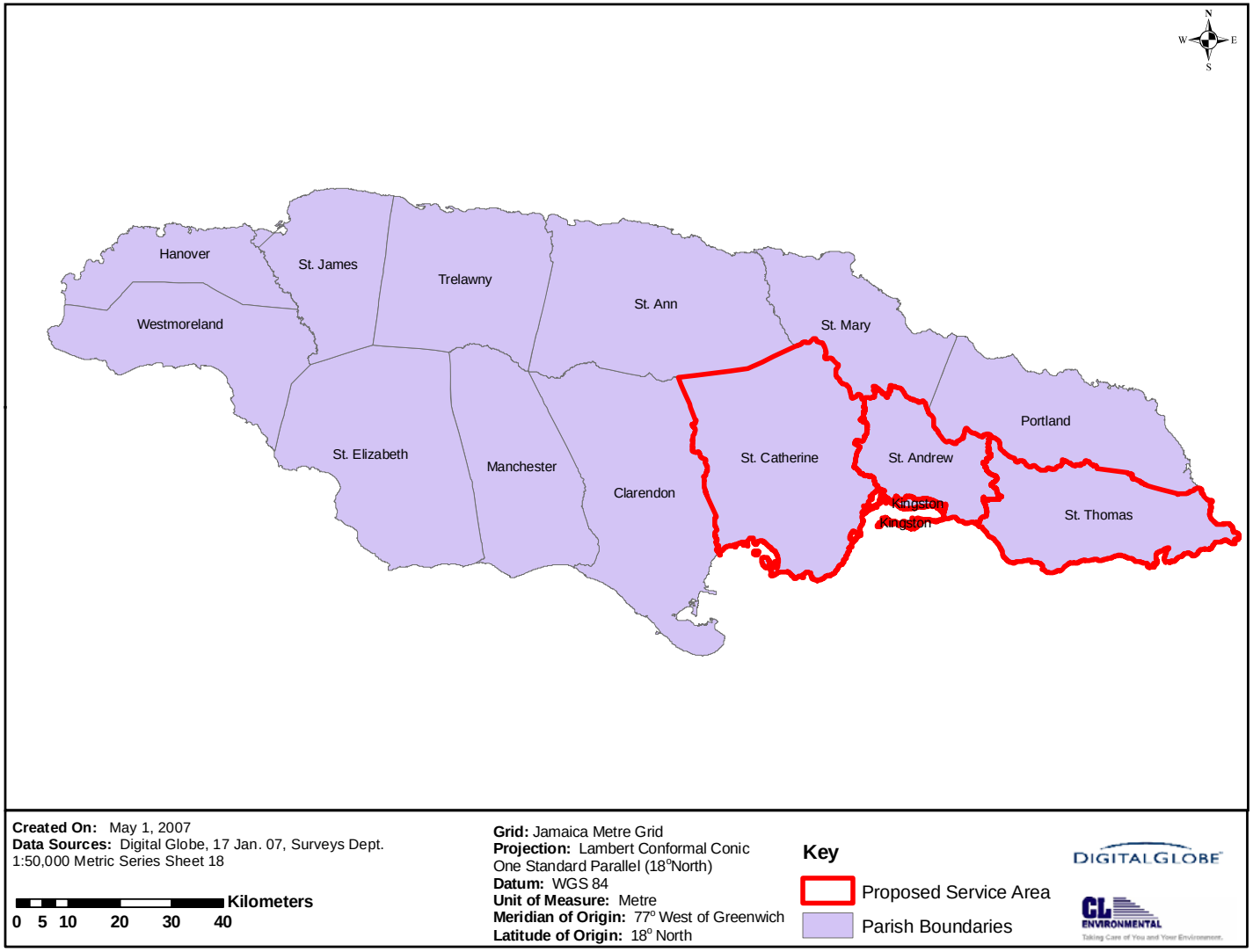


Figure 3-2 Location of the Southeast Health Region

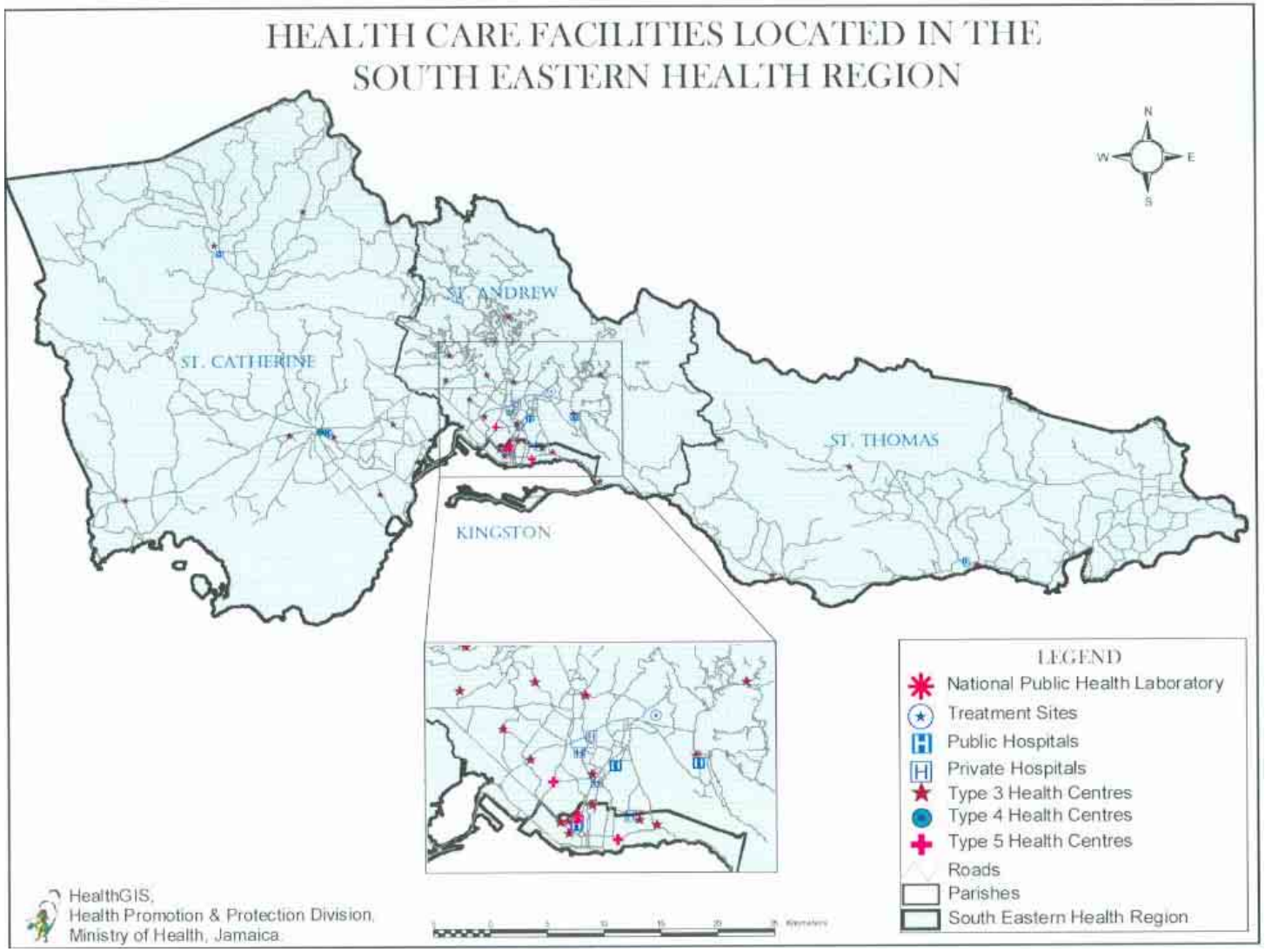


Figure 3-3 Healthcare Facilities in the Southeast Health Region

There is little documentation on the quantities of medical waste generated, incinerated or sent for final disposal[7]. In determining the quantities of waste be produced in the South East Health Region (SEHR), the Ministry of Health (MOH) combined desk research along with the study data which was available. One such study was the Medical Waste Plan which was developed for Jamaica as part of the Comprehensive Solid Waste Management Study[8] (1995). The table below which was extracted from the study, compares clinical waste generate rate estimates for Jamaica compared with the United States for Jamaica (Table 3.2).

Table 3-2 Jamaica and United States Estimated Waste Generation Rates

Generator Class	*Estimated Jamaican Rate*	*US Rate (Federal Registry)*
Hospital	1.0 kg/bed/day	2.6kg/bed/day
Clinic/Health Centre	10.0 kg/day	14.5 kg/day
Doctor's Office	10.0 kg/day	14.5 kg/day
Dentist Office	2.7 kg/week	3.6 kg/week
Veterinarians	negligible	7.2 kg/week
Medical Laboratories	54.5 kg/week	113.6 kg/week

Source: GOJ Comprehensive Solid Waste Management Study, Norconsult, October 1996

Based on an assumed generation rate of 1kg/bed/day for hospitals, 10kg/day for clinics/health centres, and 73.57kg/day for the National Public Health Laboratory and Blood Bank, the total estimated clinical waste generation from public healthcare facilities (excluding University Hospital of the West Indies) within the Southeast Health Region is approximately 490 tonnes per year, an equivalent of 1,334 kilogram per day. Hospitals operate 365 days annually producing 390 TPY, whilst health centres and the public health laboratory and blood bank operates 260 days annually, producing 78 TPY and 19TPY respectively.

[7] Medical Waste Management Policy for Jamaica, 2006

[8] GOJ Comprehensive Solid Waste Management Study, Norconsult, October 1996

Table 3.3 below shows the listings of public hospitals within the SEHR as well as the estimated clinical waste generation based on 2005 bed compliment and percentage bed occupancy.

Table 3-3 Estimated Infectious Waste Daily Generation Rate at Hospitals (2004)

TYPE [a]	NAME	# OF BEDS[b]	Avg. OCCUPANCY RATE [b] (%)	Est. Waste Generation (kg/day)
SPECIALIST	Victoria Jubilee	213	59.70%	127
SPECIALIST	National Chest	100	47.20%	47
SPECIALIST	Bustamante	244	59.50%	189
TYPE A	Kingston Public Hospital	455	69.70%	317
SPECIALIST	Sir John Golding	55	91.40%	50
SPECIALIST	National Public Health Lab + Nat'l Blood Bank[b]			74
SPECIALIST	Hope Institute	34	52.70%	18
TYPE C	Princess Margaret	124	66.90%	83
TYPE B	Spanish Town	290	77.40%	225
TYPE C	Linstead	49	26.90%	13
		1,564	**61.27%**	**1,143**

a Refer to Appendix X for a description of the type of hospital and service offered.
b Ministry of Health Hospital Monthly Statistical Report, January to December 2005
c Infectious and Non-Infectious Waste Study at the National Public Health Laboratory and Blood Bank, January 2003.

The MOH has determined that clinical waste is primarily generated in health centres classified as Types 3, 4 and 5 based on the type of healthcare services that are provided at these facilities (see Table 4.31). The predominant waste type generated at other classes of health centres was determined to be general/non-clinical waste, with the exception of small quantities of sharp waste (needles). Against this

background, only the clinical/medical waste, including sharp waste, generated at health centres will be collected for treatment at the proposed facility.

Table 3.4 shows the listings of Types 3, 4 and 5 health centres/clinics within the Southeast Health Region and the 2005 outpatient load. There are a total of 26 Type 3, 1 Type 4 and 3 Type 5 health centres.

Table 3-4 Listings of Type 3, 4 and 5 Health Centres/Clinics in the Southeast Health Region

TYPE	NAME	ADDRESS	Out Patient Load (2005)
3	Stony Hill	Stony Hill	15,1228
3	Social & Preventative Medicine	University of the West Indies, Kgn.6	9,430
3	Duhaney Park	122a Baldwin Crescent, Kgn. 20	18,214
3	Edna Manley	35a Grant's Pen Road, Kgn. 8	13,324
3	Glen Vincent	3 Trevennion Park Road, Kgn. 5	15,970
3	Gordon Town	Gordon Town Road, Gordon Town P.O.	10,405
3	Hagley Park	118 Hagley Park Road, Kgn.10	21,864
3	Harbour View	Fort Nugent Drive, Kgn. 17	13,791
5	Maxfield Park	89 Maxfield Avenue, Kgn. 10	22,672
3	Norman Gardens	Range Crescent Kgn. 2	12,158
3	Olympic Gardens	200 Olympic Way, Kgn. 11	16,414
3	Majesty Gardens	Majesty Gardens, Kgn. 11	2,760
3	Rollington Town	37a Giltress Road,Kgn 16	10,137
3	Sunrise	Red Hills Road	18,363
3	Denham Town	19 Wellington Street, Kgn 14	4,924

TYPE	NAME	ADDRESS	Out Patient Load (2005)
5	Comprehensive	55 Slipe Pen Rd., Kgn. 5	39,723
5	Windward Road	16 1/2 Windward Road	18,057
3	Mary Issa (VOUCH)	1 National Heroes Circle,Kgn 4	4,150
3	Operation Friendship	2c East Bell Road (Kgn)	5,662
3	Old Harbour	Lot 5 Marlie Ave., Old Harbour	22,985
3	Christian Pen	Christian Pen, Gregory Park P.O.	7,820
3	Greater Portmore	5W Greater Portmore, Breaton P.O.	19,620
3	Linstead	King Street, Linstead P.O.	24,081
3	Riversdale	Riversdale P.O.	3,054
3	Sydenham	36 Federal Road, Spanish Town P.O.	14,377
4	St. Jago Park	Burke Rd., Spanish Town P.O.	36,193
3	Guy's Hill	Guy's Hill P.O.	6,348
3	Morant Bay	56 Lyssons Rd., Morant Bay P.O.	23,701
3	Yallahs	Yallahs P.O.	10,544
3	Trinityville	Trinityville P.O.	3,909
	Total Patients (Daily)		**581,878**
	Total Waste (kg/day)		**300**
	Total Waste (kg/yr)		**78000**

Source: Ministry of health monthly clinical summary report, January to December 2005

On the basis of the clinical waste generated at public healthcare facilities within the Southeast Health Region (including sharps waste from types of health centres), the

proposed medical waste treatment facility will process approximately 1,885 kilogram per day or 490 tonnes annually.

In projecting clinical waste generation for a 10-year period, the following assumptions were made with respect to bed compliment, occupancy level, and waste generation rate. In addition, it took into consideration the number of patients 'serviced' at public healthcare facilities, namely hospital admission and health centres patient load.

1. The 2005 bed compliment at each hospital would remain unchanged over the next 10 years;

2. Average bed occupancy rates for each facility over the period 2000 – 2005 would remain the same over the next 10 years

3. The rate of growth of 0.12% in hospital admission for the period 2000 – 2005 would remain the same over the next 10 years.

Current trends within the health sector indicate a decline in the use of public healthcare facilities, particularly hospitals due to the following:

1. Decrease in admission rate of HIV patients due to increased access of antiretroviral drugs;

2. Increase access to medication through the National Health Fund (NHF) for treatment of 15 chronic diseases, thus decrease in admission rate of patients with such illnesses; and,

3. Increase use of private healthcare facilities.

Additionally, there is a plan to construct a new pediatric hospital in the Western Health Region, which will further reduce the number of pediatric cases currently transferred to hospitals within the Southeast Health Region for treatment.

Based on the above, the level of service at hospitals will not increase to an extent that would impact significantly on waste production. The projected clinical waste generation at hospitals within the Southeast Health Region was therefore calculated to be approximately 395 tonnes in the year 2017.

Data from the MOH has shown an average decrease of 3.23% in health centre visits in the Southeast Health Region over the period 2000 – 2005. In making a conservative projection of clinical waste generation at health centres, it was assumed that the current waste generation rate of 10 kg/day (78 tonnes per year) would remain the same up to the year 2017. A similar conservative assumption was also made with respect to the National Public Health Laboratory and Blood Bank (19 tonnes per year).

Therefore, the total projected clinical waste generation from public healthcare facilities within the Southeast Health Region is estimated to be approximately 492 tonnes in the year 2017. This represents a marginal projected increase of 2 tonnes over the 10-year period. The current treatment capacity of the proposed facility will be able to accommodate this waste load without any additional equipment.

It should also be noted that, the implementation of strategies to improve clinical waste segregation at healthcare facilities will further influence a reduction in the overall quantity of clinical waste generated.

3.3.2 The Proposed Medical Waste Collection and Treatment System

The proposed southeast regional medical waste collection and treatment system will consist of four components, namely:

A. Clinical/Medical Waste Segregation and Interim Storage at Healthcare Facilities;
B. Waste Collection and Transportation from Healthcare Facilities to the Medical Waste Treatment Facility;
C. Waste Transfer and Treatment at the Medical Waste Treatment Facility; and,
D. Disposal of Treated Waste at Landfill.

The treatment facility will replace approximately 10 malfunctioning incinerators currently in operation at public healthcare facilities within the Southeast Health Region. A plan will be developed to guide the closure of these incinerators. Figure 3.4 provides an overview of the proposed southeast medical waste collection and treatment system. Each step will be described in detail in sections to follow.

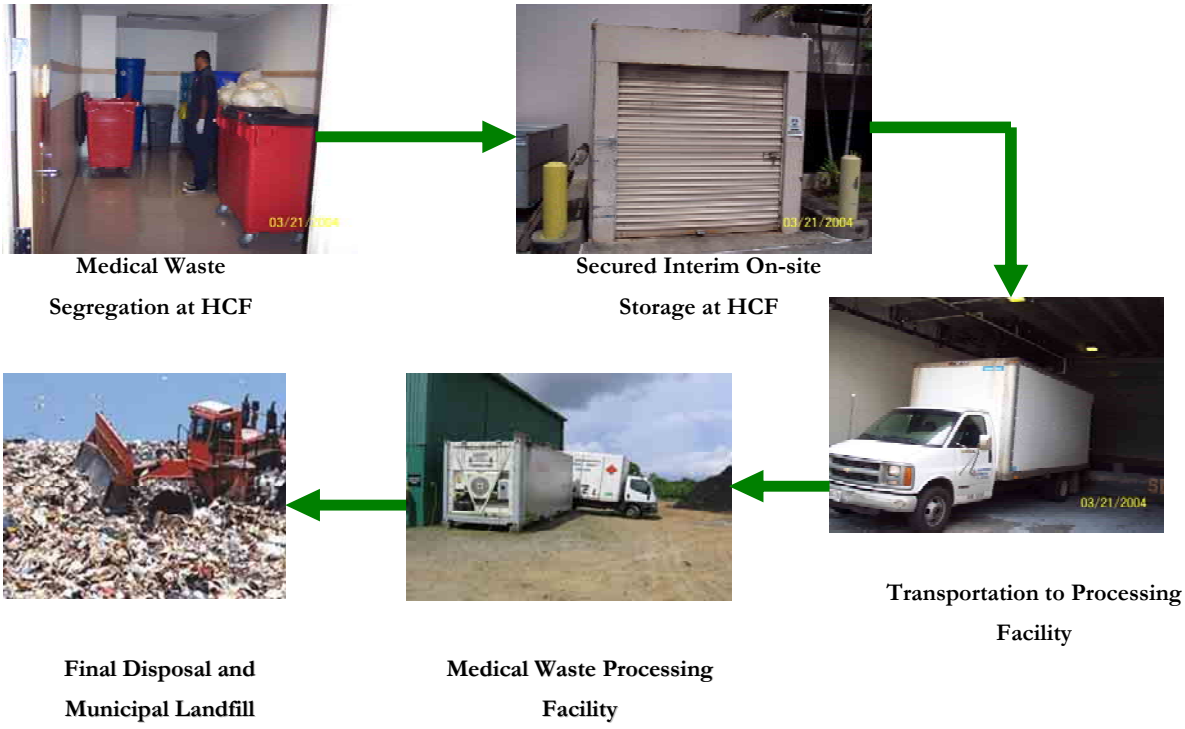


Figure 3-4 Overview of the Southeast Medical Waste Collection and Treatment System

A. Clinical/Medical Waste Segregation and Interim Storage at Healthcare Facilities

The management of medical waste at healthcare facilities will involve strategic objectives that include waste minimization and segregation as the underlying elements. The frameworks will also entail the following:

- The implementation of an effective waste collection, transportation and storage system;
- The development of facility-specific waste management plans and contingency plans;
- Staff training (on proper waste handling and segregation); and,

- Occupational safety and health considerations.

The various categories of medical waste will be sorted at the source of generation and placed into colour-coded plastic bags and containers. Contained medical waste will be visibly identifiable with the international biological hazardous symbol and the type of waste it should receive. Table 3.5 outlines the recommended colour-coding for medical waste.

Table 3-5 Recommended Segregation Colour-Code[9]

Category	*Colour-Code Container (bins and/or bags)*	*Symbol and Label*
Group A Common Waste	Black	-
Group B Infectious Waste; Pathological Waste; Animal Waste; Dialysis Waste; Human Blood and Derived Products; Isolation Waste, Laboratory Waste	Red	Biohazard Symbol and labeled "INFECTIOUS WASTE"
Group C Highly Infectious Microbiological Laboratory Waste	Orange/Red (temperature resistant bags)	Biohazard Symbol and labeled " INFECTIOUS WASTE"
Group D Sharps	Sharps Container Orange/Red/Clear Plastic container and/or Waxed Cardboard Box	Biohazard Symbol and labeled "CONTAMINATED SHARPS"
Group E • Genotoxic/Cytotoxic Waste	Purple	Telophase Symbol and labeled "CYTOTOXIC WASTE"
• Radioactive Waste	Blue (Lead container)	Radioactive Symbol and labeled "RADIOACTIVE WASTE"

[9] Heath Facility Infection Control Policies and Procedures Manual (Revised 2007)

	Category	*Colour-Code Container (bins and/or bags)*	*Symbol and Label*
•	Pharmaceutical Waste	Yellow	Biohazard Symbol and labeled "PHARMACEUTICAL WASTE"
•	Hazardous Chemical Waste; Waste Containing Heavy Metal, Mercury and Cadmium; Pressurized Containers	Yellow	Appropriate United Nations Packaging Symbol and labeled with the identity of the chemical

At healthcare facilities (HCF), infectious waste streams will be segregated and containerized in "red" plastic bags and/or sharp containers at point of generation. The sealed containerized waste will then be placed in red 770 liter lockable rigid plastic container for off-site transportation (Figure 3.5). The bins used for the transport of clinical wastes, especially infectious and pathological materials, will be dedicated solely for that purpose and will be labelled accordingly (Figure 3.6). A time table will be developed to facilitate pick up based on waste generation rates. The collection frequency will depends on the quantity of waste generated by the facility. In the greatest extent, it can be twice a day, but the preliminary collection scheduled suggest a frequency of once or twice per day to three times per week for hospitals and weekly for health centres.

The staff throughout the health care facilities will be trained in the handling and segregation of clinical waste and written procedures and appropriate signage will also be put in place.

770 L Red coloured containers with lockable and removable lid. Lid locked using standard triangular key. Inscription of a unique serial number on each container body and identification with statutory sticker on front

L: 1260 mm
W: 775 mm
H: 1320 mm

Figure 3-5 Lockable Rigid Containers For On Storage

Figure 3-6 Sample of Labels to be used on bins at Healthcare Facilities

B. Waste Collection and Transportation from Healthcare Facilities to the Medical Waste Treatment Facility

The clinical waste (stored in 770 liters bins) will be removed from the interim storage area at the health care facilities (see map) and transported to proposed Medical Waste Treatment Facility Site (MWTF) located opposite to the Kingston Public and Victoria Jubilee Hospitals.

Approximately 300 waste storage bins on wheels (770 liters) will be used to store and transfer clinical waste from healthcare facilities to the treatment plant. This represents 3 times the required numbers of bins to accommodate uses such as extra storage at healthcare facilities, during transportation and at waste treatment facility

Two fully enclosed specialized waste collection vehicles with a capacity of 5,000 kilograms will transport clinical waste to the treatment plant (Figure 3.3). These vehicles will be dedicated for the transportation of clinical waste and will be of a high standard with the following criteria/specifications:

- The vehicles have a totally enclosed car body and the driver must be separated from the waste by a bulkhead of sufficient integrity to prevent him coming into contact with the wastes in the event of an accident;

- The vehicles will be easy to clean. The internal surfaces of the body should be smooth with all corners covered. At a minimum the vehicle will be cleaned at the end of each working day and cleaning will be mandatory in the event of any spillage;

- The vehicles will be able to survive an impact with another vehicle under urban motoring conditions without an unacceptable loss of integrity, which could cause spillage from bags or containers;

- The vehicles will have clear external placard displaying the United Nation identification number 3291 and Hazard Class 6.2 on both sides(Figure 3.7) and,

- The vehicles will have body compartments with the following characteristics:

    a) Fully enclosed and lockable;
    b) Constructed of aluminium and sized to contain at least 12 bins of 770 liters at the same time;
    c) An internal finish in the truck body free of sharp angles and capable of being cleaned with a high pressure steam unit;

d) Equipped with a suitable system to secure the waste bins loaded during transportation;
e) Equipped with roller shutters or doors that is equipped with a flip-away hydraulic tail lift at the back with the following minimum requirement – galvanised steel frame and aluminium or stainless steel platform; lift weight capacity of 1500 kilogram; and platform sized at 2.50 meters x 2.00 meters; and,
f) Minimum requirement of a spill containment and clean-up kit that should be kept in the vehicle.

Figure 3-7 Specialized Collection Vehicles

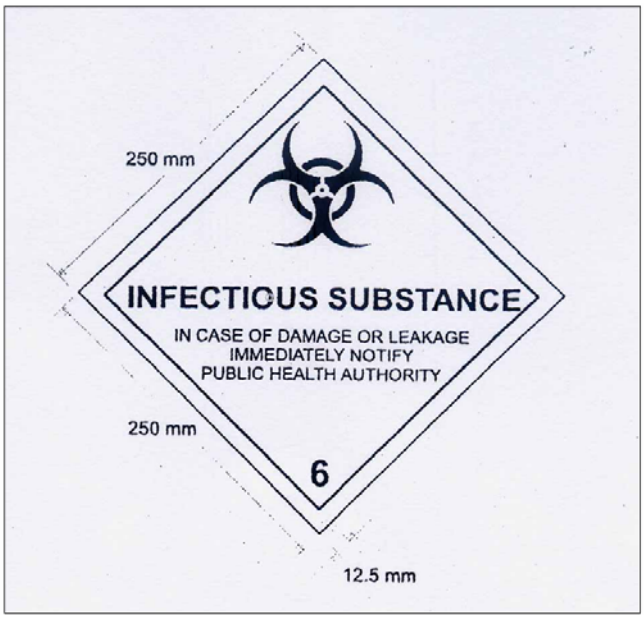


Figure 3-8 UN Identification N° 3291

Manifest and Tracking System for Medical Waste Transportation (from HCF to Treatment Facility)

Collection vehicles will be registered/license with the National Solid Waste Management Authority/National Environment and Planning Agency.

A manifest and tracking system will also be implemented to adequately identify the source, collection and transport path to the treatment and disposal between the generators, transporters, and treatment and disposal entities. The generator, transporter and receiver (treatment facility) of the medical waste will be required to complete the Medical Waste Transport Manifest form in triplicate/quadruplicate.

A copy of the manifest shall be issued to each entity, following the completion by the approved receiver (treatment and/or disposal contractor) acknowledging safe receipt and approved treatment and/or disposal of the waste. The responsibility for the distribution of the completed manifest back to the two other entities is that of the final treatment/disposal contractor. These records shall be retained by all parties and made available for inspection or in the event of an emergency or investigation.

Record systems of all parties shall be such that there is a match of incoming and outgoing movements of waste. Figure 3.8 provides an illustration of manifest and tracking system.

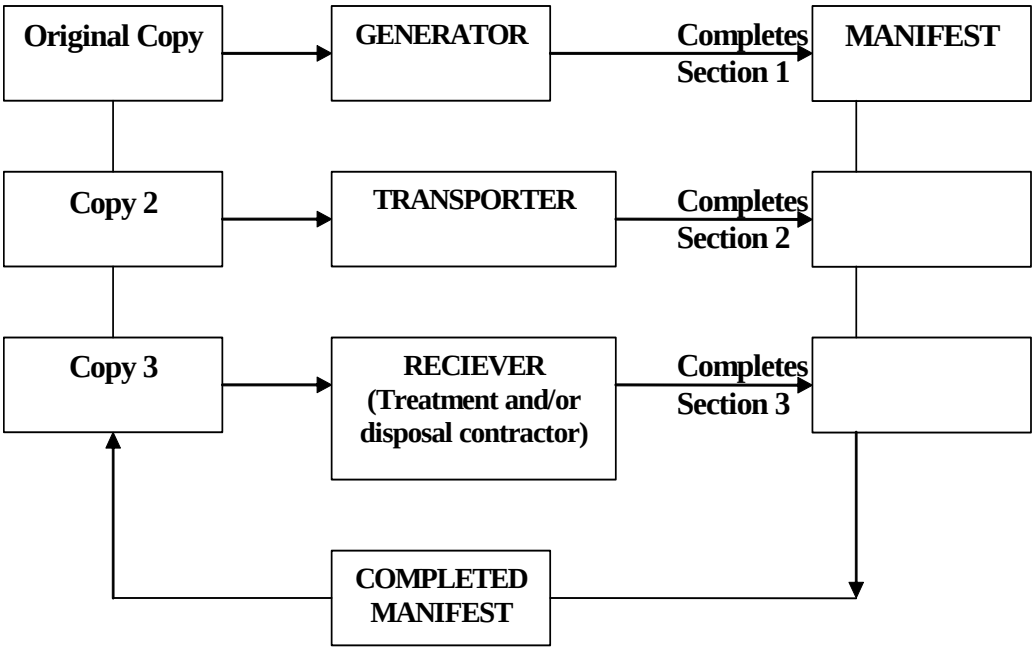


Figure 3-9 Illustration of proposed Manifest and Tracking System

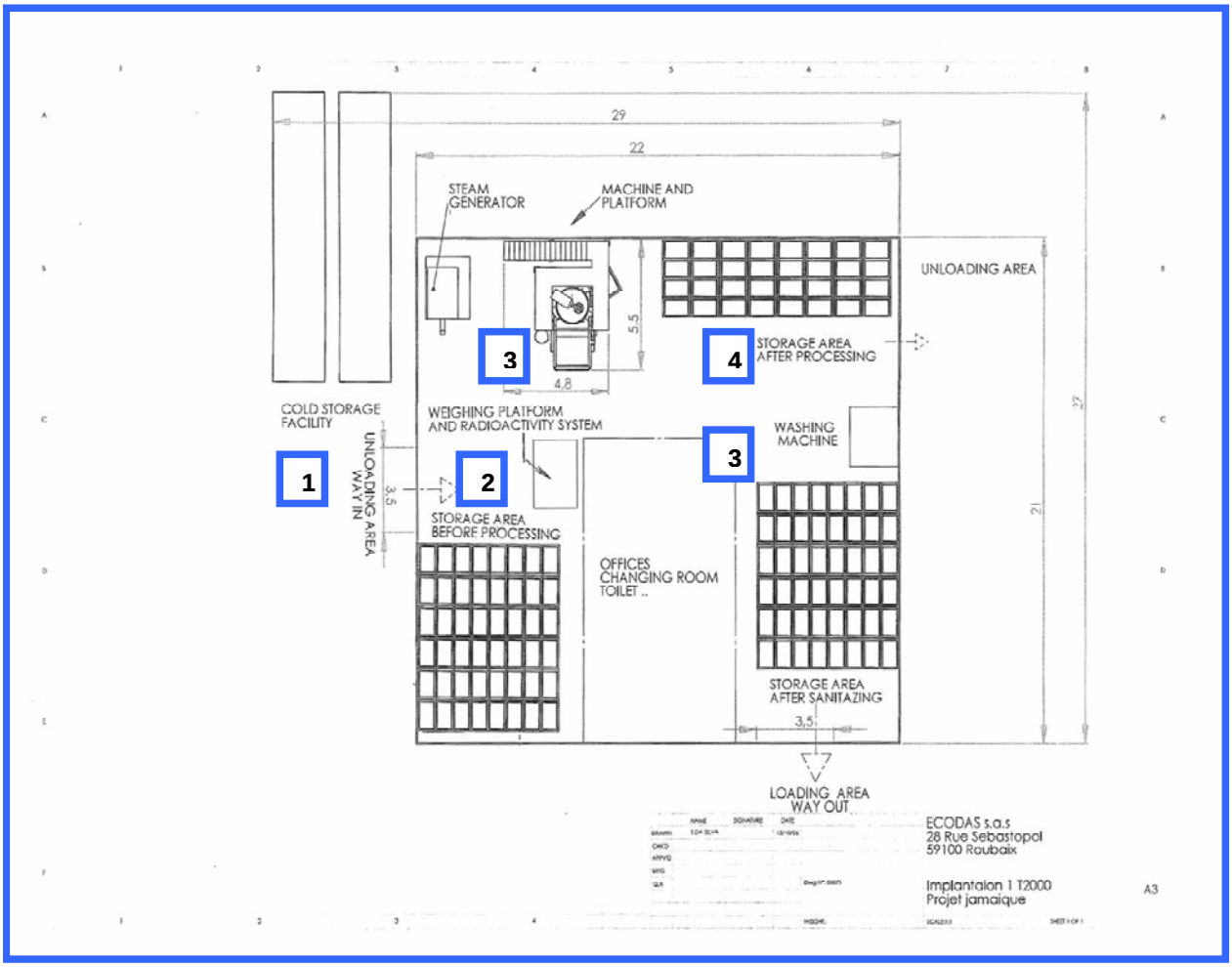
Table 3-6 Sample of Transfer Form/Consignment Note for Transportation of Medical/Infectious Waste from a Healthcare Facility

[Name of Waste Regulating Authority] Serial No. [Address and Telephone Number of Waste Regulating Authority]	
Producer's Certificate A	(1) The material described in B is to be collected from: ..... and (2) taken to **.....** Name ..... Signed ..... On behalf of ..... Position ..... Address ..... Telephone ..... Date .....
Description of the waste B	(1) General description and physical nature of waste. (2) Relevant chemical and biological components and maximum concentration. (3) Quantity of waste and size, type and number of containers. (4) Process(es) from which waste originates**.**
Carrier's Collection Certificate C	I certify that I collected the consignment of waste and that the information given in A (1) and (2) and B (1) and (3) is correct, subject to any amendment listed in this space: I collected this consignment on ..... at .....p.m./a.m. Signed ..... Name..... Date ..... On behalf of ..... Vehicle Registration Number ..... Address ..... Telephone **.....**
Producer's Collection Certificate D	I certify that the information given in B and C is correct and that the carrier was advised of appropriate precautionary measures. Signed ..... Name..... Date ..... Telephone .....
Disposer's Certificate E	I certify that waste Disposal License Number ....., issued by ....., authorizes the treatment and disposal at this facility of the waste described in B (and as amended where necessary at C)**.** Name and address of facility ..... This waste was delivered in vehicle ..... (Reg. No) at ..... a.m./p.m. on .....(date) and the carrier gave is name as ..... on behalf of ..... Proper instructions were given that the waste should be taken to ..... Signed ..... Name ..... Position..... Date ..... on behalf of .....
For use by Producer/ Carrier/ Disposer	

Source: WHO (1999), Safe Management of Wastes from Health care Activities.

C. Waste Transfer and Treatment at the Medical Waste Treatment Facility

At the facility, the 770 liter containers will be off-loaded from the vehicle inside of the treatment building. After manifesting, radioactive testing and weighing, the containers will be mechanically lift dumped into the steam sterilization and shredding system, which treat the waste under timed, pressurized, steam conditions designed to completely disinfect all materials. Figure 3.10 shows a schematic diagram of activity/process flow of waste bins at the treatment facility.



SCHEMATIC DIAGRAM OF ACTIVITY / PROCESS FLOW
1 - Unloading of the waste bins (from the trucks or the refrigerated containers)
2 – Weighing and radioactivity testing of the bins to be treated : depending on the tracking system set up by the employer, either after or before storage (right after unloading or right before treatment)
3 – Treatment cycle / Sanitization of emptied bins and storage of sanitized bins in the dedicated area
4 - unloading of the treatment equipment after processing and storage in the dedicated area prior to collection for final disposal

Figure 3-10 Flow of Bins through the Facility

The emptied bins will then be sanitized using a mechanical washing system and then stored in the dedicated area for sanitized bins before they are returned to the healthcare facilities. The mechanical washing machine (Figure 3.11) will comprise the following specifications:

- totally stainless steel with automatic loading;
- able to process at least 10 bins per hour.
- operate at washing temperature of 50 Celsius degrees (water steam heated and/or cool-down water from the steam sterilization equipment);
- fitted with water recycling pump and programmable dose pump for disinfection products;
- minimum dimension of 3.5 meters (length) x 2.5 meters (width) x 2.5 meters (height)

Figure 3-11 Mechanical Washing System

The collection vehicles will be sanitized at a truck washing platform and its wastewater will go into the wastewater treatment system.

The weighing platform has a capacity of 600kg and is fitted with non-slip stainless steel access ramp, indicator and transmitter connectable to a computer and label printer.

D. Disposal of Treated Waste at Landfill

Once the treatment cycle is completed, the shredded unrecognisable sterilized waste residue will be off-loaded into dedicated wheeled bins, which will then stored into the dedicated area inside the building prior to being tipped be into a roll-on/roll-off containers or skips. These containers will be removed daily and transported directly to the Riverton disposal site for final disposal. Given the level of sterility of the waste residue (8 log 10), which is greater than that of municipal/domestic waste, it can be handled similarly to how regular municipal waste is handled at the disposal site. Thus, no special handling is required.

However, in light of the current operational realities of the Riverton disposal site and the presence of 'pickers' on the site, the NSWMA may consider special handling of the treated waste. This is also against the background that the Riverton disposal site is not a sanitary landfill[10] due to the absence of daily cover and sufficient equipment. Special handling of the treated waste at the Riverton disposal site may include a designated cell with daily covering of the waste based on the following the guidelines and the workforce will need to be trained in the safe handling of the material. Additionally, written operational procedures outlining good practice may have to be developed and records maintained regarding the disposal of the material.

i) A cell will be prepared and the treated waste should be deposited at the working area or face. The working face is usually a small, confined area. It must be wide enough to operate the equipment safely and efficiently, but not so wide that it becomes difficult to manage and maintain properly.

ii) The treated waste should be spread into thin layers up to approximately 2 feet thick and compacted by heavy equipment.

[10] A Sanitary land filling is an engineered method of disposing solid waste on land in a manner that minimizes environmental hazards and nuisances. A sanitary landfill site is carefully selected, designed, and the solid wastes are spread in thin layers, compacted to the smallest practical volume, and ideally at the end of each operating day, covered with earth, which is also compacted.

iii) The layers should be covered daily with a minimum of 6 inches of compacted soil. Intermediate cover, for areas which will not be active within a year, is usually a minimum of 12 inches.

iv) The compacted waste and daily soil cover constitute a cell. The cell is the common building block used. The depth of each cell of refuse before sealing may vary between 2 and 15 feet or more. Eight feet is usually the maximum recommended.

v) A minimum of two feet of compacted soil is the actual depth that will be required for final cover once a cell is full.

Approximately 1,885 kg of sterile unrecognisable moist waste residue will be transported to the Riverton disposal site daily.

3.3.3 The Treatment Facility

The estimated quantity of medical waste to be treated at the proposed southeast medical waste treatment facility is approximately 1.885 tonnes per day (490 tonnes per year). The facility is expected to operate for 14 to 16 hours per day (6 a.m. to 8 p.m. or 6 a.m. to 10 p.m.) five days per week, Mondays to Fridays. This is equivalent to 60 – 70 effective hours/week of waste treatment (i.e., treatment equipment processing waste 12 – 14 hours/day possible between the hours of 7a.m. to 7p.m. or 6a.m. to 8p.m). Thus, the treatment capacity at the facility is estimated at 2.4 to 2.8 tonnes/day or (624 to 728 tonnes/year), which exceeds the required treatment capacity of 1.885 tonnes per day (490 tonnes per year).

The treatment facility will comprise:

- One (1) pre-engineered treatment plant building of approximately 462m^2;
- One (1) 200 kg/hour hybrid steam sterilization and shredding treatment system with associated accessories and equipment including;
    - Electric Broiler – to provide a source of steam for the treatment equipment
    - Radioactive detection device – fitted with an alarm system to prevent any radioactive waste to be processed in the facility

- Cooling system – this will reduce water consumption by 50%, thus reducing the quantity of cool-down water to be disposed. The cooling system is fitted with a silencer;
- Spare parts – minimum stock of mandatory spare parts as provided together with all equipment including one additional shredder

- One (1) mechanical washing system to sanitize storage bins before returning to healthcare facilities
- One (1) weighting platform/machine of 500kg capacity fitted with (non-slip) stainless access ramp, indicator and transmitter connectable to a computer and label printer; to be used for weighing of waste upon arrival at the facility
- Two (2) refrigerating containers of 12 meters to be used for the temporary storage of pathological waste in the event of equipment down time;
- One (1) back-up power generator sized at 500 KW;
- Four (4) 7,600 liters (2000 US gallon) back-up water storage tanks with balancing connections and a total capacity of 30,400 liters (8000 US gallon) for four days;
- One (1) roll-on/roll-off container or skip with a capacity of 10 cubic meters for transfer of sterilized/treated waste to the Riverton landfill; and,
- One (1) truck washing platform integrating a waste water treatment system with oil/water separator (Figure 3-12).

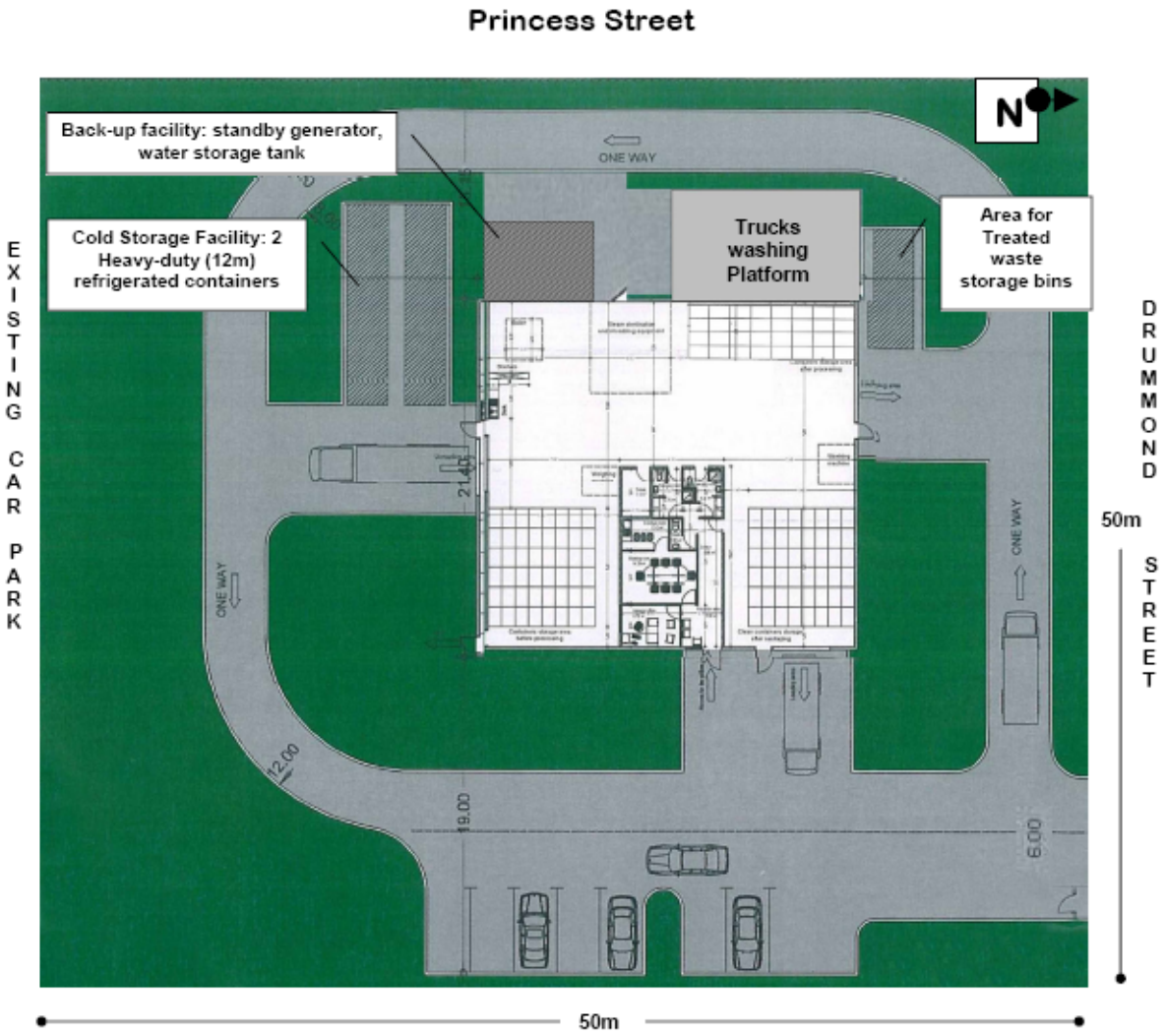


Figure 3-12 Proposed organization of the site – scale: 1/100e

CL Environmental Co. Ltd.
clenviro@cwjamaica.com

Treatment Plant Building

The design and configuration of the proposed treatment plant building allows for the accommodation of:

a) Equipment and Work Area

- Accommodate up to 10 persons working with treatment equipment, washing system, weighing platform, waste containers for processing and off load vehicles;
- facilitate easy and efficient flow of activities;
- sink with cold and hot water;
- work bench and shelving;
- optional additional space for an additional unit to be added in the future should there be an increase in treatment throughput capacity; On the proposed organization a space for two machines is available provided that part of the treated waste is stored outside the building (ref to site organization drawing – Platform for bins, roll on roll off, containers, compactor..)
- temporary holding areas for waste bins before treatment and after sanitization;
- Total holding/storage capacity shall provide for 24 – 48 hours of processing and 8 – 24 hour processing capacity of the treatment equipment.

b) Store Room

- To be used for the storage of containers, protective clothing, spare parts, consumables and supplies, etc

c) Office

- Accessible from inside the building and fitted with telephone, computer connections and shelves;
- Area must be able to accommodate for lunch room for staff;
- An office, reception area and meeting.

d) Changing Rooms, Toilets and Shower

- Two rooms (male and female) each fitted with toilet, shower, sink, hot and cold water supply and storage/locker facility for plant operators.

e) Parking

- The facility will provide for eight (8) parking spaces. Seven (7) for car or small vehicles and one (1) for visit delivery trucks.

- The existing site plan indicates entry and exit on Drummond Street.

Structural Design of the Building

- Dimensions: 22 metres x 21 metres with a 4.5 metres eave height
- Height at the ridge: at least 7 metres to accommodate the treatment equipment
- STEEL float finish for the floor: smooth finish, consisting in a final coat of fine cement polished by a steel blade/spatula machine to ensure waterproofing.
- Beam will be position right above the equipment in order to accommodate a hoisting gear for the shredder maintenance
- Roof aeration system positioned right above the equipment (air vent or air extractor) to prevent odours appearing at the opening of the equipment for unloading.
- Three (3) 4m x 4m motorized roller shutters
- Dry wall internal partitions, wash rooms, showers,
- External walls: cement blocks up to 3 metres high, and above, up to the roof cladding (aluminium sheets)

Truck Washing Platform

The truck-washing platform integrating a wastewater treatment system will comprise of the following components.

1. a dedicated platform with waterproof floor of 5m x 10m with discharge system for wastewater

2. filter and decanter system with activated charcoal to manage the mechanical waste oils from the cleaning of the vehicles prior to discharge in the public sewer system

3. an electric panel 380V

4. an area for the washing equipment with high pressure

5. a storage area for cleaning products (bactericidal, fungicidal, etc)

A schematic drawing of the proposed truck washing platform and wastewater treatment system is illustrated in Figure 3 -13 below.

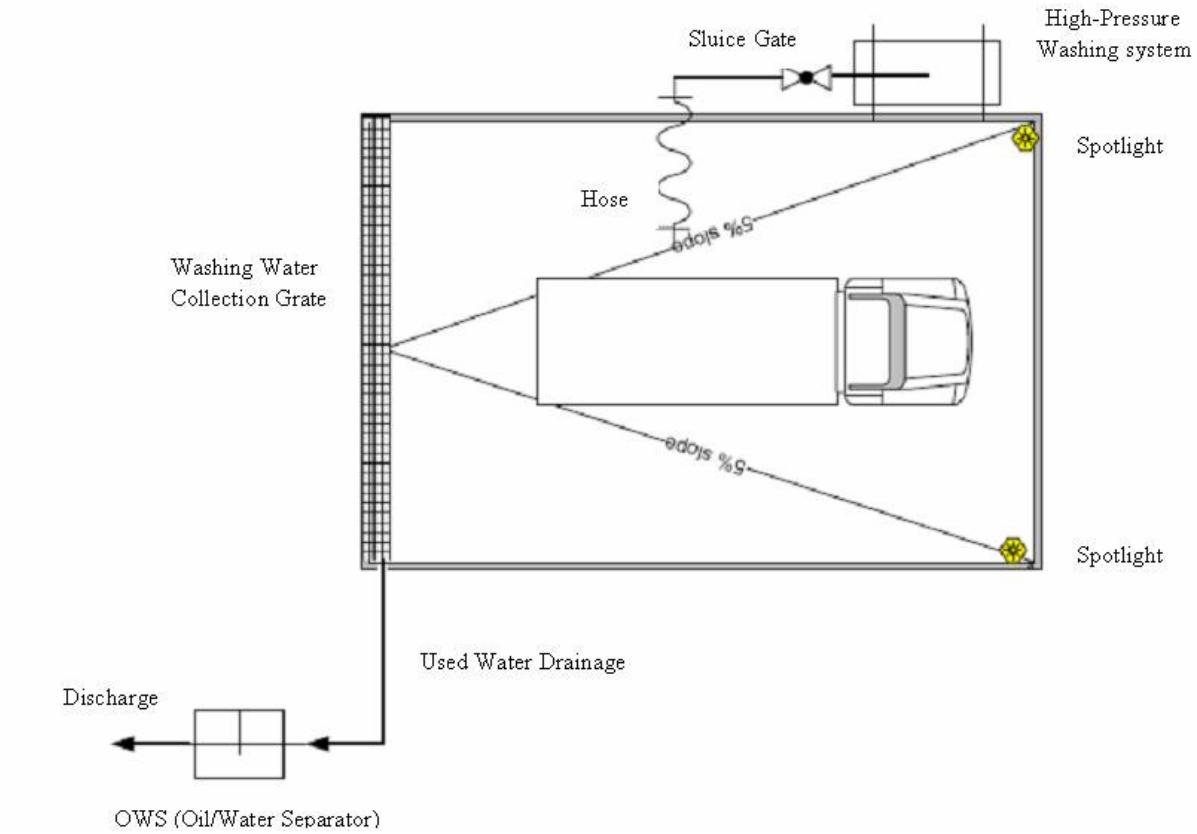


Figure 3-13 Schematic Drawing of truck washing platform with integrated wastewater treatment system

3.3.4 The Technology

General Overview of the Steam Sterilization Technology

Traditionally, incineration has been a method of treatment and destruction of medical waste, hazardous chemical waste, and municipal waste. Over the past several years however, public health and environmental pollution concerns as well as new stringent regulatory requirements for air emissions from incinerators have fostered the development of a variety of environmentally medical waste technologies as alternatives to incineration. Such technologies included steam sterilization (autoclave), microwave, pyrolysis and mechanic/chemical disinfection.

The treatment technology which is proposed to be used at the southeast regional medical waste treatment facility is steam sterilization, which uses low-heat thermal energy to decontaminate the waste (destroy pathogens in waste) at temperatures insufficient to cause chemical breakdown or to support combustion or pyrolysis.

Steam sterilization, a standard process which has been used in hospitals for disinfecting reusable instruments, has been adapted for medical waste treatment. As such, it is not regarded as a disposal option, but as a necessary form of pre- treatment required for certain categories of clinical waste before they can be disposed of by other means. There are two traditional type of equipment used for steam treatment: autoclave and retorts. A new generation of autoclaves has been developed that may be considered alternative treatment technologies (advance autoclaves). These technologies now incorporate maceration or shredding during the treatment process to ensure better penetration of steam. Additionally, these systems achieve significant volume reduction (up to 85%). Autoclaves continue to be one of the most popular methods of treatment because of their history of use and track record within healthcare.

Steam sterilization of clinical waste utilizes saturated steam within a pressure vessel (known as steam sterilizer, autoclave, or retort) at temperatures sufficient to kill infectious agents present in the waste. Treatment by steam sterilization is time and temperature dependent; therefore, it is essential that the entire waste load is exposed to the necessary temperature for a defined period. Often, the exposure times are based on twice the minimum time required to achieve a 6 $\log_{10}$ kill of bacterial spores

under ideal conditions; equivalent exposure times at different temperatures can be estimated. The minimum exposure temperature-time criterion is 121^{O}C (250^{O}F) for 30 minutes[11]. In steam sterilization, decontamination of the waste occurs primarily from steam penetration while heat conduction provides a secondary source of heat transfer. Therefore, for effective and efficient treatment, the degree of steam penetration is the critical factor. For steam to penetrate throughout the waste load, the air must be completely displaced from the treatment chamber.

[11] Source: Health Care Without Harm, "Non-Incineration Medical Waste Treatment Technologies: A Resource for Hospital Administrator, Facility Managers, Healthcare Professionals, Environmental Advocates and Community Members", August 2001.

The Proposed Technology

The MOH proposes to use the patented T-2000 ECODAS steam sterilization and shredding technology from France, which is a hybrid design of existing static autoclave technology (advance autoclave). The ECODAS treatment technology is a vertical autoclave that is fully automated with an internal shredding/maceration system at the start of the treatment cycle (Plate 3.1). The pre-shredding/maceration of infectious and pathological waste exposes greater surface area and allows easy and effective waste treatment with direct pressurized heated steam all in one enclosed system to achieve complete sterilization of infectious materials. The ECODAS system achieves a volume reduction of 80% and allows the decontamination of the whole inside, including the shredder, during each cycle. Additionally, it allows for the shredder to be decontaminated throughout the normal course of the cycle, should the need arise for service. The final treated waste is harmless, unrecognizable, unusable, and is safe for disposal, just like ordinary municipal waste in a controlled sanitary landfill (Plate 3.2).

The T-2000 Ecodas equipment ensures microbial inactivation of up to 8 $\log_{10}$. This is above the maximum efficiency level (Level IV) defined by the State and Territorial Association on Alternative Treatment Technology (STAATT), USA: "Inactivation of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacteria, and B. *stearothermophilus* spores at a 6 $\log_{10}$ reduction or greater".

The system is made of stainless steel and is certified up to 9 bars, while the operating pressure if below 4 bars. The ECODAS Company is certified ISO 9001:2000 and carry the Conformité Européenne (CE) approval. The technology has extensive history with installations in many parts of the world including the Caribbean (refer to Appendix D).

The T2000 ECODAS machine is fitted with an automated system for the loading of the waste to be treated, able to accommodate 770 litres plastic wheeled bins. This loading system, combined with a high treatment capacity, ensures absolute minimal handling for a maximum security of the operators.

Plate 3.1 Photograph showing a T2000 Ecodas Treatment System

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Plate 3.2 Photograph showing sterile unrecognizable waste residue from a T2000 Ecodas Treatment System

Treatment Cycle

The treatment cycle of the ECODAS system is shown in Figure 3.13. It involves the following steps:

1. Loading
2. Shredding
3. Heating
4. Sterilisation
5. Cooling
6. Draining
7. Vacuum
8. Unloading

The equipment is a top loading and clinical waste will be offloaded into the treatment vessel by an automated loading system into the upper stainless steel chamber equipped at the bottom with a

heavy duty shredder. Once the loading door of the upper chamber is closed, the processed (shredded) material falls by gravity into the lower treatment chamber, where every particle is steam heated to 138°C (280 F) and pressurized to 3.8 bar (55 psi) for 10 minutes (Figure 3.14). This destroys all forms of microbial life. The shredding permits steam penetration and ensure that all waste material is in direct contact with the sterilizing steam.

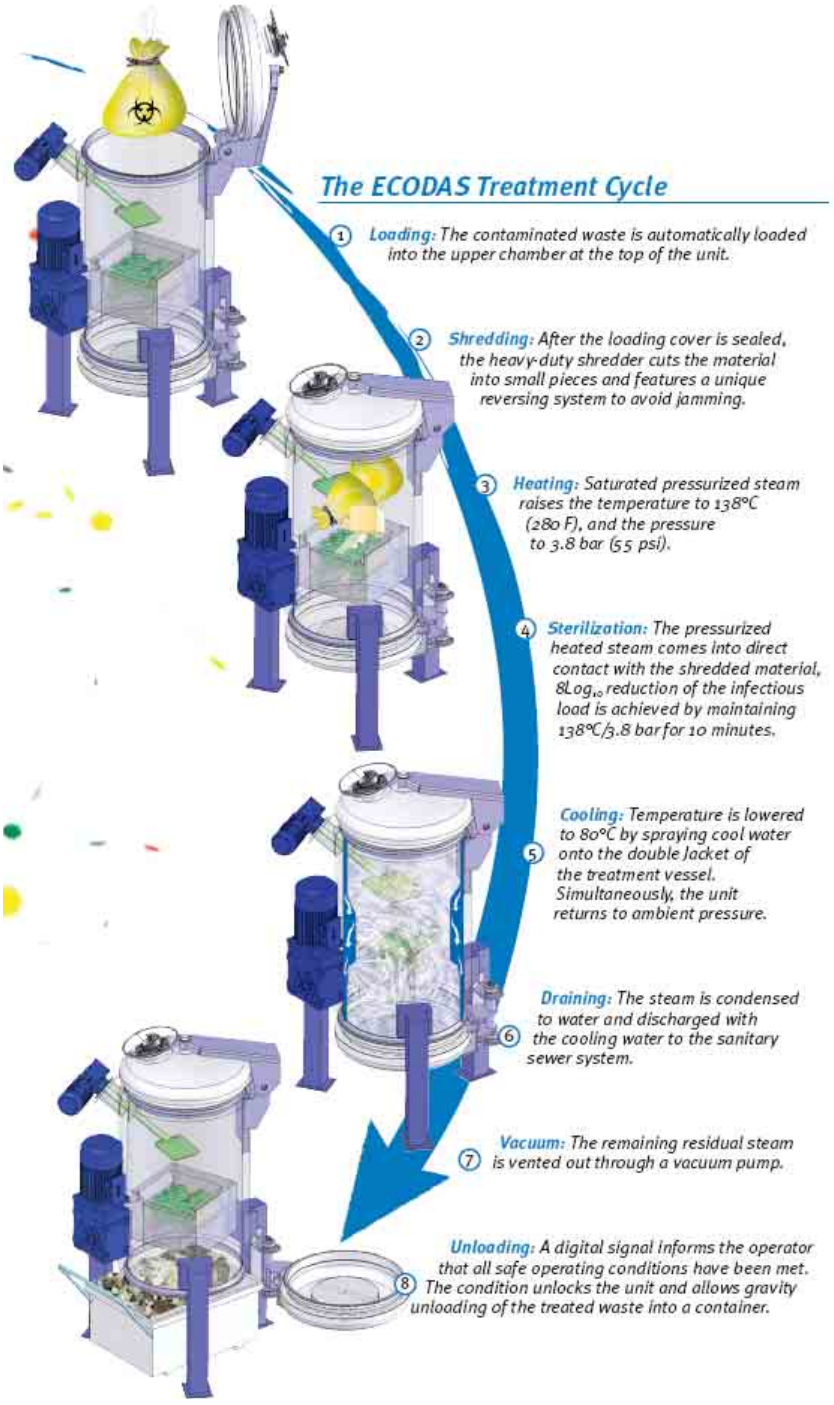


Figure 3-14 Overview of Ecodas Treatment Cycle

Source: SEEN Environment (2006) Invitations for Bids No IFB018: Supply and Installation of a Treatment Plant and Equipment for Hazardous Healthcare Waste Collection and Treatment

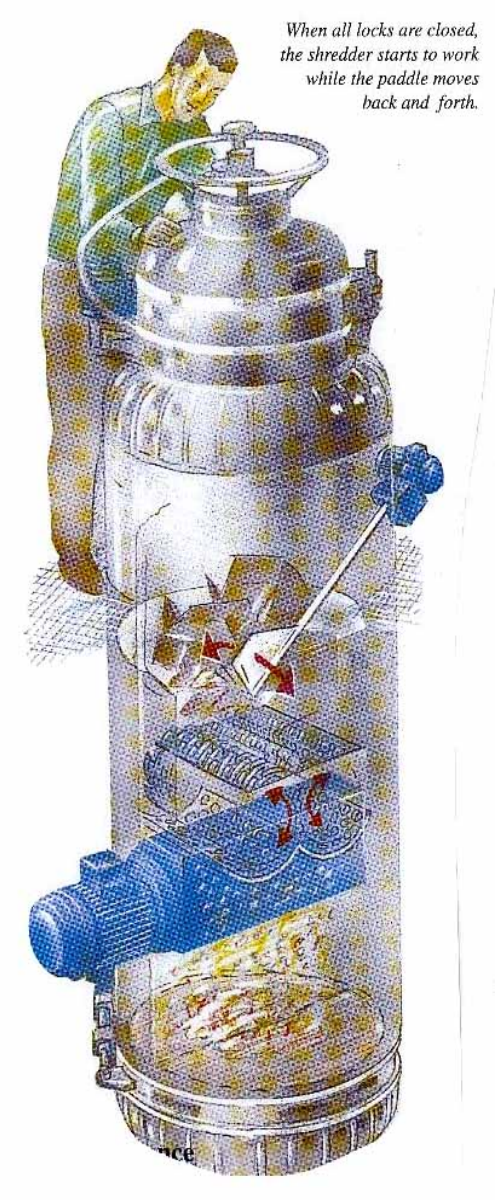


Figure 3-15 Pre-shredding of Waste in the ECODAS Treatment System

Once the sterilization process is completed, the temperature is lowered by 80^0C by spaying cooling waster onto the double jacket of the treatment vessel (Figure 3.15). Simultaneously, the unit returns to ambient pressure. The steam is condensed to water and discharged with the cooling water to the sanitary sewer via a buffer tank. The remaining residual steam is vented out through a vacuum pump and drained out of the treatment plant through a pipe placed at least 3 meters high. This prevents

any aerosol from occurring. Sterile unrecognizable fragments are discharged from the bottom of the machine into containers. A 216 KW electrical boiler capable of generating 300 kg of steam per hour with a capacity of 2000 liters will provide the needed steam to operate the machine. The boiler compressor will be fitted with a silencer.

The operating conditions are continuously monitored and validated to achieve complete sterilization. The 60 minutes average duration process cycle is totally automated. During the treatment cycle, the equipment is totally enclosed and pressurized.

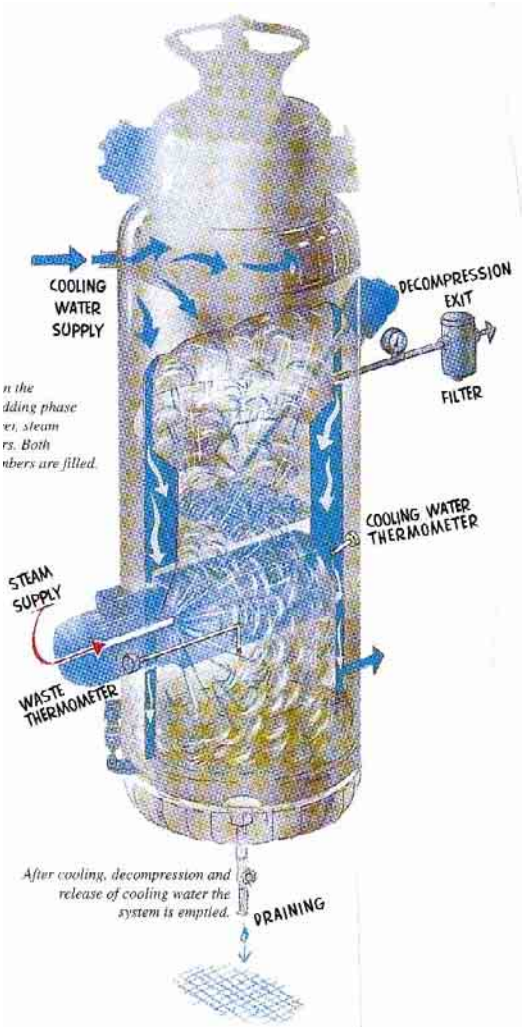


Figure 3-16 Sterilization of Waste in the ECODAS Treatment System

Technical Description and Specifications

The technical description of the ECODAS treatment machine includes the following:

- The treatment stainless steel vat, stamping 4.5 bars,
- The inclusive crusher and its moto-reductor with a power of 15 KW,
- The waste receiving system and waste sterilization system by steam,
- The removing material system for a correct feeding of the crusher,
- One set of valves: heating, cooling, decompression and draining,
- The filtration system of air rejection,
- The vacuum pump for drainage suppression,
- The cooling system,
- The whole being insulated with rock-wool of 50 mm width and protection in stainless steel,
- An electrical panel: a PLC, the necessary interfaces, the power relays for the engines, the printer that is giving all information regarding the treated material.
- Electrical and pneumatic connection between panel and machine.

Figure 3.16 shows a ground and sectional layout of the proposed T2000 Ecodas Autoclave and Shredding Equipment, whilst Figure 3.17 shows the performance parameters and a three dimensional view of the treatment equipment.

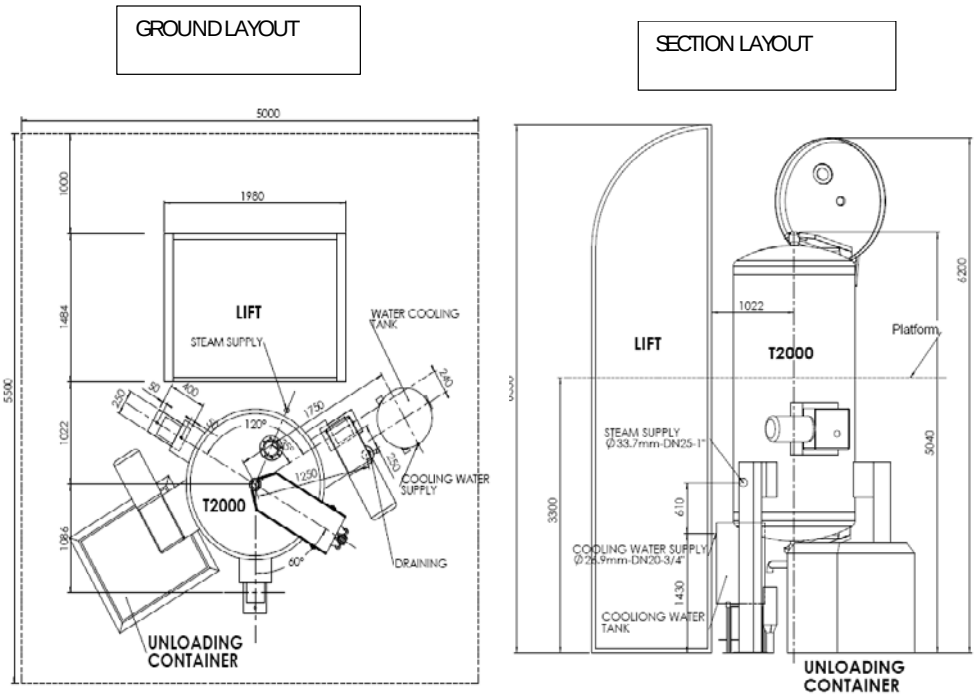
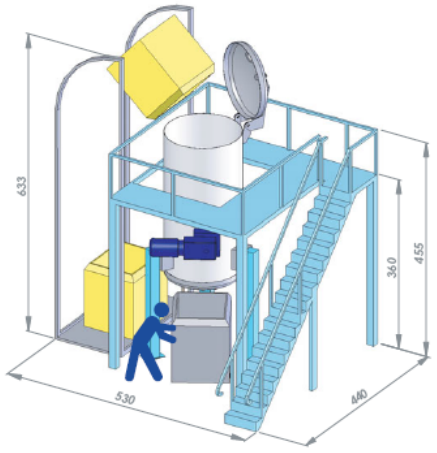


Figure 3-17 Ecodas T2000 Ground and Section Layout



T 2000

TECHNICAL SPECIFICATIONS

General Characteristics	
- Dimensions (L x W x H). cm	300 x 300 x 630
- Dimensions (L x W x H). ft	9.8 x 9.8 x 21
- Shipping Weight. kg	5200
- Max Weight when filled with water. For a special hydraulic test. kg	10500
- Stress. kg/cm²	3.5
- Steam Pressure. Bar	8
- Max Steam Flow. kg/h	500
- Compressed Air. Bar	6
- Electricity 380 V / 3-Phase Surge Protection System	35 kW
Operating Characteristics	
- Average Cycle Time. minutes	60
- Process Volume Capacity. liters	2000
- Average Waste Density. kg/m³	100
- Average Process Weight Capacity. kg/Cycle	200 - 300
- Average Process Weight Capacity. lb/Cycle	440 - 660
- Microbial Inactivation	8 $\log_{10}$
- Waste Volume Reduction	80 %
Consumption / Cycle	
- Steam. kg	40
- Electricity. kW/h	9
- Water. liters	330

Figure 3-18 Performance Parameters and 3-D View of the Ecodas T2000 Equipment

Source: SEEN Environment (2006) Invitations for Bids No IFB018: Supply and Installation of a Treatment Plant and Equipment for Hazardous Healthcare Waste Collection and Treatment

Quality Monitoring

The T2000 Ecodas equipment has a computerized system that monitors the process and automatically prints a report with the essential sterilizing parameters (date and time, duration of the cycle, temperature and pressure achieved) at the end of each treatment cycle for accurate record keeping (Figure 3.18). All events in every cycle are logged on a computer in a data base as well as being continuously printed out.

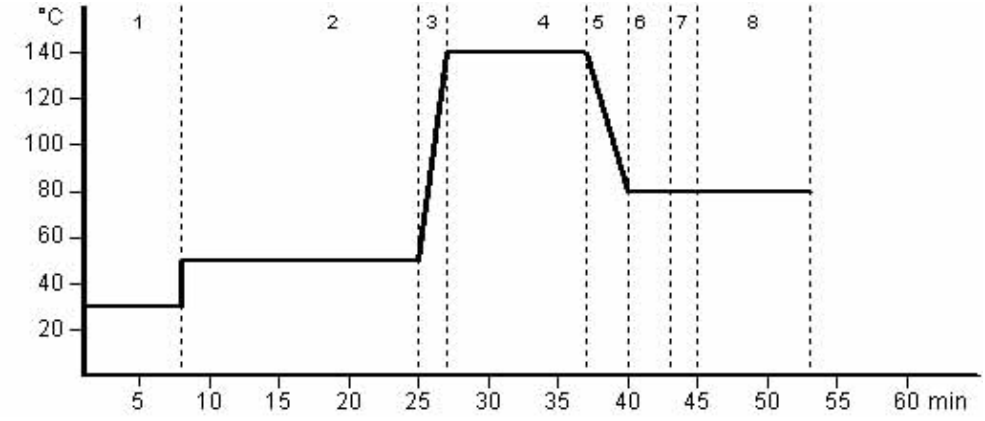


Figure 3-19 Sterilisation Cycle Graph

Fail-Safe Built In Device: Human Machine Interface (HMI)[12]

The ECODAS SYSTEM has a state-of-the-art touch screen operator's console to allow a direct and friendly interface with the machine control system. It clearly displays cycle information, stages, alarms (type and frequencies), parameters, temperature and pressure diagrams and the sterilization FO factor. It also displays all the functions with their explanations directly accessed from the touch screen itself. The operator cannot open the machine is the treatment cycle is not completed successfully. There is a Security time, during which it is ensured that all conditions are met to allow an opening of the system.

In case of any dysfunction (including non achievement of treatment parameters and blocking of the shredder for instance), the system will stop the cycle and alert the operator (light and sound alarm). The

[12] SEEN Environment (2006) Invitations for Bids No IFB018: Supply and Installation of a Treatment Plant and Equipment for Hazardous Healthcare Waste Collection and Treatment

screen will display a message with the type of incident and the procedure to be followed. (The operator is also trained to manage each type of incident and has a the technical manual of the machine)

In case of a failure or incident during a treatment cycle that requires intervention inside the machine like a shredder jam, the special sterilizing program: "SAFETY CYCLE" must be launched to ensure basic safety. It ensures complete sterilization of the inside of the machine.

The machine will not open as long as this "SAFETY CYCLE" is launched and completed. Thus, this is the only way to access the shredder and remove the jammed sterilized elements and pursue treatment. Given the fact that not necessarily all the waste would have been shredded before sterilization, the technicians are trained to take all the necessary measures to ensure maximum safety during the operation (adequate personnel protective equipment).

The Shredding Technology

The technology used for the shredding is no doubt one of the most remarkable features of the system. Waste experts and professionals are fully acquainted with the fact that it is difficult to various types of waste properly shredded all together. For instance, something not expected, like a screw driver or a small steel surgical tool, can ruin the mechanism and that the moving parts could be clogged by melt plastics. The Ecodas shredder's design eliminates these eventualities. The counter rotating rolls of the shredder systematically change direction at regular intervals. In addition to that, if system bumps into something, it automatically changes direction as well in order to avoid any blocking. However, if any blocking occurs, the Safety Cycle must be launched (See paragraph "Fail-safe built in technology" below).

The dimensions and the form of the claws are totally innovative, with a proven efficiency of more that 10 years. The rolls are constructed from the most durable material available. The power input to the shredder is 11 kW or 20 HP (horsepower).

A replacement shredder is supplied with the equipment to allowed easy refurbishment of the claws (recommended on a yearly basis). During refurbishment or maintenance of one shredder, the other is

used for operation. Therefore, the employer can use alternatively the two shredders over a period of 6 to 8 years.

3.4 Pollution Control and Waste Management Information

3.4.1 Maintenance Programme

The maintenance programme for all equipment at the facility will include:

a. Routine Maintenance: Everyday cleaning of equipment and weekly maintenance by trained staff
b. Preventative Maintenance: on a every four – five months visit by equipment vendor
c. Technical Assistance: Mandatory availability of the vendor's technicians to be on the spot in the maximum time of 48 hours, in the event of malfunction which may not be solved by local personnel

The T2000 Ecodas treatment equipment is a low maintenance system. Maintenance will be done in accordance with the manufacturer's requirements (Table 3.7). Additionally, there will be a maintenance and service agreement with the manufacturer.

Table 3-7 Recommended maintenance schedule

The following is the recommended MAINTENANCE schedule:

Machine Area	Action	Frequency
Loading cover		
	Check if there is no residue or buildup on the seal	Every cycle
	Clean the seal	Every week
Cooling water pipe system		
	Clean the water pipe system	Every 3 months
Paddle Assembly		
	Check the oil level of paddle gearbox and refill with Mystic Gear 80/90 oil if necessary	Every 6 months
	Clean the paddle assembly	Every week
High efficiency filter		
	Change the filter cartridge	Every year or if Alarm 12 is on
Shredder		
	Shredder replacing	4000 CYCLES
	Check the grease level of the shredder greasing pump and refill with recommended grease if it's necessary	Every day
	Clean the shredder	Every week
	Check the oil level of the shredder gearbox and	Every month

3.4.2 Contingency

Contingencies to be employed in the case of equipment downtime including breakdown, power outage and/or maintenance will include:

At Treatment Facility

- Containers with waste already at the facility during downtime will remain in storage inside the treatment building and/or in the 2 refrigerating containers in the case of pathological waste. The building and refrigerating containers will provide a total storage capacity for 3 days.

- A minimum stock of mandatory spare parts, including one shredder, will be maintained at the facility along with a list of source companies, manufactures, and distributors. This will reduce downtime associated with a breakdown or malfunction.

- Should the shredder breakdown, it will be replaced immediately with the spare shredder from the stock of mandatory spare parts. A new shredder will be purchased to ensure that one is always available.

- The facility will also have a 450 KW stand-by electricity generator and water storage tanks with a total capacity of 23,000 liters (3 days supply) in case of power failure and water lock-off respectively. This will ensure that the facility can still operate.

Alternative Disposal

- Waste will be transported for treatment at one of three existing incinerators located at the May Pen, Mandeville or St. Ann's Bay hospitals and/or to one of the other regional medical waste treatment facility proposed for the remaining three health regions. Funding for these proposed facilities are currently being sourced and implementation is anticipated to commence in 2008/2009.

- The aforementioned incinerators are among those identified by the Ministry to be evaluated (air quality) and retrofitted with appropriate air pollution and control devices. Evaluations are anticipated to commence in 2007. They form part of the treatment capacity for the respective health regions within which they are located.

- Another option includes the encapsulation of medical waste and buried in special constructed cells at the Riverton landfill.

At Healthcare Facilities

- Healthcare facilities will be equipped with 2 – 3 days interim storage capacity, including refrigeration units for pathological waste, to store waste generated at the facility. Under the National Medical Waste Management Policy and the Health Facilities Infection Control Policy and Procedures Manual, medical waste may be stored at healthcare facilities for a period not to exceed 72 hours.

- Waste will not be transported to the treatment plant during downtime.

Emergency and Contingency Plan

An emergency and contingency response plan will be developed to ensure that the proper response to unplanned, emergency, or abnormal events. It will be developed with the assistance of the manufacturer (vendor) and by using the manufacturer supplied information. The primary objectives of this emergency and contingency response plan are:

- To prevent or minimize biological and/or chemical agent release to the environment;
- To prevent or minimize exposure to the equipment operator or other support or maintenance personnel;
- To develop contingency medical waste treatment or disposal alternatives for untreated or inadequately treated waste.

Information to be provided within the plan includes:

- A description of all potential occupational safety and health-risks posed by the equipment and its uses
- A description of proper responses for system upsets and emergency conditions;
- A description of personal protective equipment (PPE) requirements for routine, abnormal, and emergency operations;
- A description of proper medical response if required
- A pre-designated disposal site(s) for untreated or inadequately treated medical waste if a mechanical failure precludes the treatment equipment's use.

3.4.3 Medical Waste Management and Operations Plan

The facility will have a waste management and operations plan which will comprise the following:

- A description of the medical waste handled by the facility including type and volume of medical waste and wastes types prohibited for treatment;
- A detailed narrative explaining how the facility will operate, including design capacity, a description of all medical waste storage areas and equipment specifications. Also a

description of procedures to mitigate the effects of equipment failures and power outages including provisions for alternative storage and disposal capacity;

- Hours and days of operation at the facility and the number of truck delivering medical waste that are expected daily;
- Treatment efficacy monitoring procedures;
- Personal protective equipment requirements;
- A general inspection schedule for the facility;
- Description of security procedures and equipment;
- Training requirements and procedures for personnel who handle medical waste; including procedures in place to prevent and minimize exposure of personnel to medical waste;
- Emergency spill containment and clean-up procedures and equipment;
- The names and positions of the equipment operators; and,
- The name, address, and telephone number to the person(s) responsible for medical waste management at the facility.
- Manufactures operational and maintenance manuals for both routine and preventative maintenance of all equipment.

3.4.4 Engineering Controls - Periodic Monitoring

Engineering controls of the treatment equipment will be periodically monitored to ensure that they are functioning properly. Additionally, wastewater discharge will be periodically analyzed for Volatile Organic Compound (VOC) and heavy metals.

Colour-changing chemical indicators or biological monitors (e.g. B. *stearothermophilus* or B. *subtilis* spore strips) will be used to monitor the treated solid waste. This will be conducted periodically (or at frequency dictated by regulatory agency) to verify that sufficient steam penetration and exposure time have occurred, thus verifying the composition of treated waste and ensure effective treatment. It will be done by placing the indicators or monitors at the centre of test loads

3.4.5 Operating Personnel and Collection Staff

Training

Operational and collection staff will receive training, which will include (but not limited to) the following. They will also attend the installation, assembly and commissioning of the treatment plant.

a. Basic understanding of the treatment system and operational issues associated with all other equipment at the facility.

b. All occupational health and safety issues as they apply to the handling and treatment of medical waste, washing to storage containers, operating of all equipment at the facility. Training will included but not limited to personal protective equipment, noise and abatement, machine guarding, exposure to blood-borne pathogens, ergonomics, proper waste handling techniques, hazards associated with steam and hot surfaces.

c. Procedures in appliance regarding workers safety while operating processing units, including the mechanical washing system, sterilization and shredding equipment, the loading system or any engineering machine part of the treatment plant and washing system.

d. Routine and preventative maintenance procedures of the sterilization and shredding equipment and related accessories. Such training may include overseas travel to an existing facility in operation.

e. Record keeping.

Personal Protective Equipment (PPE)

The operators of the treatment unit will use appropriate personal protective equipment dictated by the situation (gloves, shoes or boots with thick soles and good traction, coveralls, goggles, face shield or mask, respirators). Company uniform will be mandatory at work. The personnel will be subject to receiving preventive vaccination and two medicals each year.

COLLECTION AND TREATMENT UNIFORM :
Thick short gloves and short safety boots

WASHING UNIFORM :
- Thick long gloves
- Safety plastic high boots
- Rain suit
- Protective Eyewear for the projections

SPILL CONTAINMENT UNIFORM :
- Tyvek suit
- Thick long gloves
- Protective breathing device
- Protective Eyewear for the projections

- Protective Eyewear for the projections
- Protective breathing device
- Thick short gloves
- Thick long gloves

Figure 3-20 Personal protective equipment to be worn by operators

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Figure 3-21 Personal protective equipment to be worn by operators

3.4.6 Medical Waste Records and Reports

Medical Waste records and reports to be kept or made for the facility will include:

- Record, by source, type and weight, of all waste received at the facility
- Record of all waste treated at the facility
- Record of all treated waste transported from the facility for disposal at the Riverton Landfill
- Waste manifests
- Record of employee training and orientation
- Safety Meeting Minutes that show issues and action taken
- Record of accidents and related injuries requiring medical treatment
- Report of all work related injuries
- Report of all accident investigations
- Weekly equipment inspection report and related corrective action reports
- Record of maintenance activities
- Record containing the dates and results of chemical or biological indicator tests, PSI, sterilization time and temperature profile for each batch
- Records required for NWC water/sewer connection

3.4.7 Method to contain spillage

All waste will be placed by the generators first in red bags or sharps containers, which will then be placed in enclosed, secure 770L containers with lockable lids provided by the facility. All waste containers will be inspected by the driver/sideman prior to loading onto the specialized truck and securely placed in the truck to prevent load shifting during transport. They will then be transported to the treatment facility. Upon arrival at the facility, all containers will be inspected and unloaded from the truck via a hydraulic tail lift directly in side the facility building. Mechanical lift attached to the treatment equipment will be used to offload the waste into the treatment chamber. Thus, there will be no opportunity for the waste to be exposed to the land outside the building.

All facility operating personnel, including truck drivers will be trained in contingency planning that will cover methods of spill containment, should spillage occur. Trucks transporting the waste will be equipped with spill containment material/kit.

3.4.8 Methods to control disease vectors

The risk of exposure to blood borne pathogens at a treatment facility will be minimal as the waste will be packed according to the Medical Waste Management Guideline of the Health Facilities Infection Control Policy and Procedures Manual. That is, segregated and containerized into red bags and sharps containers before placed into 770L containers for transportation. Large (770L) Containers that are leaking or packaged in such a manner as to allow release of materials will not be accepted for pick up. Potential exposure situations would include leaky containers during loading or unloading of the waste or the breakage or leaking of a container during transport or storage. Control measures, the steps that will be taken to eliminate or minimize the risk of exposure to bloodborne pathogens, will be in place and will include the following:

- Engineering Controls: Engineering controls will reduce worker exposure by either removing or isolating the hazard or isolating workers from exposure. Examples of such engineering controls that will be used to minimized potential exposure to bloodborne pathogens include, but not limited to, bags of adequate strength, containers of adequate rigidity and mechanical

aids. Engineering and work practice controls are generally accepted as the primary means of eliminating exposure to bloodborne pathogens.

Where occupational exposure remains after the institution of these controls, personal protective equipment (PPE) will also be used.

- Personal Protective Equipment: Workers will wear PPE to shield themselves from bloodborne pathogens. PPE may include puncture and heat resistant gloves, plastic apron, hard boots, face shields and dusk masks at minimum. But, PPE will not be used as the primary means to control exposure, unless substitution, engineering or administrative controls are not available or not practicable. Additional protection is required where engineering and administrative controls may be insufficient to eliminate exposure, or the exposure may result from temporary or emergency conditions only.

  Staff will be instructed not to carry out any work when there are reasonable grounds to believe that to do so would result in imminent danger to the health and safety of the staff member, any other person, or employer or facility property.

  All medical waste will be placed into containers that are: closeable, constructed to contain all contents and prevent leakage during handling, storage and transport, labelled and colour-coded according to the Medical Waste Management Guideline of the Health Facilities Infection Control Policy and Procedures Manual. All containers will be closed prior to removal to prevent spillage or protrusion of content during handling, storage and transport.

- Administrative or Work Practice Controls: Administrative or work practice controls will reduce the likelihood of occupational exposure to risks by altering the way the task is performed. Work practice controls may include but not limited to safe work procedures, adequate supervision, training and education, and purchasing standards.

- Occupational Health: Personnel will receive tetanus and Hepatitis B vaccinations if they do not already have these immunizations.

3.5 Water and Wastewater

Water supply for the area is provided by the National Water Commission (NWC). Discussions with NWC personnel revealed that there are no significant issues at this time with water supply to the area, and therefore service can be made available to the proposed development.

There are sewer mains running along Drummond Street, Princess Street and North Streets with diameters of 6", 10" and 30" respectively. They are connected to the Hanover Street sewage pumping station, which is channelled to the Western Treatment Plant (WTP) - primary treatment. This WTP will be decommissioned (within the next 18 months) once the new tertiary treatment plant at Soap Berry is completed and commissioned.

3.5.1 Water Requirements

Water will be required for both personal hygiene (domestic/foul sewage) and for facilitating the facility's operation (trade effluent).

Based on the projected operating hours of 14 to 16 per day of the treatment facility, it is estimated that the facility will require an employee population of 14 persons. The autoclave operation will require 150 litres per cycle[13] in order to treat the estimated 200 Kg per cycle (per hour) of medical waste.

The overall water requirements for the project are estimated to be 7,800 litres (2,026 gallons) per day. See Table 3.8 for a breakdown.

[13] The use of a cooling device with the treatment equipment will effectively reduce water consumption per at a rate of 50% per treatment cycle (hour). Thus, the autoclave operation will require 150 liters per cycle instead of 300 liters.

Table 3-8 Daily water consumption

Activity/ Source	*Quantity*	*Rate (liters)*	*Amount (litres/day)*
T2000 Treatment Equipment Cycle	14	150	2,100
Electric Boiler	1	640	640
Mechanical Washing machine	1	2,130	2,130
Cleaning of Treatment Area	1	1,200	1,200
Cleaning of Trucks	2	228	456
Employee Use (office, toilets & shower) & Contingency	14	91	1,274
TOTAL			**7,800**

3.5.2 Wastewater

Wastewater Streams

Two types of wastewater streams are expected from the facility. These are:

- Domestic/foul sewage (1,274 litres per day)
- A relative small amount of trade effluent/industrial effluent wastewater (6,526 litres per day)

Wastewater effluent includes:

d. Sterile residual steam

e. Low risk cooling water of the treatment equipment

f. Discharge waters from the cleaning and disinfecting of the waste containers, trucks and the treatment area

These liquid effluents will be drained into a common tank before final discharge to the sewage system. This buffer tank will be sized at 1 cubic meter and will allow cooling down the water temperature between 2 cycles (2 hours). That is, the low risk cooling water which is usually at temperatures of 65°C – 70°C will be cooled down to 26 °C – 28 °C prior to being discharged.

The cooling water is generated as water is sprayed onto the outside wall of the inner chamber of the sterilization unit to cool down the system at the end of the treatment cycle. This water, at **no** time,

comes into contact with the waste before, during or after treatment and is therefore not contaminated in any way.

Effluent from toilets, washing rooms etc. will be directly discharge into sewer drain.

Wastewater Quality

The manufacturers of the proposed system provided effluent quality from 4 treatment plants utilizing a T2000 Ecodas treatment system. The average effluent quality from these facilities were compared against the NEPA Trade Effluent Standards and found for the most part to be fully compliant with the standards (Table 3.9).

Two parameters exceed the Trade effluent standards before the proposed holding tank. These are:

- COD (with a range of values from 236 to 655 mg/l in the effluent versus a standards of 100 mg/l) and
- Nitrates (with a range of values from 12 to 16 mg/l in the effluent versus a standards of 10 mg/l)

Table 3-9 Wastewater Effluent Characteristics

	Parameters	Units	Wastewater Effluent Characteristics					Trade Effluent Standards
			Hospital 1	Hospital 2	Hospital 3	Hospital 4	Average	
	Microbial							
1	Total Coliform	per 100 ml	0	0	0	0	**0.00**	500
2	Fecal Coliform	per 100 ml	0	0	0	0	**0.00**	100
	Organics							
3	Pesticides presence							
4	Cyanide	mg/l						0.2
5	Total Organic Carbon	mg/l						100
6	BOD	mg/l		240	215	94	**137**	
7	COD	mg/l	655	375	330	236	**399**	100
8	Phenolic compounds							0.1
9	Oils and Grease		1.12				**1.12**	10
	Inorganic							
10	Aluminium	mg/l						
11	Antimony	mg/l						
12	Arsenic	mg/l	0.005				**0.01**	0.5
13	Barium	mg/l						5
14	Beryllium	mg/l						0.5
15	Boron							5
16	Cadmium	mg/l	0.005	0.005	0.010		**0.005**	0.1
17	Calcium	mg/l						
18	Chromium	mg/l	0.050	0.050	0.050		**0.05**	1
19	Copper	mg/l	0.050	0.050	0.050	0.020	**0.04**	0.1
20	Cyanide (as free cyanide)	mg/l						0.1
21	Fluoride	mg/l						3
22	Iron	mg/l				0.030	**0.030**	3
23	Lead	mg/l	0.010	0.010	0.010	0.100	**0.03**	0.1
24	Magnesium	mg/l		0.050	0.050		**0.03**	
25	Manganese	mg/l				0.010	**0.01**	1
26	Mercury	mg/l	1.200				**1.20**	0.02
27	Mercury (inorganic)	mg/l						
28	molybdenum	mg/l						
29	Nickel	mg/l	0.050	0.050	0.050	0.030	**0.05**	1
30	Nitrate	mg/l	16	15	15	12	**14.5**	10
31	Nitrites	mg/l	0.07	0.05	0.05	0.081	**0.06**	
32	Phosphates-P	mg/l	0.40	1.50	2.00	0.09	**1.00**	5
33	Potassium	mg/l						
34	Selenium	mg/l						0.5
35	Silica	mg/l						
36	Strontium	mg/l						
37	Sulphates	mg/l						250
38	Thallium	mg/l						
39	Uranium	mg/l						
40	Zinc	mg/l	0.140	0.140	0.080	0.145	**0.126**	1.5
	Disinfectant and Disinfectant By-products							
41	Chlorine	mg/l						
42	Bromide	mg/l						
43	Trihalomethane	ug/l						
	Compliant and Process parameters							
44	Ph	u.pH	8	7.75	8.15	7.6	**7.9**	8.5
45	TDS	mg/l						1000
46	TSS	mg/l	19	14	40	30	**26**	50
47	Total Hardness	mg/l						
48	Ammonia	mg/l						1
49	Hydrogen Sulphide	mg/l						0.2
50	Bicarbonates	mg/l						
51	Sodium	mg/l						100
52	Conductivity							
53	Chloride	mg/l						300
54	Turbidity							

Source: SEEN Environment (2006) Invitations for Bids No IFB018: Supply and Installation of a Treatment Plant and Equipment for Hazardous Healthcare Waste Collection and Treatment.

3.6 Drainage

The site has a nominal area of 3,000 square metres with an overall slope of about 3.2% from the northern to the southern end of the property. The project area is also elevated above the road level by 1.1 to 1.8 metres. The entire project area is already impermeable and will remain totally impermeable after construction. No net increase of runoff is therefore expected.

The SCS Method was utilized for estimating the storm water runoff for the area. A peak runoff for the five year rainfall event was estimated at 0.100 cubic metres per second. This is a relative small storm water flow that can be captured and conducted towards the nearby sub-surface storm water network.

Table 3-10 Drainage Input

Input Parameters	Project	Units
Area	3000	m2
Main stream length, L	60	m
Secondary length (from top of main drain to catchment boundary), L	25	m
Distance from outlet to centroid, Lc	30	m
Lower elevation	0.00	m
Upper elevation	1.60	m
Slope	2.667%	
Ct	1.50	
Cp	0.17	
Runoff Coefficient, C	95.0%	
Curve Number, CN	98	
Hydrology		
Time of concentration		
Time entry	0.083	hours
Overland/shallow flow, Tt (NCCS revised)	0.004	hours
User switch (Box = 1, V = 2, Trapezoidal =3; Pipe = 4)	1	
Time of travel in main channel	0.083	hours
Tc	0.17	hours
Rainfall-24 hours (1 in 10 year return period)	190	mm/24hours
Runoff		
Maximum potential retention, S	5.2	mm
Rainfall intensity for tc	14.38	mm/24hours
Time of Concentration		
Tc-Australian	0.1	
Tc-FAA	0.1	
Effective Runoff (SCS) - Peak/instanteous	**0.10**	**m3/s**
Effective Runoff (SCS) - Peak/Tt	**0.10**	**m3/s**

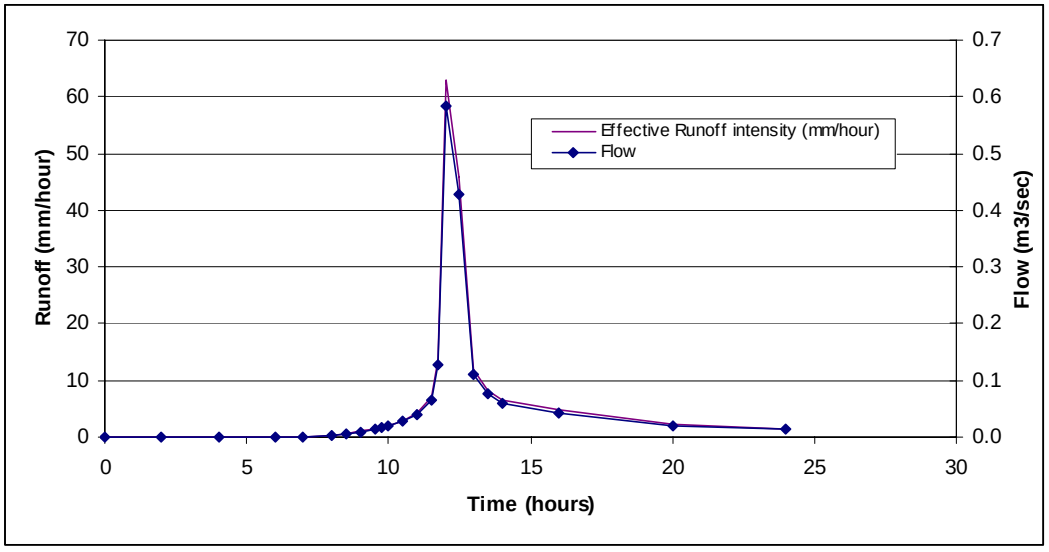


Figure 3-22 5 Year Return Period rainfall runoff hydrograph

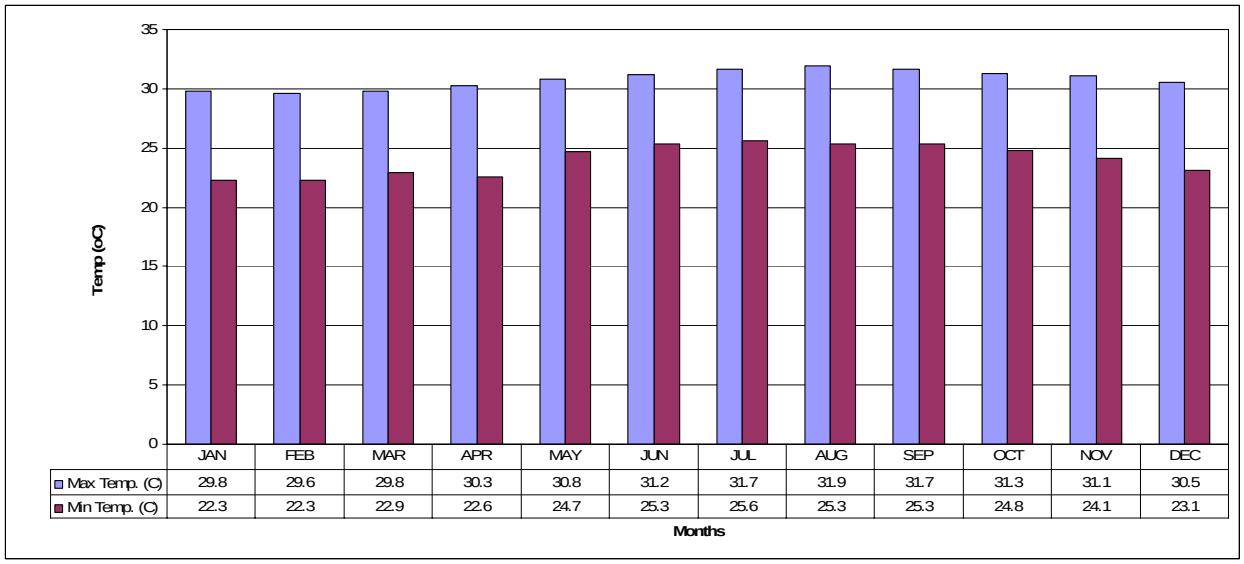
4.0 BASELINE DESCRIPTION

4.1 Climatology, Meteorology and Air Quality

4.1.1 Climate

Temperature

The mean monthly temperatures are lowest in January (22.3°C) and February (22.3°C) and highest between July and September (31.7 – 31.9°C) (Figure 4.1).



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Max Temp. (C)	29.8	29.6	29.8	30.3	30.8	31.2	31.7	31.9	31.7	31.3	31.1	30.5
Min Temp. (C)	22.3	22.3	22.9	22.6	24.7	25.3	25.6	25.3	25.3	24.8	24.1	23.1

Figure 4-1 Mean monthly temperatures for Norman Manley International Airport

Humidity

The mean monthly relative humidity ranges between 60 and 80 percent. Relative humidity is lower in the afternoons (Figure 4.2).

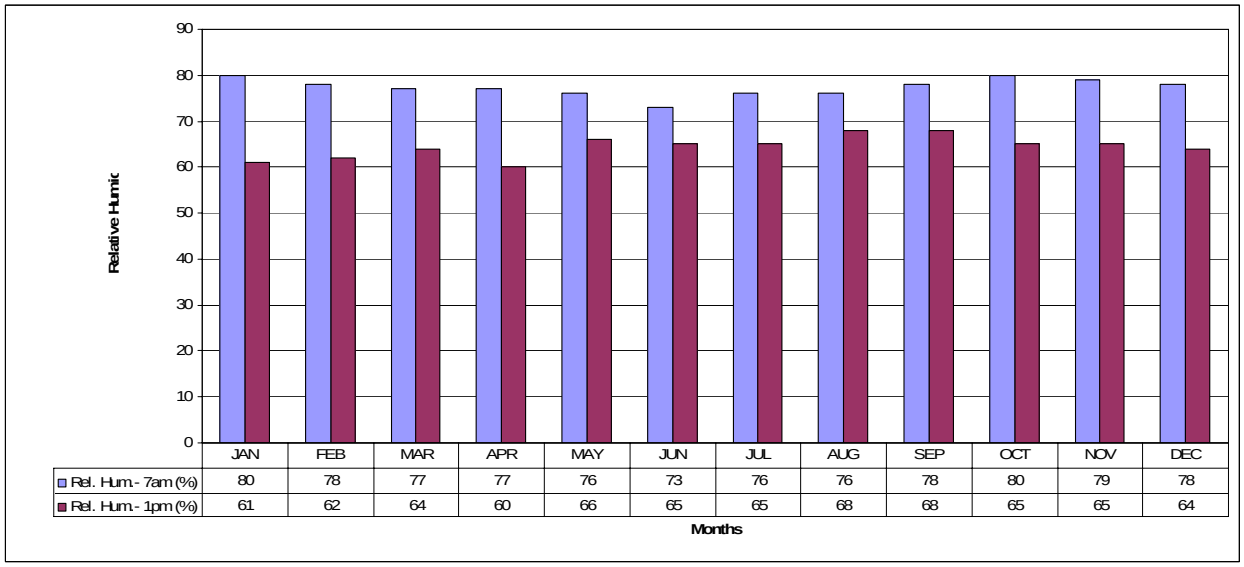


Figure 4-2 Mean monthly relative humidity for Norman Manley International Airport

Rainfall

The data indicates that there are two rainy seasons in the year. These times are the May to June period and the August to October period where the highest intensities occur (Figure 4.3 and Figure 4.4).

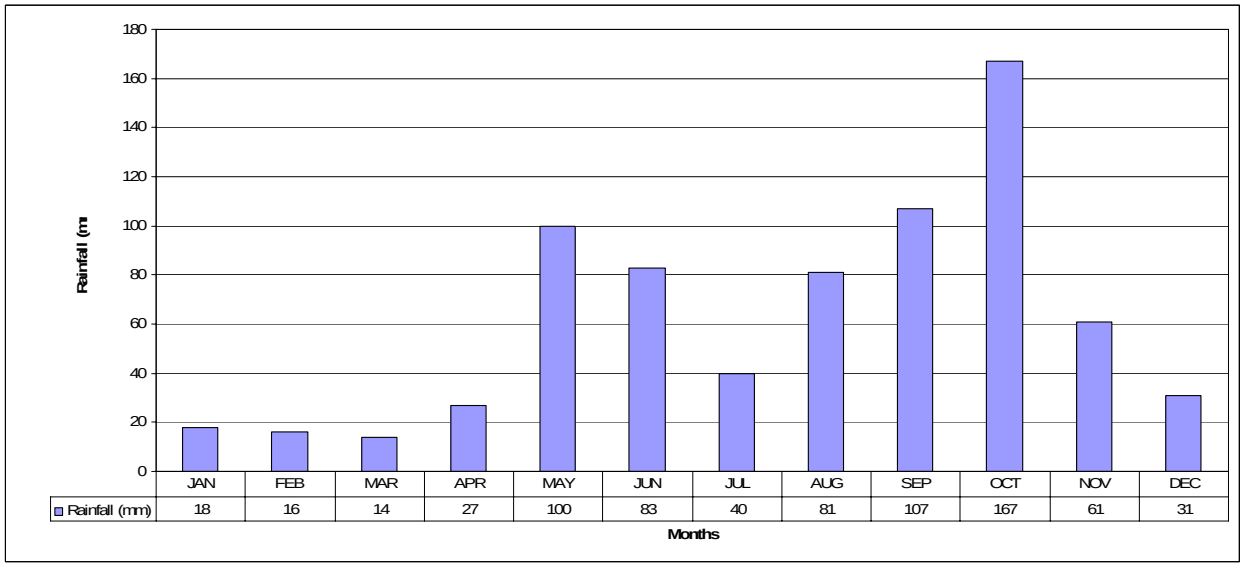


Figure 4-3 Mean monthly rainfall data for Norman Manley International Airport

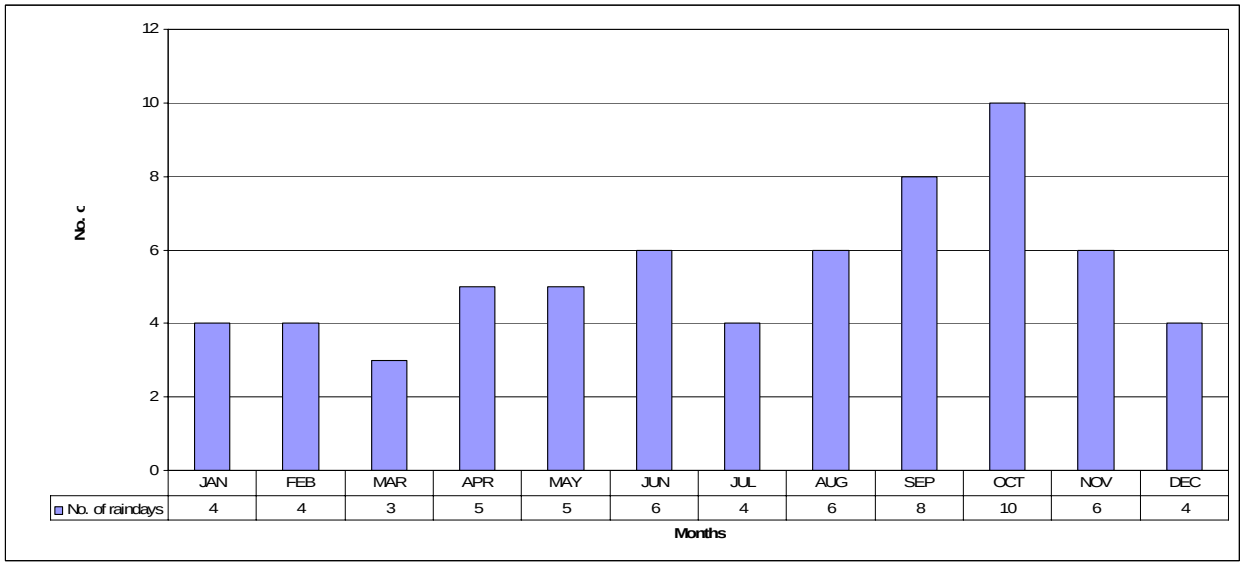


Figure 4-4 Mean number of rain days for Norman Manley International Airport

Wind

Figure 4.5 shows an annual wind rose for the Norman Manley International Airport (NMIA) from January 1999 through December 2004. The predominant wind direction is from the east southeast with average wind speeds of 7.70 m/s.

The proposed development is approximately 4.5 km (≈ 2.8 miles) north of the NMIA. The wind data gives an indication of what is expected at the proposed site.

A monthly analysis of wind direction and speeds indicated that monthly the winds generally blew to the west with wind speeds ranging from 6.32 to 10.97 m/s with the highest wind speeds occurring in the months June to August (10.97, 9.57 and 9.22 m/s respectively).

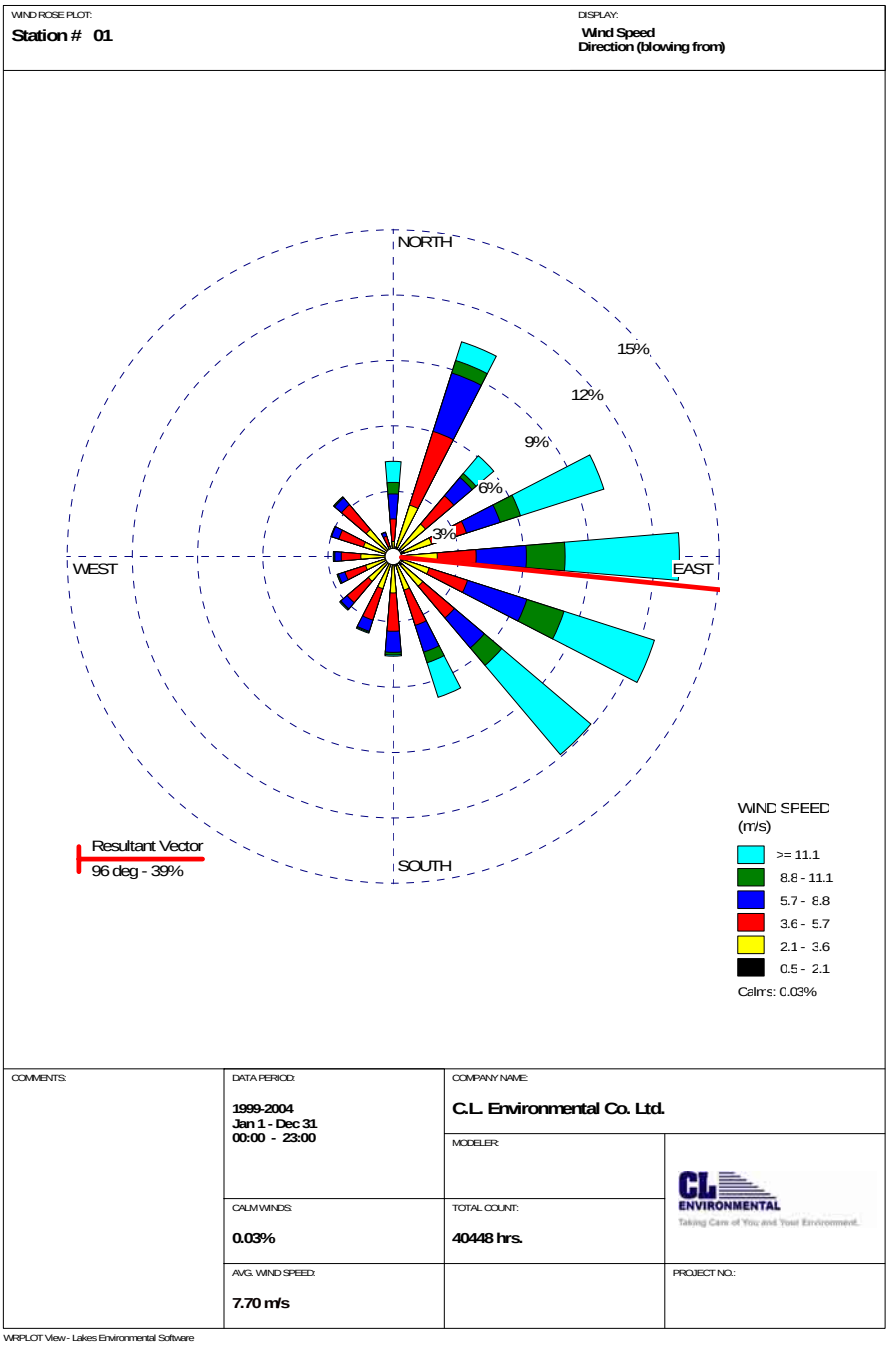
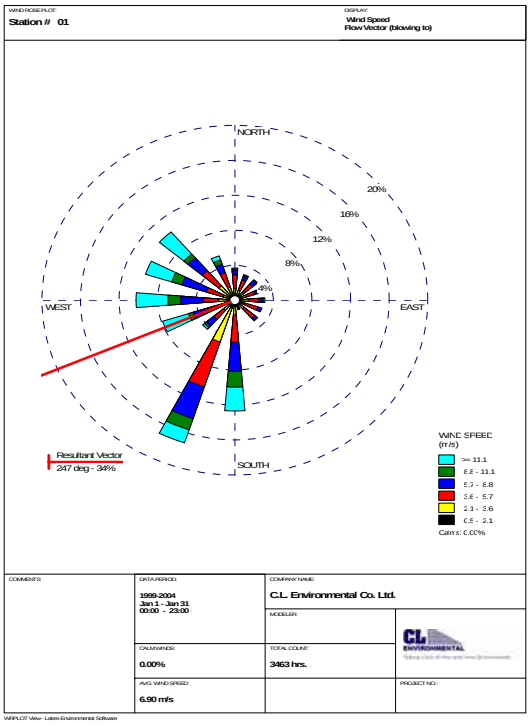
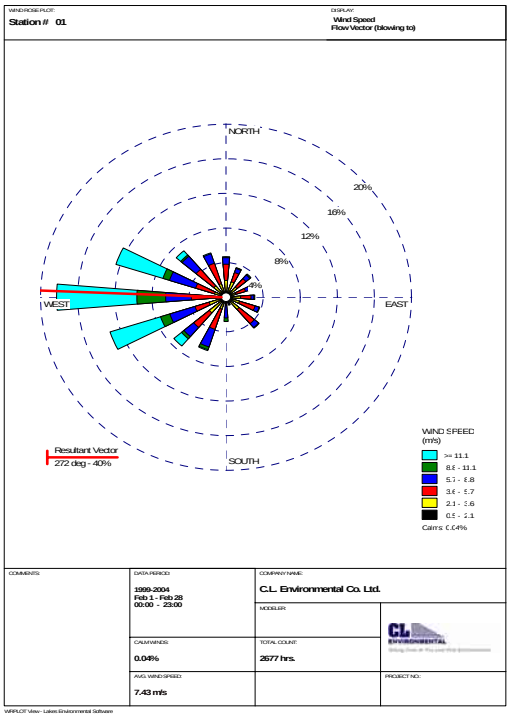


Figure 4-5 Annual wind rose for Norman Manley International Airport (1999-2004)

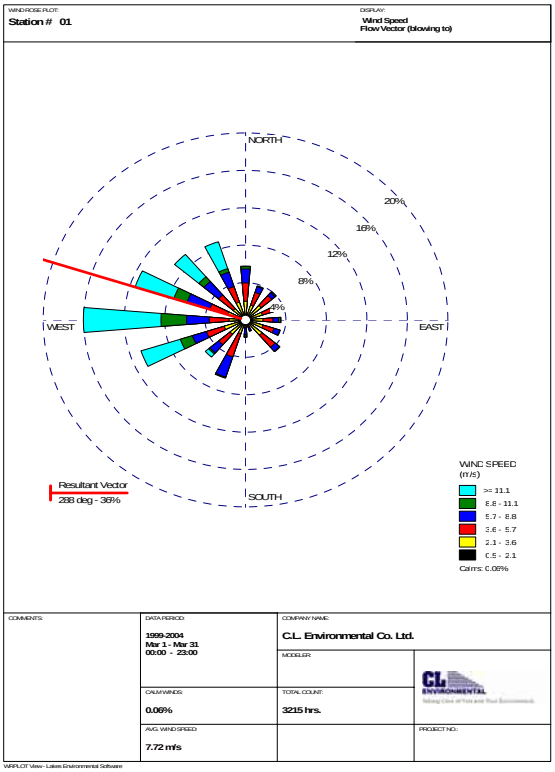
Figure 4-6 Monthly wind rose for Norman Manley International Airport (1999-2004)



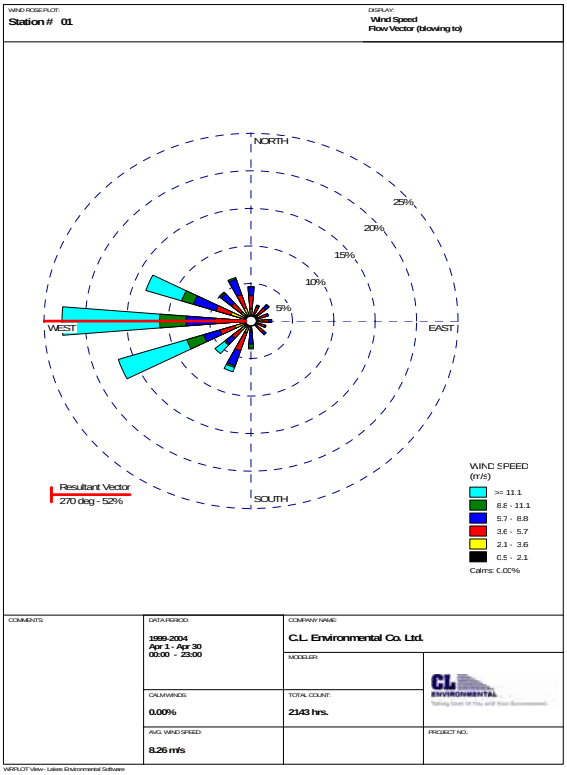
January



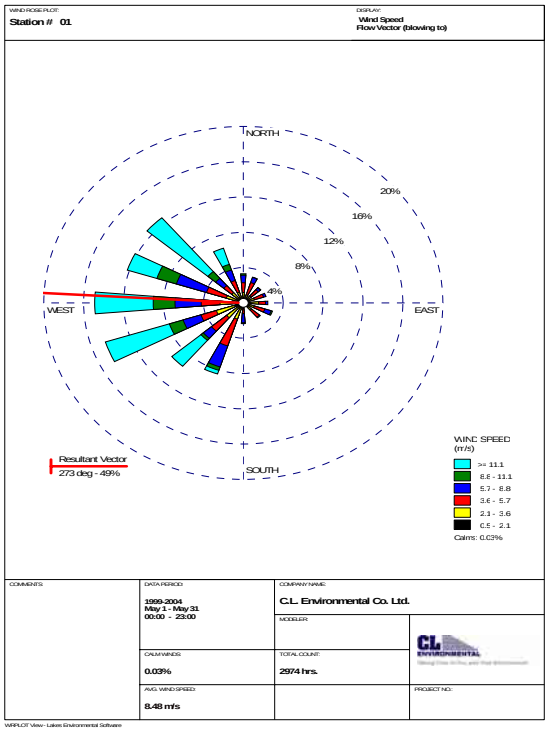
February



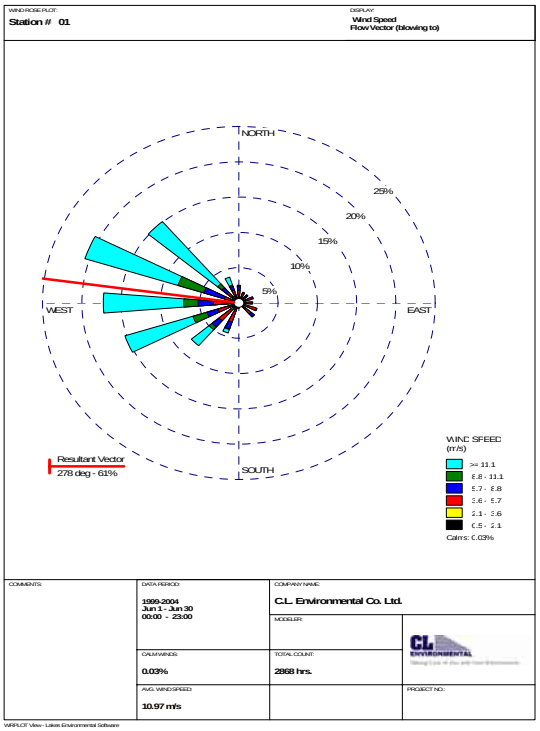
March



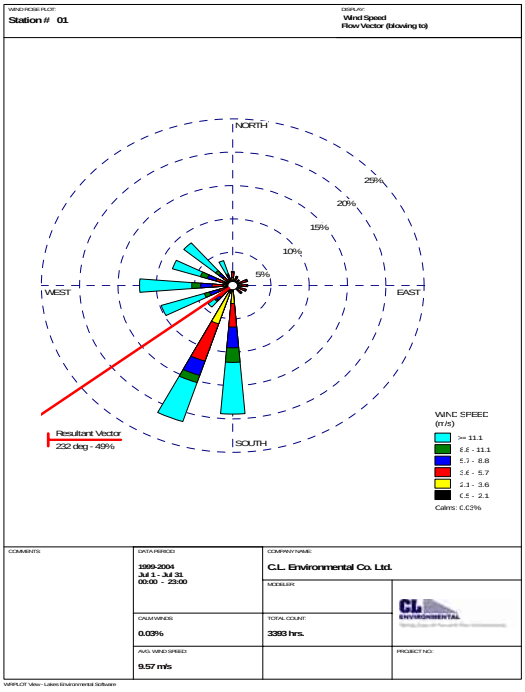
April



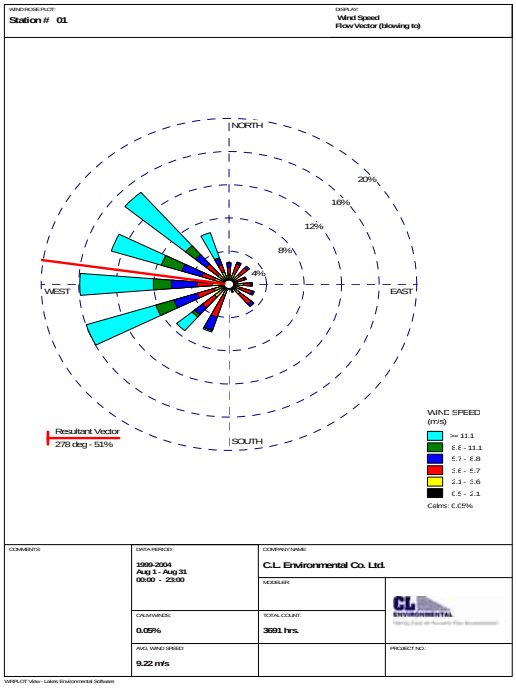
May



June



July



August

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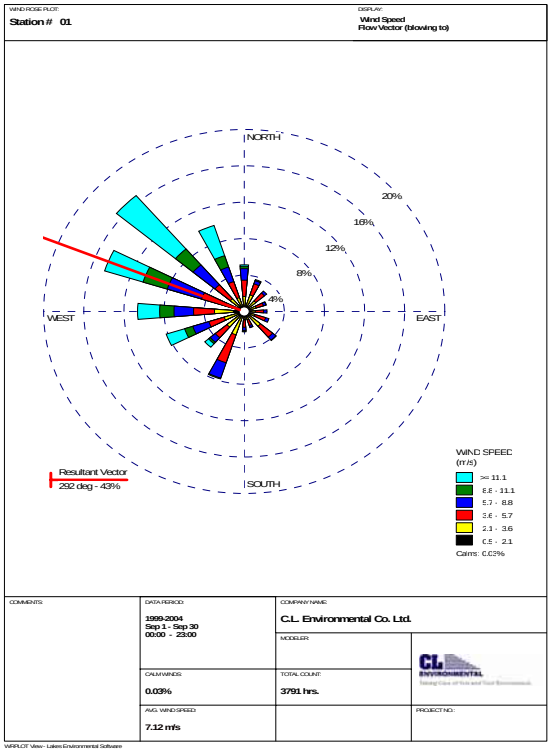
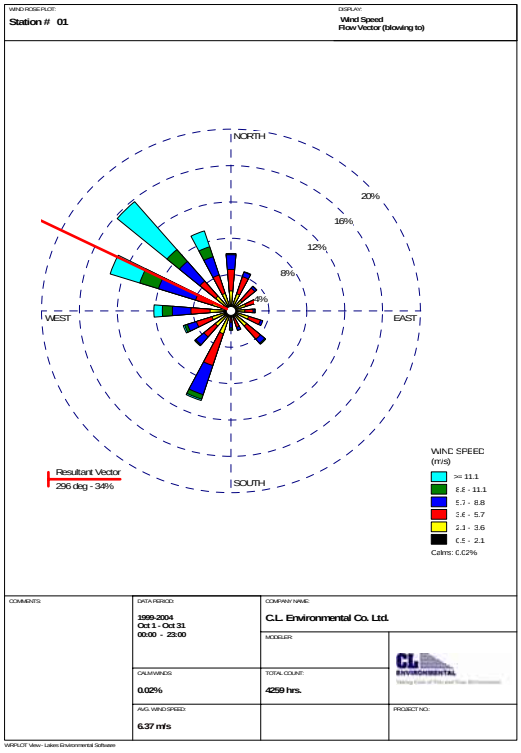
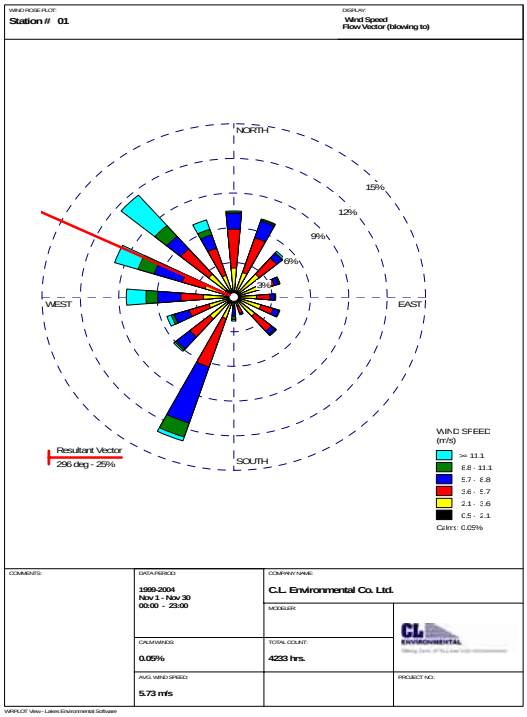
clenviro@cwjamaica.com



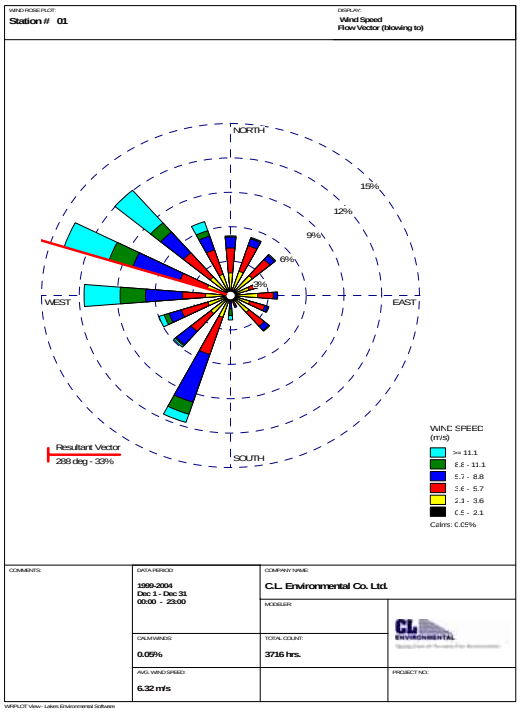
September



October



November



December

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clenviro@cwjamaica.com

4.1.2 Air Quality

A joint sampling collaboration between the Environmental Health Laboratory, the National Environment and Planning Agency (NEPA) and the University of the West Indies at the National Public Health Laboratory between January to December 2006 indicated that the levels of both PM10 (particulate matter ten microns and less in width) and Total Suspended Particulates (TSP) were within acceptable levels.

The levels for PM10 ranged from 13.89 -187.37 $\mu g/m^3$ with an annual average of 27.24 $\mu g/m^3$. The annual average complied with the NEPA standard of 50 $\mu g/m^3$. The levels of TSP ranged from 13.89-111.16 $\mu g/m^3$ with an annual average of 38.22 $\mu g/m^3$. This complied with the NEPA standard of 60 $\mu g/m^3$.

Temperature, Relative Humidity, Carbon Dioxide, Nitrogen Dioxide and Sulphur Dioxide

Temperature, relative humidity and carbon dioxide concentrations were taken by using a Quest Technologies AQ 5000 meter, and nitrogen dioxide and sulphur dioxide levels were obtained by using Sensidyne's precision gas detector tubes. The nitrogen dioxide tubes had a measuring range of 0.5 – 30 ppm and a detectable limit of 0.1 ppm. The sulphur dioxide had a measuring range of 0.25 – 10 ppm and a detection limit of 0.1 ppm.

Temperature ranged from 30.9 – 31.8 ^oC and relative humidity varied from 64.2 – 69.0 %. Carbon dioxide levels at the boundaries to the proposed site ranged from 538 – 581 ppm. This is within the expected range for outdoor carbon dioxide. The levels of nitrogen dioxide and sulphur dioxide were all below the detection limits.

Atmospheric Emissions of the Proposed Waste Treatment Equipment[14]

Tests were conducted to determine the characteristics of the atmospheric emissions of the waste processor and impact on the nearby environment at a hospital in France. The tests were conducted during various cycles (Table 4.1 and Table 4.2) and at two locations (within the area that holds the waste processor (autoclave) in the alley of the delivery platform and on the 2nd floor of the building, vertically above the area holding the waste processor.

Table 4-1 Sampling of organic volatile compounds – waste from the area that holds the waste processor (autoclave) in the alley of the delivery platform

Sample reference	*Period of measurement*	*Running conditions of the plant*
A	11:10- 11:20	Between loading and unloading
B	11:35-11:45	During loading
C	12:00-12:10	Between loading and unloading
D	13:05-13:15	During loading
E	13:25 13:35	During loading
F	13:45-13:55	Between loading and unloading

Table 4-2 Sampling of organic volatile compounds – reception area 2nd floor of the building, vertically above the area holding the waste processor

Sample reference	*Period of measurement*	*Running conditions of the plant*
G	11:25- 11:35	Between loading and unloading
H	11:35-11:45	During loading
I	12:00-12:10	Between loading and unloading
J	13:05-13:15	During loading

The results of these tests are outlined in Table 4.3, Table 4.4 and Table 4.5.

[14] SEEN Environment (2006) Invitations for Bids No IFB018: Supply and Installation of a Treatment Plant and Equipment for Hazardous Healthcare Waste Collection and Treatment (Health Laboratory of the City of Paris)

Table 4-3 Measurements by means of direct-reading tubes in the are that holds the waste processor (autoclave) in the alley of the delivery platform (results in milligrams per cubic metre of air (mg/m³)

	11h10 Between loading and unloading	***11h35 Loading***	***12h00 Between loading and unloading***	***13h05 Loading***	***13h23 Loading***	***13h45 Between loading and unloading***
Acids (1)	<0.2	<0.2	1.5	<0.2	<0.2	<0.2
Ammoniac NH3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Amines (2)	4.3	4.7	2.6	4.3	<0.8	<0.8
Hydrogen sulphide H2S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercaptans (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Active Chlorine Cl2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

(1):in equivalent acetic acid

(2): in equivalent methylamine

(3): in equivalent methylmercaptan

Table 4-4 Organic volatile compounds in the wastes of the area that holds the waste processor (autoclave) in the alley of the delivery platform (results in micrograms per cubic metre of air (µg/m3))

Sample Reference Running of processor	***A Between loading and unloading***	***B Loading***	***C Between loading and unloading***	***D Loading***	***E Loading***	***F Between loading and unloading***
Aromatic Hydrocarbons						
Benzene	1	0.6	0.7	3	1.2	1.3
Toluene	7.8	6.4	5.8	111	16	9.9
Ethylbenzene	3.1	2.7	2.2	8.5	2.7	2.4
m,p Xylene	5.3	6.1	6.2	13	6.6	5.1
Styrene	6.7	4.4	2.4	26	4	2.7
o Xylene	1.4	1.3	1.4	3.8	1.5	1.2
1,2,4 trimethylbenzene	0.9	1.4	1.1	3.7	1.6	1.2
Hydrocarbons						
Halogen Compounds						
Chloroform	7.8	2.7	1.1	2.2	<0.2	<0.2
Trichloroethylene	0.8	2.6	2.1	65	7.7	3.5
Tetrachloroethylene	0.2	0.3	0.3	<0.2	0.3	0.4

1,4-Dichlorobenzene	4.4	4.5	3.5	3.7	3	4
Alcohols						
2-propanol	940	550	190	360	59	53
1-propanol	1790	860	350	3050	470	170
1-butanol	760	390	140	800	130	110
Aldehydes						
Formaldehyde	<20	<20	<20	118	<20	<20
Acetaldehyde	310	160	80	430	68	76
Acroleine	<20	<20	<20	<20	<20	<20
Propanal	19	<10	<10	28	<10	<10
Crotonaldehyde	<10	<10	<10	<10	<10	<10
Methacroleine	64	20	<20	<20	<20	<20
Butyraldehyde	27	<20	<20	29	<20	<20
Benzaldehyde	<20	<20	<20	<20	<20	<20
Pentanal	<20	<20	<20	<20	<20	<20
Tolualdehyde	<20	<20	<20	<20	<20	<20
Hexanal	<20	<20	<20	<20	<20	<20

Table 4-5 Organic volatile compounds in the air at the reception area 2nd floor of the building, vertically above the area holding the waste processor (results in micrograms per cubic metre of air (µg/m³))

Sample Reference	***G***	***H***	***I***	***J***
Running of processor	***Between loading and unloading***	***Loading***	***Between loading and unloading***	***Loading***
Aromatic Hydrocarbons				
Benzene	1	0.4	0.7	<0.4
Toluene	3.5	3.8	4	3
Ethylbenzene	1	0.8	1.1	0.8
m,p Xylene	1.9	1.9	2.6	2
Styrene	0.7	3.3	0.5	0.4
o Xylene	0.8	0.9	0.8	0.9
1,2,4 trimethylbenzene	1.1	1.1	1	0.7
Hydrocarbons				
Halogen Compounds				
Chloroforme	<0.2	<0.2	<0.2	<0.2
Trichloroethylene	1.1	2.8	3	2.2
Tetrachloroethylene	<0.2	0.2	0.3	<0.2
1,4-Dichlorobenzene	2.6	2.7	4.4	2.8
Alcohols				
2-propanol	5.3	3.1	2.2	2.9
1-propanol	3.8	2.9	3	2.3
1-butanol	2.4	1.2	1.4	1.7
Aldehydes				
Formaldehyde	<20	<20	<20	<20
Acetaldehyde	<20	<20	<20	<20
Acroleine	<20	<20	<20	<20
Propanal	<10	<10	<10	<10
Crotonaldehyde	<10	<10	<10	<10
Méthacroleine	<20	<20	<20	<20
Butyraldehyde	<20	<20	<20	<20
Benzaldehyde	<20	<20	<20	<20
Pentanal	<20	<20	<20	<20
Tolualdehyde	<20	<20	<20	<20
Hexanal	<20	<20	<20	<20

The results for both areas indicated that the levels obtained were generally low and were within acceptable levels with established standards such as the Occupational Safety and Health Administration (OSHA) and therefore should pose no significant health risks.

4.2 Physiography, Geology and Structure

4.2.1 Physiography

The site of interest lies on the lower part of the Liguanea Plain, an alluvial fan deposit that slopes gently from an altitude at its apex of 220 m to sea level at the northern edge of Kingston Harbour. This is an old fan, originally deposited by a predecessor of the present Hope River, but now in a state of degradation being eroded by the gully systems that traverse the fan. The altitude of the site is about 26 m above sea level.

4.2.2 Geology

The Liguanea fan is made up of semi-consolidated and unconsolidated sediments of the Liguanea Formation of Pleistocene age (less than 2 million years old). These are sands and gravels with up to cobble and small boulder-sized debris, interbedded near the coast with silty and clayey layers. The surface of the fan is weathered to form soils belonging to the Maverly Loam of the Soil and Land Use survey (Vernon & Jones, 1959), but these have been built over and disturbed by construction over the past two or three hundred years in the lower Kingston area.

4.2.3 Structure

The sediments of the Liguanea fan overlie Tertiary limestones and rocks of the Coastal Group at depth. These have been extensively faulted with the youngest faults post-dating most of the Coastal Group (Late Miocene to early Pleistocene perhaps as young as 1 million years old), but the extent of faulting affecting the Liguanea fan is not known.

4.3 Natural Hazards

4.3.1 Hurricane

Jamaica lies in an area in the Atlantic which experiences hurricanes (Table 4.6). Hurricanes and tropical storms are frequently accompanied by heavy rainfall. It has also been widely suggested

that the Atlantic-Caribbean region is moving, even has already moved, into a cycle of wetter and more severe tropical disturbances (IPCC, 2001). Hurricanes produce heavy rainfall and high winds which have the potential to cause damage and dislocation at the proposed Medical Waste Treatment Plant.

Johnson and Watson (1999) estimated the following return periods for wind speeds at the Kingston Central Port.

Table 4-6 Kingston Central Port Wind Results (knots): Maximum Likelihood Estimates and Upper Prediction Limits for Various Return Periods (1 minute sustained wind at 10 meters above ground). From Johnson & Watson, 1999.

	MLE	***50%***	***75%***	***90%***	***95%***	***99%***
10 year	57	58.2	61.2	63.9	66.0	70.4
25 year	76	77.0	81.6	86.7	90.6	104.4
50 year	89	90.5	97.0	105.0	111.4	130.4
100 year	102	103.1	112.8	124.0	133.1	157.8

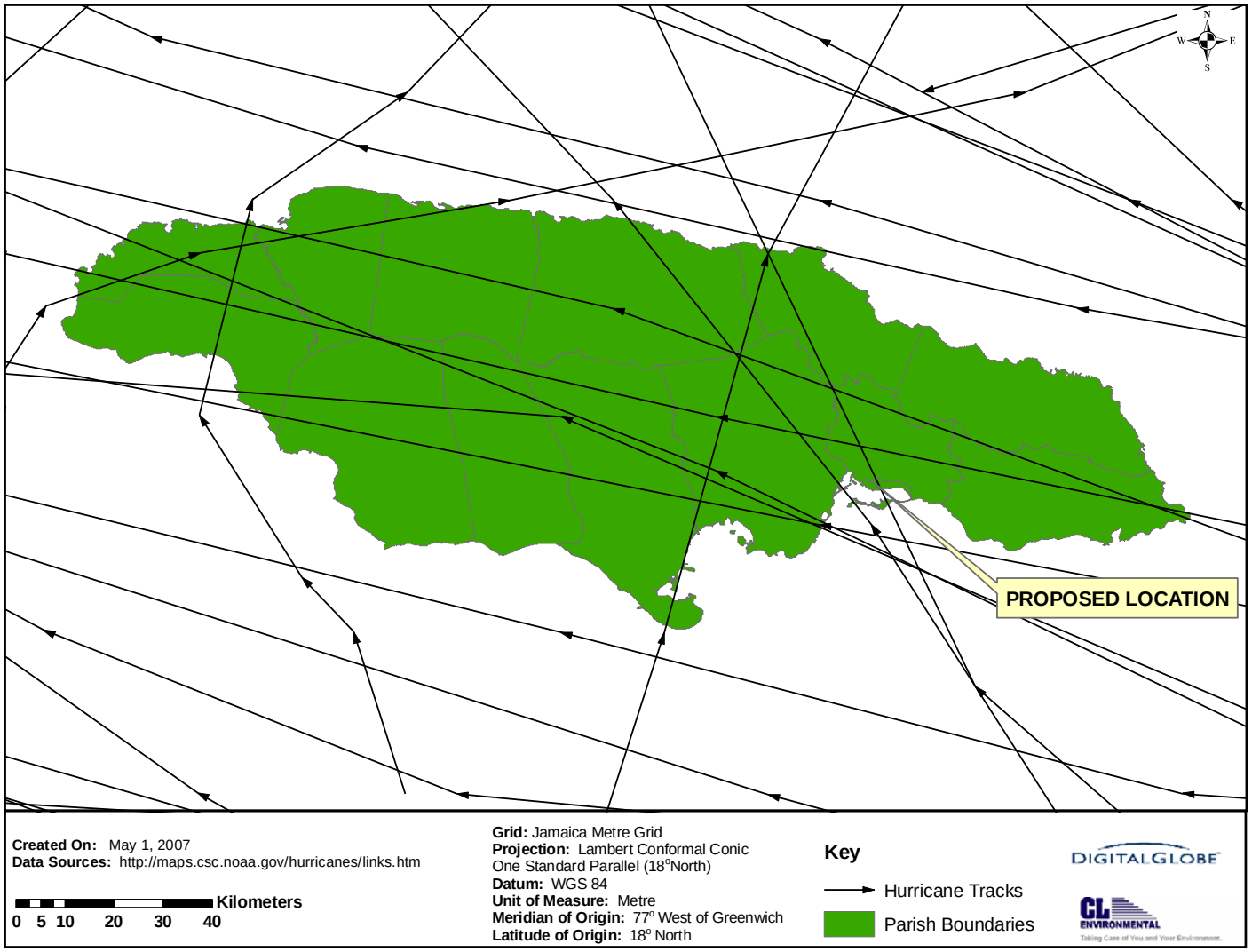

Figure 4-7 Historical hurricane tracks 1851 - 2006

4.3.2 Earthquake

Figure 4.8, a map showing the relative frequency of seismic events in different parts of Jamaica, indicates that > 20 events greater than intensity MMVI occur per century occur in the Kingston area (see Appendix F for Modified Mercalli Scale). The intensity of seismic shaking depends largely on the quality and thickness of the unconsolidated or semi-consolidated sediments overlying the bedrock. Shallow (less than 50 m) thicknesses transmit short period motions to best effect. Longer period motions are transmitted best by thicknesses up to about 100 m (Aspinall & Shepherd, 1978).

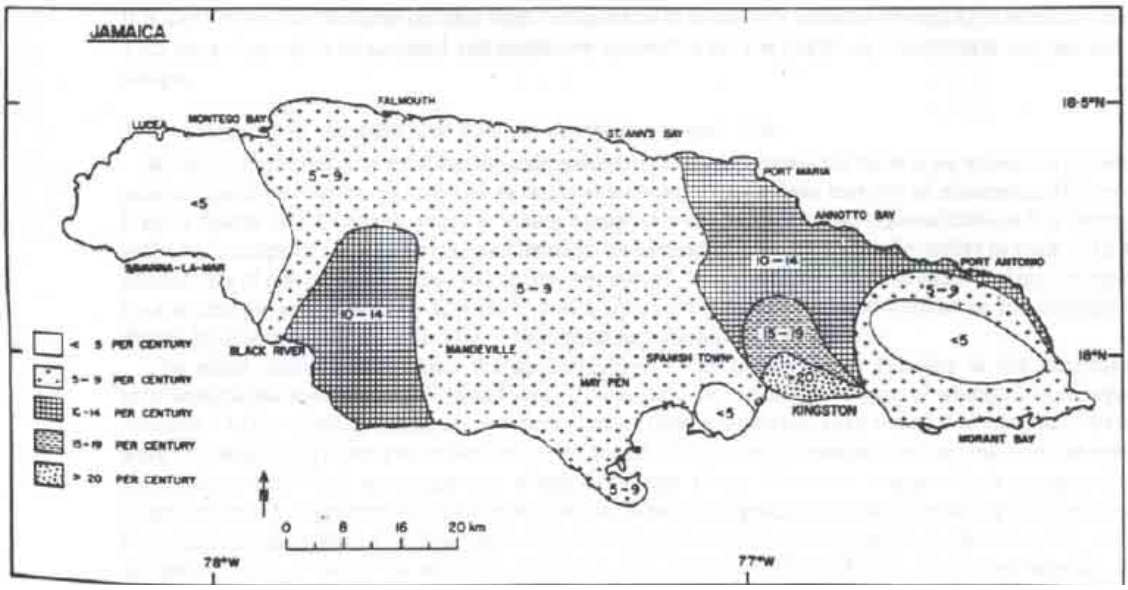

Figure 4-8 Map showing number of times per century that intensities of MM VI or greater have been reported, 1880-1960 (from Shepherd & Aspinall, 1980)

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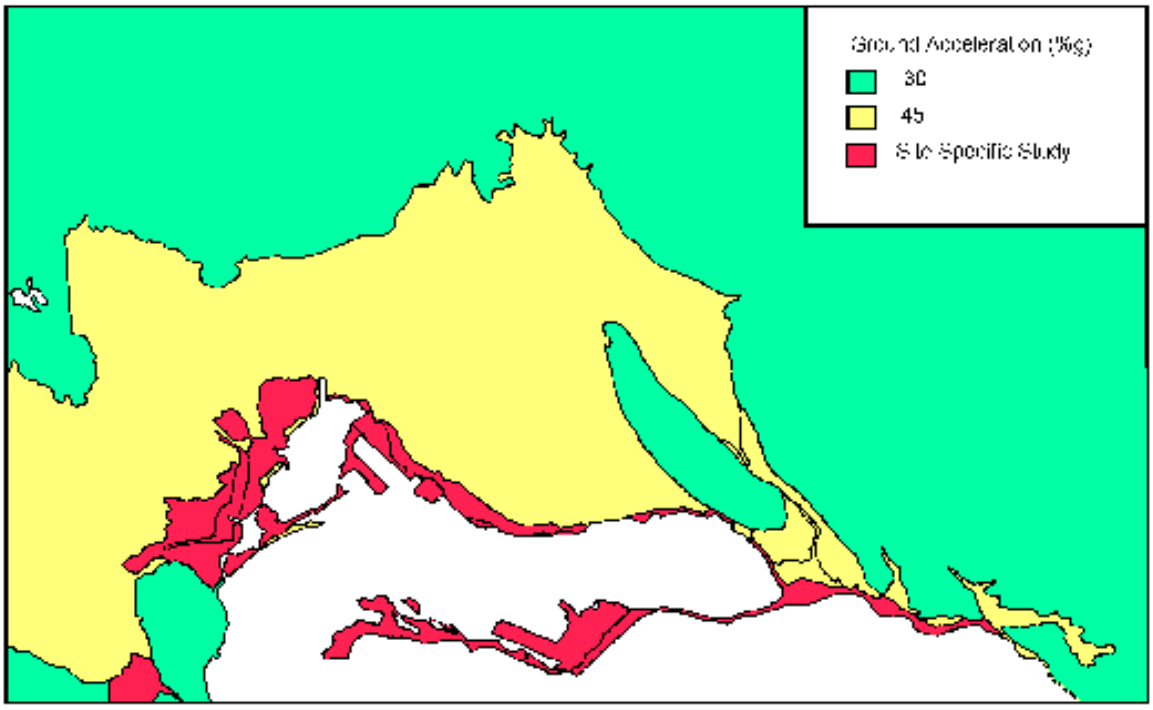

Figure 4-9 Modified strong motion map for the Kingston Metropolitan Area of expected ground accelerations with a 10% probability of not being exceeded in 50 years. Accelerations modified by local site conditions. Assumed ground acceleration for B type soil was 30%g. See text for details. From CDMP KMA Seismic Hazard Assessment, 2001 (see also 4.8 map guidelines). The assumed ground acceleration for the site of interest would be 45%g (yellow area).

4.4 Drainage/Flooding Assessment

4.4.1 Extreme Rainfall Events

The proposed project will be subjected to inclement rainfall events. The rainfall duration-frequency curve for Norman Manley Internal Airport (Figure 4.10 indicates that the 5 minute 5 Year return period rainfall event is approximately 160 mm in one hour.

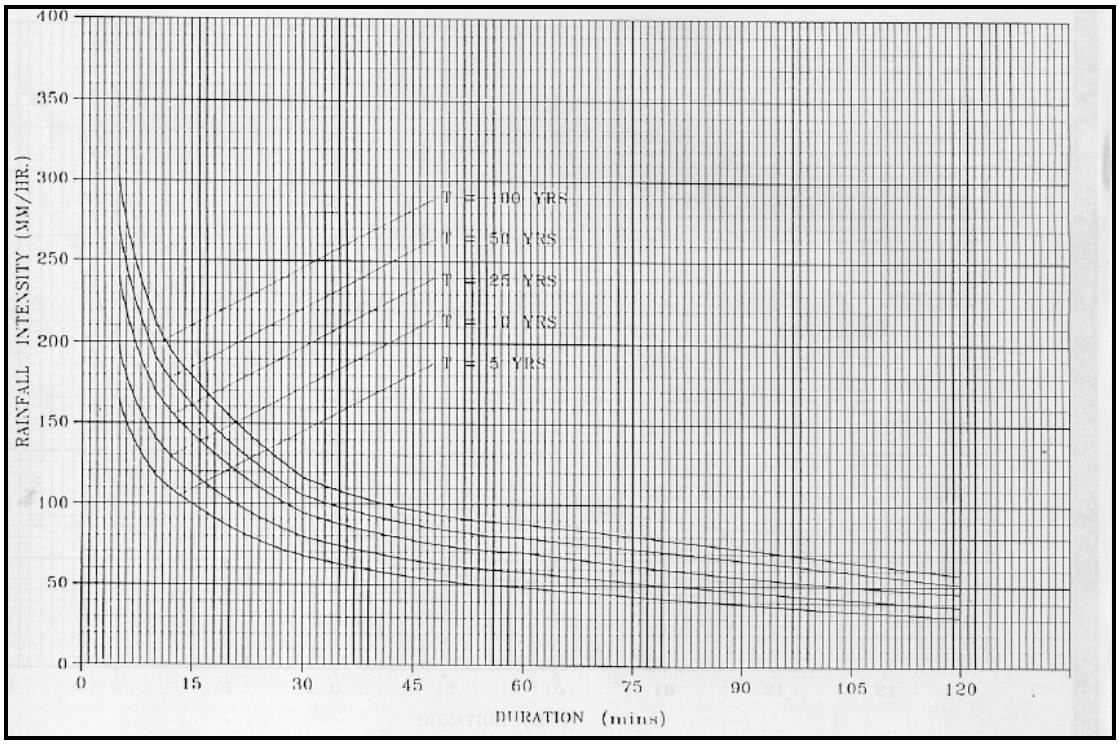

Figure 4-10 Rainfall frequency duration curve for Norman Manley International Airport (Meteorological Service)

4.4.2 Drainage Features

The only immediately observable drainage feature in the area was a set of drop inlets on the main road on the western boundary of the project area. The area is apparently served by a network of sub-surface storm water sewer pipes. There were no reports of frequent flooding in the immediate area during heavy rainfall.

4.5 Biological Resources

4.5.1 Terrestrial Fauna

The disturbed nature of the proposed site (car park) and the limited vegetation resulted in no fauna being present on the site.

4.5.2 Terrestrial Flora

The proposed site for the South-east Regional Medical Waste Treatment Facility is currently used as the Visitor's Parking facility for the Kingston Public Hospital (KPH). The area is paved and the vegetation observed on the site was limited to the periphery and found in pockets. The trees were represented by solitary species of *Cassia fistula* (Golden Shower Tree) (Plate 4.1), *Leucaena leucocephala* (Lead Tree), *Albizia lebbeck* (Woman's Tongue Tree), *Cordia alba* (Duppy Cherry) and Species A (Plate 4.2).

The vegetative pockets observed were mainly of Grass, interspersed with *Calotropis procera* (French Cotton) (Plate 4.3), *Ricinus communis* (Oil Nut), *Tribulus cistoides* (Kingston Buttercup) and *Ludwigia octovalvis* (Ludwigia). The twiner, *Passiflora maliformis* (Sweet Cup) was observed in abundance on the left fence, facing the Hospital.

Plate 4.1 *Cassia fistula* (Golden Shower Tree)

Plate 4.2 Species A observed on the site

Plate 4.3 *Calotropis procera* (French Cotton)

In total, twelve species were observed on the site and is presented in Table 4.7.

Table 4-7 Plant species observed on the proposed site

Scientific Name	*Common Name*	*Status*
Albizia lebbeck	Woman's Tongue Tree	Common
Calotropis procera	French Cotton/Duppy Cotton/Giant Milkweed	Common
Cassia fistula	Golden Shower Tree/Cassia Stick Tree	Common
Cordia alba	Duppy Cherry	Common
Leucaena leucocephala	Lead Tree	Common
Ludwigia octovalvis	Ludwigia	Common
Passiflora maliformis	Sweet Cup	Common
Ricinus communis	Oil Nut	Common
Tribulus cistoides	Kingston Buttercup	Common
Species A		
Species B		
Species C		

The vegetation found on the proposed site are not rare, endangered or endemic and as such the potential negative impact from the proposed development is insignificant.

4.6 Water Quality

4.6.1 Ground Water

The proposed development will dispose of its wastewater into the public sewer as such the potential for contamination of ground water is minimal.

4.7 Land Use

4.7.1 Study Area

The Kingston Development Order of 1966 has developed the Kingston Development Area Land Use Zoning map (Figure 4.11). Within the Social Impact Area (SIA), it outlines the following uses:

1. Residential;

2. Industrial;
3. Commercial;
4. Offices (Business and Professional);
5. Open Space (public and Private) and Cemeteries;
6. Government Purposes and Statutory Undertakings; and
7. Main Roads

Existing land use in the study area is industrial, commercial, residential, recreational (open spaces) and offices. The built environment dominates the existing land use of the study area. It accounts for approximately 80% of the land use of the SIA.

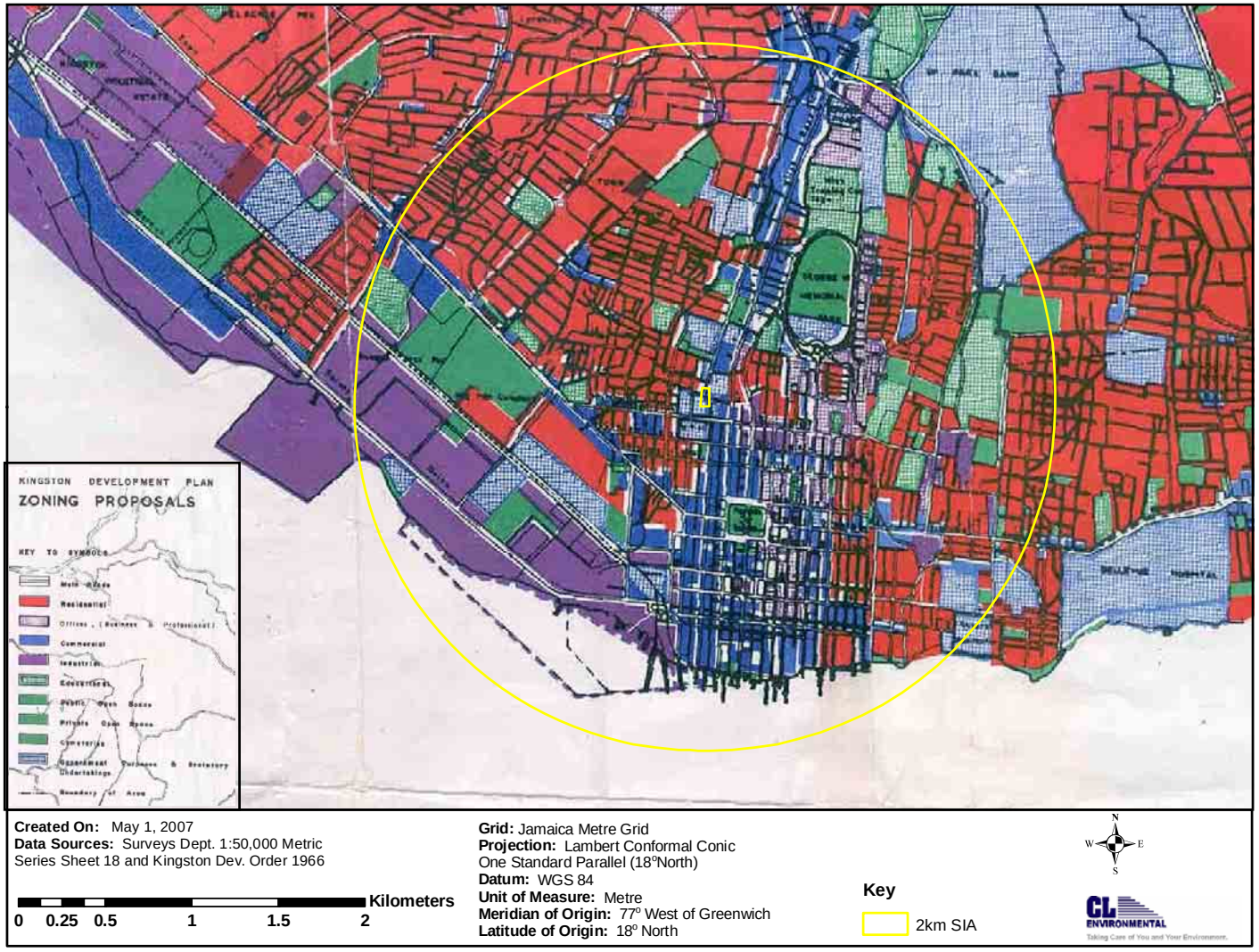

Figure 4-11 **Section of the Kingston Development Area land use zoning falling within the SIA (Adapted Kingston Development Order 1966 – Town and Country Planning Authority)**

4.7.2 Proposed Site

The proposed site currently used as the public/visitors parking lot is active (Plate 4.4). However, the area is not properly designed with demarcated parking lots. During hospital visiting hours and/or functions at the facility, a maximum of 150 cars was observed in the parking lot. Hospital visiting hours are between the hours 8 a.m. to 9 a.m. (Victoria Jubilee); 11 a.m. to 12 noon and 5 p.m. to 6 p.m. (Kingston Public). Kingston Public Hospital does however have additional staff parking in the main parking lot on the hospital premises for approximately 160 staff and visitor cars. This does not include parking lots for senior management who park in designated area on the hospital premises.

Table 4 8 indicates the number of cars observed at this parking lot over a one day period.

Table 4-8 Observation at the Kingston Public Hospital parking lot

Time	Number of Vehicles
9:00 a.m	30
9:30 a.m.	53
10:00 a.m.	61
10:30 a.m.	66
11:00 a.m.	85
11:30 a.m.	150
12:00 p.m.	105
12:30 p.m.	79
1:00 p.m.	54
2:00 p.m.	31
3:00 p.m.	19
4:00 p.m.	40
4:30 p.m.	66
5:00 p.m.	89
5:30 p.m.	45
6:00 p.m.	20

In the evenings, visitors are allowed to park on the KPH compound, thus the reduced number of vehicles observed during the evening hours.

Plate 4.4 Example of the vehicles using the proposed site for parking

On the site, the hospital stores its domestic/general waste in four skips (Plate 4.5) at the northern side. However, there is evidence that these are not collected efficiently and as such the garbage is burned within these skips (Plate 4.6). It is estimated that the Kingston Public and Victoria Jubilee Hospitals transports/stores approximately 2 tonnes of domestic garbage daily to the proposed site. They are stored in skips which are collected daily by Minott Services Limited.

Plate 4.5 A hospital worker carrying garbage to be placed in one of the four skips located at the northern side of the proposed site

Plate 4.6 Four skips used by the Hospitals and the wall showing evidence of burning

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In addition to the hospital using the site for storing the domestic waste, the site is also used for informal dumping of domestic waste by residents in the neighbouring communities. There was evidence of dumping of commercial waste for example bottles, old air conditioning units (Plate 4.7). The area is also used as an informal bathroom. There is also evidence on the walls of burning of these piles.

Additionally, during our site visits they were some persons rummaging through the garbage in the skips.

Plate 4.7 Domestic and commercial garbage piles (evidence of burning white arrows)

Twelve (12) stalls were observed, one (1) within the car park area along the southern boundary and eleven (11) along the outside perimeter of the car park along the south and west boundary in the vicinity of the North Street United Church. Of the eleven, one stall was for "pan" chicken, one was a cook shop/ mobile restaurant and nine were variety stalls, selling snack items, fruits, drinks and juices and alcohol.

4.7.3 Future Land Use

The southern section of the existing lot will be upgraded to a car park (Figure 4.12, outlined in red) to replace the area that will be lost due to the proposed development. This will result in a reduction of approximately 38% of the car park area. The MWTF will remove approximately 2,500 square metres of the existing informal parking area in the northern section of the lot. The remaining land space and realigned parking area to the south (North Street) side of the lot will provide for approximately 2,200 square metres of land for parking. The realigned parking lot will be properly designed and provide for approximately 85 lots. These provisions were estimated on an aerial basis (with a provision of 26 square metres per parking space and circulation space). It is our understanding that the layout and details of the public parking is being finalized at this time.

The vacant lot located to the north of the existing parking lot (proposed project site), is proposed to be the site of the new Public Morgue (Figure 4.12).

A section of the southern section of the realigned visitors' parking lot will be used to accommodate a compactor to store the domestic garbage that is currently being stored at the northern section of the proposed project site.

Both the proposed project site as well as the realigned parking lot will be secured with a perimeter fence.

Additionally, an aerial access ramp linking KPH/VJH to the realigned parking lot and treatment facility will be constructed.

Figure 4-12 Figure showing proposed future land use

4.8 Noise

4.8.1 Methodology

Noise level readings were taken by using a Quest Technologies DLX 1 – 1/3 Sound Level Meter (Acoustics Standards: EN/IEC61672, ANSI S1.4-1983, EN/IEC61260, ANSI S1.11-2004 & ANSI S1.43-1997 (Also fulfils all requirements of earlier standards IEC 60651 and IEC 60804)) in the data logging mode. In this mode noise levels were stored every second over a two (2) minute for each location. Average noise levels over two minute time period for each location were calculated. The averaged noise levels were then compared to the National Environment and Planning Agency's (NEPA) noise guidelines.

In addition to measuring noise levels (dBA scale), octave band analysis (dBZ scale) was also conducted at all the locations. Frequency readings were taken in the low, medium and high frequency bands. Octave band analysis was conducted which provided eleven (11) octave bands from 16 Hz to 16.0 kHz. The calibration certificate is found in Appendix G.

Baseline noise measurements were taken at eight (8) locations using a Quest SoundPro DLX sound level meter. These locations are listed in Table 4.8 (coordinates are in Jamaica Grid 2001) and Figure 4.13 depicts the locations of the stations. The sound level meter was calibrated with a Quest QC - 10 sound calibrator and a windscreen (sponge) was placed over the microphone to prevent measurement errors due to noise caused by wind blowing across the microphone.

Table 4-9 Locations of the noise stations

Noise Station #	JAD2001 GPS Coordinates (WGS84)	
	Easting	Northing
N1	647491.977	771812.151
N2	647495.173	771771.312
N3	647441.905	771768.471
N4	647437.999	771810.375
N5	647463.212	771811.086
N6	647466.408	771769.181
N7	647429.121	771723.371
N8	647395.384	771807.889

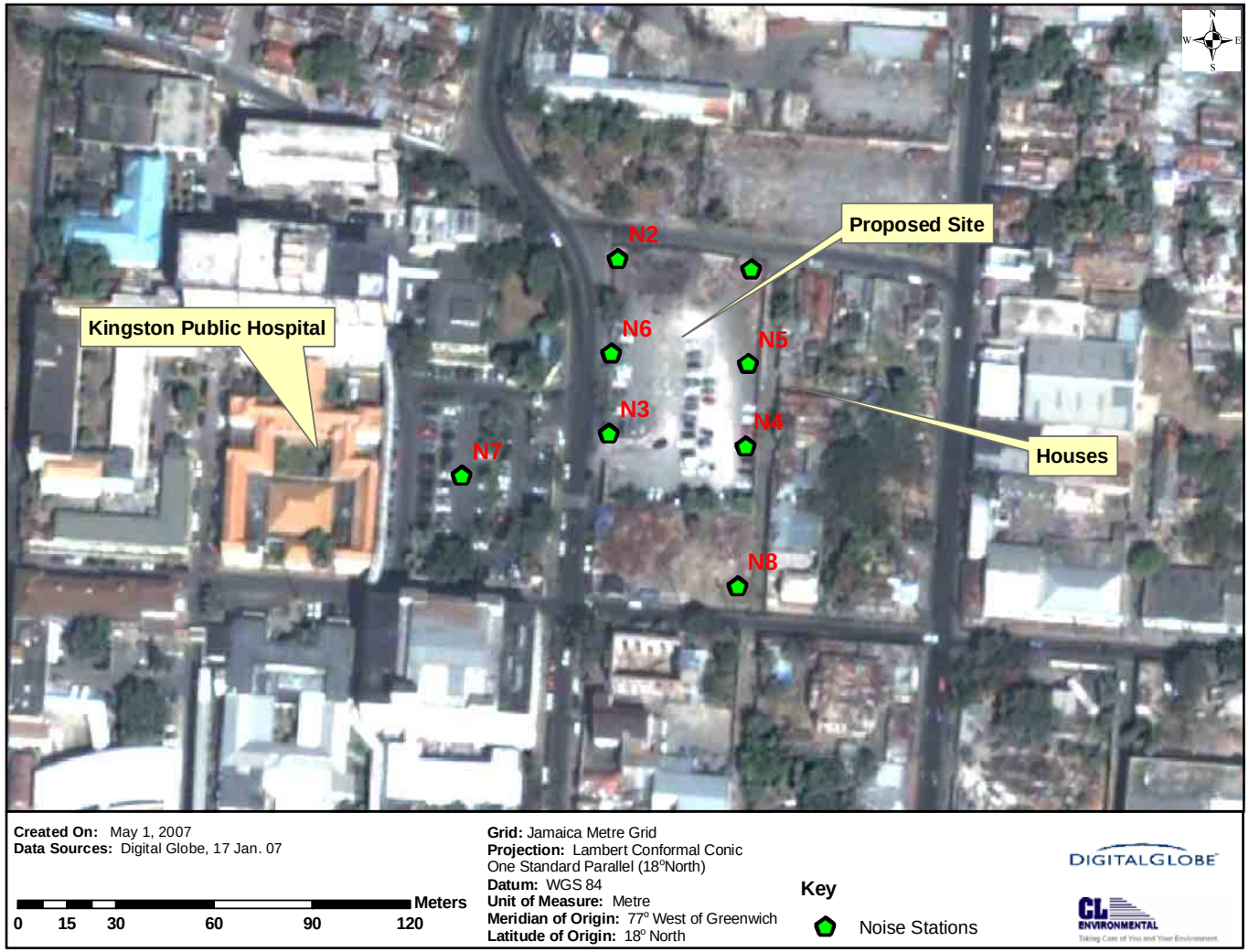

Figure 4-13 Map depicting noise stations at the proposed Ministry of Health, Southeast Regional Medical (Infectious) Waste Treatment Facility, Princess Street, Kingston

4.8.2 Results

During the noise assessment it was observed that:

- There is a steady flow of traffic in the area along the main road (Princess Street).
- Other sources of noise were car alarms and horns, talking, radios, sound systems, revving car engines.

Table 4.9 below outlines the results of the noise measurements taken.

Table 4-10 Noise data

STATIONS	HIGH (dBA)	LOW (dBA)	AVG (dBA)	GEOMETRIC MEAN FREQUENCY (Hz)	OCTAVE FREQUENCY RANGE (Hz)
N1	64.2	52.3	55.6	63	56 - 71
N2	82.2	57.1	67.0	63	56 - 71
N3	69.8	54.6	59.2	63	56 – 71
N4	67.6	55.8	58.8	63	56 – 71
N5	67.1	53.1	56.7	63	56 – 71
N6	66.6	55.7	59.8	63	56 – 71
N7	66.4	56.0	58.9	63	56 – 71
N8	67.0	53.4	59.4	63	56 – 71

The average noise levels at all stations were not compliant with the NEPA guidelines for silence zone (50 dBA – daytimes and 40 nighttimes). A silence zone is defined as areas up to 100 metres around such premises as hospitals, educational institutions and courts. Certain activities (e.g. the use of car horns and loudspeakers) are banned in a silence zone. Figure 4.14 depicts the area to be considered a silence zone around the Kingston Public and Victoria Jubilee Hospitals.

Octave band analysis shows that the noise at the stations was in the low frequency band centred around the geometric mean frequency of 63 Hz.

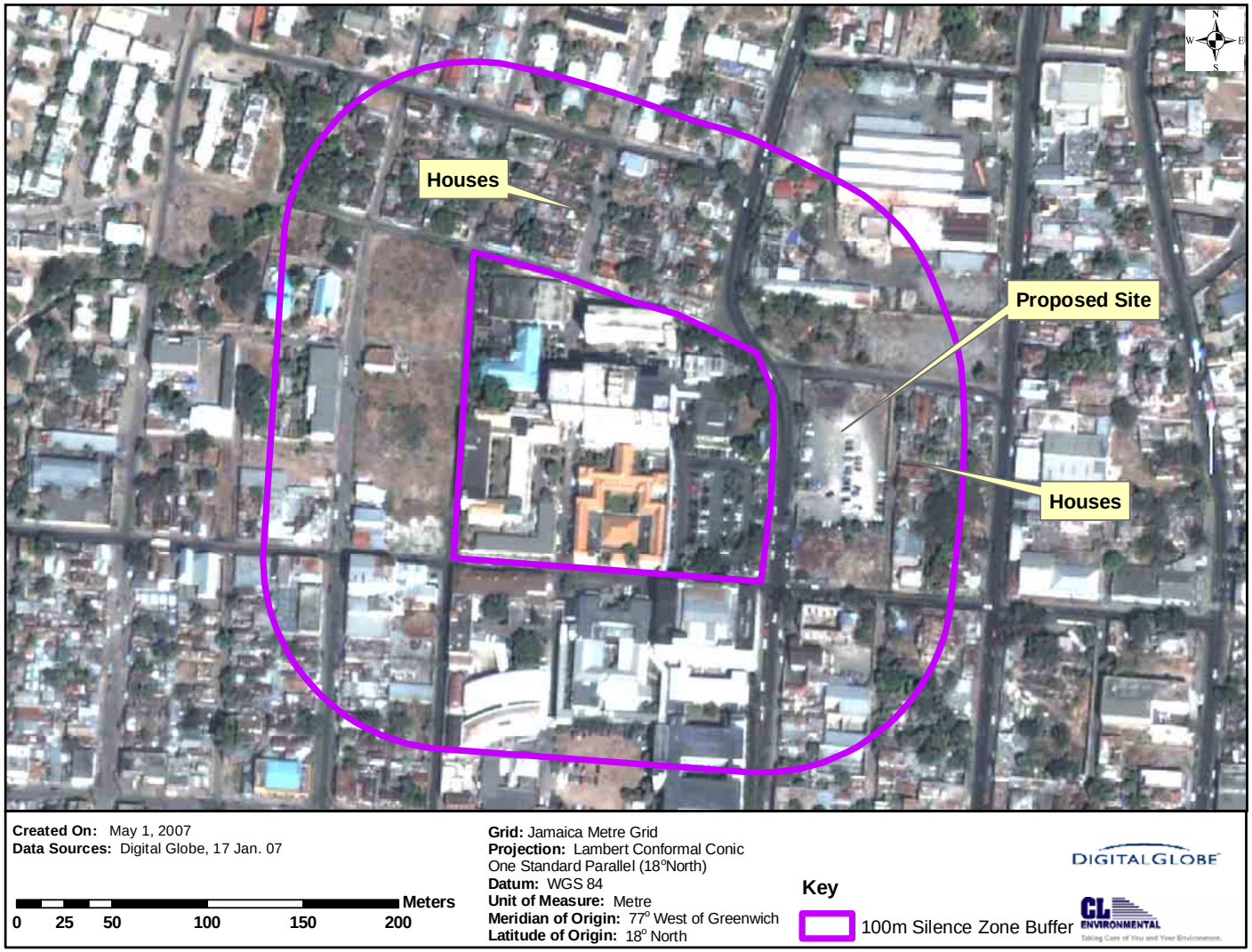

Figure 4-14 The 100m silence zone around the Kingston Public and Victoria Jubilee Hospitals

4.9 Historical and Cultural Resources

The Jamaica National Heritage Trust (JNHT) website (

http://www.jnht.com/parish.php?ph=Kingston and http://www.jnht.com/monuments.php have listed buildings, places and monuments that are of historic of cultural significance in close proximity to the proposed Medical Waste Treatment Facility.

These include;

2. **Buildings of Architectural and Historic Interest**

    - 40 Harbour Street,
    - Headquarters House,
    - Duke Street,
    - Kingston Railway Station, Barry Street.

3. **Churches, Cemeteries and Tombs**

    - Coke Methodist Church, East Parade,
    - Negro Aroused,
    - Kingston Parish Church, South Parade.

4. **Statues and Other Memorials**

    - The Bust of General Antonio Maceo, National Heroes Park (NHP),
    - The Cenotaph (NHP),
    - Negro Aroused, Ocean Boulevard,
    - The Monument to Rt. Excellent Alexander Bustamante (NHP),
    - The Monument to Rt. Excellencies George William Gordon and Paul Bogle, (NHP),

- The Monument to Rt. Excellent Marcus Garvey (NHP),
- The Monument to Rt. Excellent Norman Manley (NHP),
- The Monument to Rt. Excellent Sam Sharp (NHP),
- The Monument to Rt. Excellent Nanny of the Maroons (NHP),
- Monument to the Rt. Excellent Sam Sharpe,
- National Heroes Park, The Monument to Rt. Hon. Donald Sangster (NHP),
- The Statue of Queen Victoria, St. William Grant Park (SWGP),
- The Statue of Father Joseph Dupont (SWGP),
- The Statue of Hon. Edward Jordan (SWGP),
- The Statue of Sir Charles Metcalfe (SWGP),
- The Statue of Rt. Excellent Alexander Bustamante (SWGP).

5. Historic Sites

- Liberty Hall, 76 King Street

6. Public Buildings

- Ward Theatre, North Parade,
- George William Gordon House, Duke Street which is protected.

Another area of cultural/social interest is Sabina Park, which upon recently was the only international recognised cricket field in Jamaica to which many a generations have come to watch and enjoy both test match and one day cricket.

4.10 Socioeconomics

Social The Social Impact Area (SIA) for this study was demarcated as two (2) kilometres from the proposed development area. This is outlined in the map below (Figure 4.15). The SIA covers sections of the parishes of Kingston and St. Andrew.

4.10.1 Methodology

Interviews were conducted with key stakeholders including Member of Parliament for the area, Mayor of Kingston, Management Staff of KPH/VJH, community leaders, Community Development Committee (CDC) and residents within the communities in the study area. Five persons were asked to administer a total of 63 questionnaires in the neighbouring communities, such as Fletcher's land, Hannah Town and Mathews Lane. The CL Environmental team, with CDC representative conducted ten interviews with households along Luke Lane. See Appendix J for questionnaire.

Historical socio-economic data was obtained from the Statistical Institute of Jamaica (STATIN) 2001 population census.

Population was calculated using the formula [$i_2 = i_1 (1 + p)^x$]; where i_1 = initial population, i_2 = final population, p + actual growth rate and x = number of years. Water consumption was calculated based on the assumption that water usage is 227.12 litres/capita/day and sewage generation at 80% of water consumption. Domestic garbage generation was calculated at 0.75 kg/capita/day (National Solid Waste Management Authority).

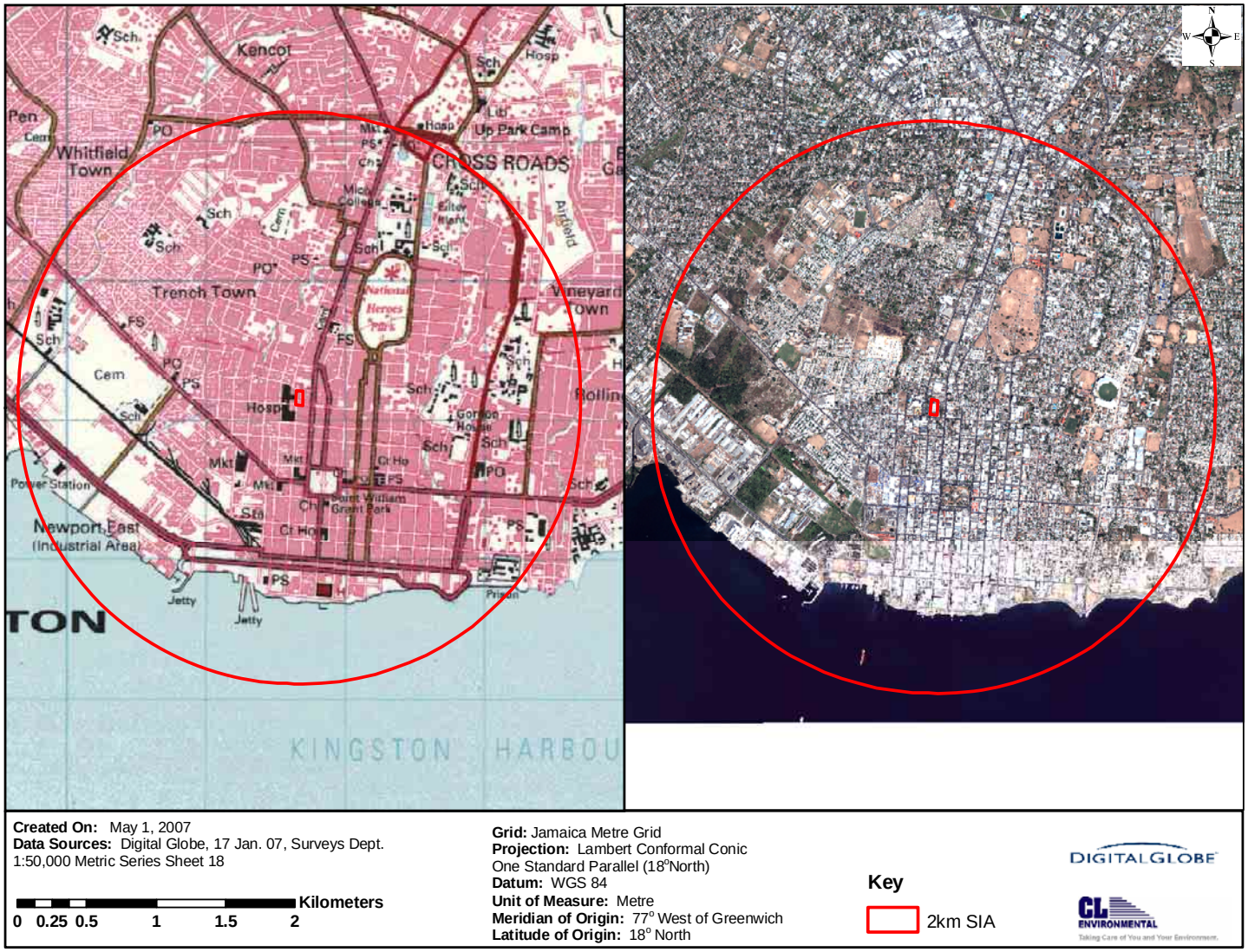

Figure 4-15 Social Impact Area demarcated

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4.10.2 Demography

Regionally the population of Kingston was 96,016 persons, St. Andrew was 555,726 persons, St. Catherine was 482,265 persons and St. Thomas was 91,597 persons. During the last intercensal period (1991 –2001), St. Kingston, St. Andrew, St. Catherine and St. Thomas had annual growth rates of -0.38%, 0.29%, 2.36% and 0.70% respectively. The estimated population for the four (4) parishes at the time the study was conducted and the anticipated populations over the next 25 years if the annual growth rate remains the same are listed in Table 4.10.

Table 4-11 Population estimates for 2001, 2007 and 2032

PARISH	2001 POPULATION	2007 POPULATION	2032 POPULATION
Kingston	96,016	93,848	85,327
St. Andrew	555,726	565,466	607,921
St. Catherine	482,265	554,712	993,858
St. Thomas	91,597	95,512	113,709
TOTAL	**1,225,604**	**1,309,538**	**1,800,815**

The study area (SIA) had a population of approximately 97,301 persons in 2001. At the time the study was conducted, the estimated population was 96,791 persons, calculated at an annual growth rate of -0.38 and 0.29 % for Kingston and St. Andrew respectively (1991-2001 intercensal period). It is expected that the population will reduce to 95,105 persons over the next 25 years if the current population growth rate is maintained.

Within the SIA in 2001, the 15-64 years age category accounted for 59.7% of the population, with the age 0-14 years (35.4%) and the age 65 and over category accounting for 4.9%. The segment of a population that is considered more vulnerable are the young (children less than five years old) and the elderly (65 years and over). In this population, approximately 11.9% were in the young category and 4.9% were in the 65 years and older category (Table 4.11).

Table 4.11 shows the percentage composition of each age category to the population. This is compared on a national, regional and local level. The data shows that the percentage contribution to the population for the 0-14 years age category in the SIA was higher than the

national and regional levels. The 65 & over age category was lower in the SIA when compared to the national and regional levels.

Table 4-12 Age categories as a percentage of the population

AGE CATEGORIES	Jamaica (%)	Kingston (%)	St. Andrew (%)	St. Catherine (%)	St. Thomas (%)	SIA (%)
0-14	32	32.8	29.8	32.2	34.0	35.4
15 - 64	60	61.7	63.2	61.9	57.0	59.7
65 & Over	8	5.5	7.0	5.9	9.0	4.9

(Source: STATIN Population Census 2001)

The sex ratio (males per one hundred females) in the SIA in 2001 was 93.2, which indicates that a higher percentage of the population in the SIA were females.

The child dependency ratio for the SIA in 2001 was 593 per 1000 persons of labour force age; old age dependency ratio stood at 81 per 1000 persons of labour force age; and societal dependency ratio of 674 per 1000 persons of labour force. This indicates that the youth (child dependency) is more dependent on the labour force for support when compared with the elderly.

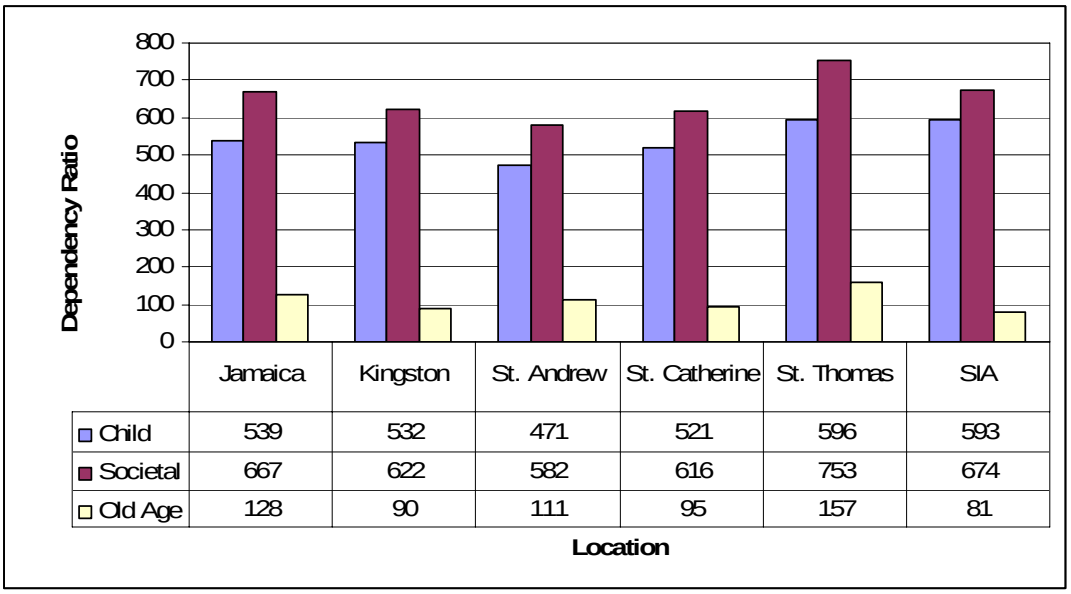

Figure 4-16 Dependency Ratios

A comparison of the dependency ratios revealed that St. Thomas had the highest child, societal and old age dependency ratios. With the exception of St. Thomas, the SIA had the highest child and societal dependency ratios than the National and the other parishes. Also it had the lowest old age dependency ratio.

4.10.3 Population Densities

The land area within the SIA was calculated to be approximately 11.47 km^2. With a population of approximately 97,301 persons the overall population density was calculated to be ≈ 8,483 person/km^2. This population density is higher than National figure (238 persons/ km^2) by at least fourfold. The population density of the SIA is considered high. Figure 4.17 shows that the areas with the high densities are found west northwest of the proposed development site.

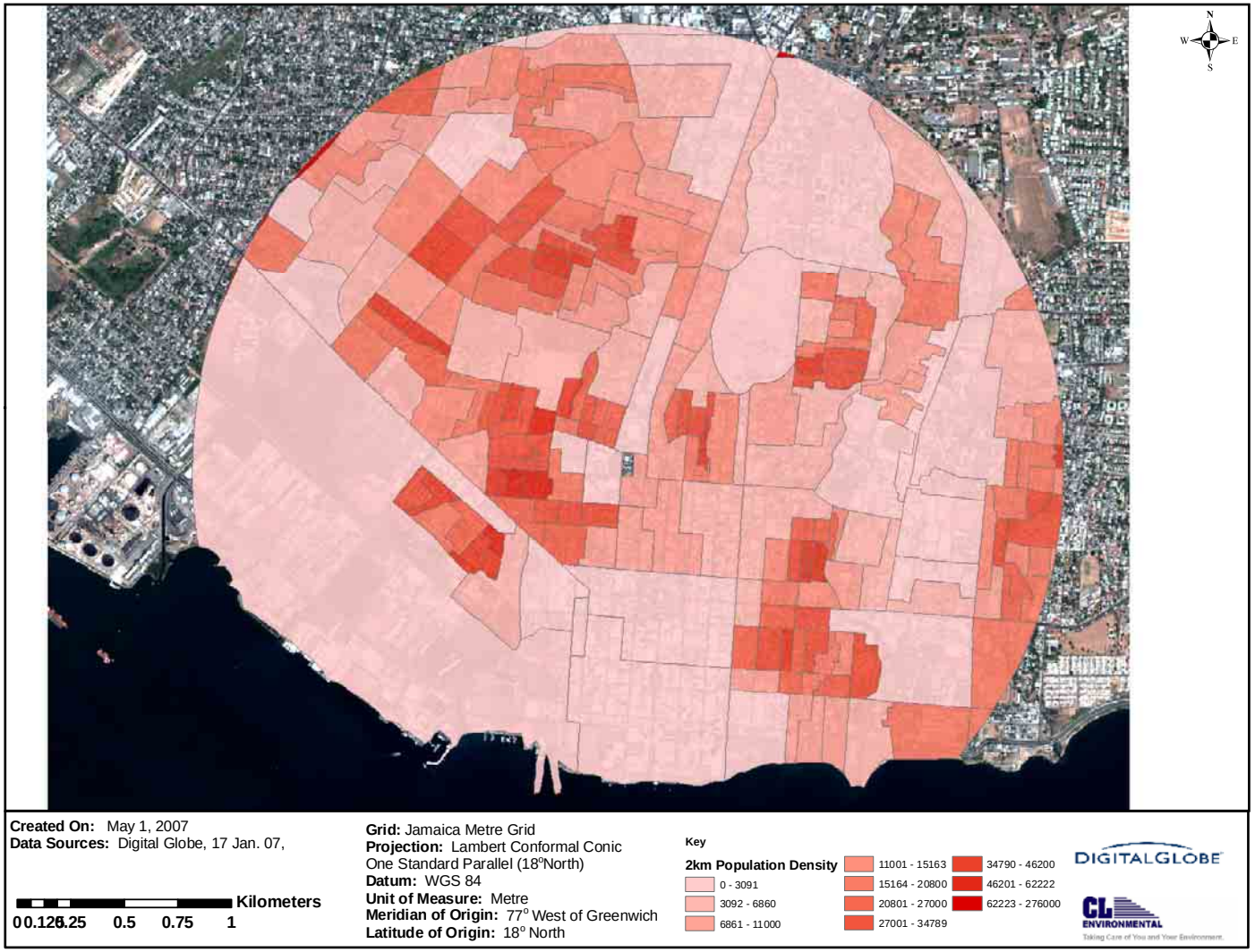

Figure 4-17 Population density map

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4.10.4 Employment and Income

The main employment within Kingston rely heavily on the Services, Commerce and Industry sectors including the Wholesale and Retail Trade, whilst in the parishes of St. Andrew and St. Catherine Community Social and Personal Services provide most of the employment. Table 4.12 gives the distribution of employment by industry by parish in 2002.

Table 4-13 Distribution of employment by industry by selected parish in 2002

PARISH	AGRICULTURE (%)	WHOLESALE (%)	COMMUNITY, SOCIAL, PERSONAL SERVICES (%)	OTHER (%)
Kingston	0.9	35.6	28.0	35.2
St. Andrew	4.9	20.0	38.8	36.2
St. Thomas	30.4	18.4	27.9	23.9
St. Catherine	13.7	20.5	30.3	35.5

(Source: Jamaica Survey of living Conditions, Parish Report 2002)

Unemployment rate for the four parishes in which the Southeast Medical Region fall, having varying unemployment rates over the five year period (1998 – 2002). In 2002, St. Andrew (11.5%) had the lowest unemployment rate whilst St. Thomas had the highest (22.3%) (Table 4.13).

Table 4-14 Unemployment rates (April/ July) by parish, 1998-2002 (percentages)

PARISHES	1998	1999	2000	2001	2002
Kingston	16.7	16.7	9.9	6.4	17.7
St. Andrew	10.4	11.8	12.5	12.2	11.5
St. Thomas	20.9	21.9	19.5	19.9	22.3
St. Catherine	13.2	16.0	16.9	19.1	13.7

(Source: Jamaica Survey of living Conditions, Parish Report 2002)

Within the Southeast Health Region in 2002, St. Catherine (6.2%) had the lowest incidence of poverty and St. Thomas (28.7%) had the highest (Table 4.14).

Table 4-15 Incidence of poverty by parish, 1992, 1998 and 2002 (percentages)

PARISHES	1992	1998	2002
Kingston	17.1	12.6	18.3
St. Andrew	19.8	7.7	14.8
St. Thomas	37.1	9.4	28.7
St. Catherine	28.2	8.2	6.2

(Source: Jamaica Survey of living Conditions, Parish Report 2002)

During construction of the proposed development it is anticipated that approximately twenty eight (28) persons will be employed. This is broken up into 16 skilled workers and 12 unskilled labourers. The categories of skilled workers are detailed below;

- Concrete Works Supervisor 1
- Steel Fixers 2
- Carpenters 2
- Masons 3
- Steelwork Supervisor 1
- Steel erectors 2
- Project Manager 1
- Sheeting Supervisor 1
- Sheeters 3

Total 16

It is anticipated that during the operation of the facility the staffing requirement will be approximately 14 persons. The categories include:

- Manager 1
- Supervisor 1
- Operators 4
- Drivers 3
- Sidemen 3
- Security 2

Total 14

4.10.5 Education

The educational attainment of persons four years and older in 2001 are represented in Table 4.15. Most persons within the SIA attained a secondary school education followed by those attaining a primary education. The educational statistics of the SIA indicated that the percentage of the population 4 years and older was highest for pre-primary, secondary and those obtaining other forms of education and lowest of those obtaining a tertiary education when compared to the National and parish data.

Table 4-16 Educational attainment as a percentage of the population for persons 4 years and older

CATEGORY	JAMAICA (%)	KINGSTON (%)	ST. ANDREW (%)	SIA (%)
Pre-Primary	4.7	4.9	4.3	5.3
Primary	31.2	25.4	23.4	24.8
Secondary	49.7	55.2	50.8	56.9
University	3.1	1.5	7.4	1.0
Other Tertiary	5.9	5.2	8.0	4.3
Other	2.8	3.4	3.0	3.6

CATEGORY	JAMAICA (%)	KINGSTON (%)	ST. ANDREW (%)	SIA (%)
Not Stated	1.7	3.2	2.4	3.0
None	0.9	1.2	0.7	1.1

(Source: STATIN Population Census 2001)

Within the study area there are over ten (10) schools.

4.10.6 Land Tenure

In 2001, 8% of the households in the SIA owned the land on which they lived. Approximately, 13.7% rented the land on which they were, 10.5%, lived rent free, 65.2% did not report the type of ownership arrangements they had, probably due to informal arrangements ("squatting"), to which they did not want to admit to, 1% "squatted" 0.9% had other arrangements and 0.7 leased (Table 4.16).

There are a lower percentage of households in the SIA owning, leasing or renting the land they are living on. There is however a large percentage (65.2%) of the households in the SIA not reporting their living arrangements when compared to the national and regional setting.

Table 4-17 Percentage household tenure nationally, parish and SIA

CATEGORY	JAMAICA (%)	KINGSTON (%)	ST. ANDREW (%)	SIA (%)
Owned	37.5	12.6	27.2	8.0
Leased	5.0	1.2	5.4	0.7
Rented	14.8	18.3	17.9	13.7
Rent free	17.0	8.5	10.8	10.5
Squatted	2.9	1.5	2.6	1.0
Other	0.9	0.6	1.0	0.9
Not Reported	21.9	57.3	35.2	65.2

(Source: STATIN Population Census 2001)

4.10.7 Housing

For the purposes of this study the definition of housing unit, dwelling and household are those used in the conduct of the population census conducted by the Statistical Institute of Jamaica. This definition states that a "housing unit is a building or buildings used for living purposes at the time of the census. A dwelling is any building or separate and independent part of a building in which a person or group of persons lived at the time of the census". The essential features of a dwelling unit are both "separateness and independence". Occupiers of a dwelling unit must have free access to the street by their own separate and independent entrance(s) without having to pass through the living quarters of another household. Private dwellings are those in which private households reside. Examples are single houses, flats, apartments and part of commercial buildings and boarding houses catering for less than six boarders.

Approximately sixty five percent (65.1 %) and 81.5% of the housing units in 2001 in Kinston and St. Andrew respectively were of the separate detached type, 30.6 % and 16.7 % attached type, 2.0 % and 0.4 % part of commercial building, and 0.3 % and 0.1 % improvised housing, 0.6 % and 0.1 % other and 1.3 % each not stated.

In 2001, nearly eight three percent (83.2 %) and 66% of the households in Kingston and St Andrew respectively occupied between 1 and 3 rooms, 12.7% and 26.1% between 4 and 6 rooms, 2.1 % and 5.5% occupied 7 and over rooms and 2.1% and 2.3% did not state how many rooms they occupied Table 4.17). Most of the households in Kingston (43.0 %) and St. Andrew (23.6 %) occupied one (1) room. Table 4.18 depicts the number of rooms that households used for sleeping within the parishes of Kingston and St. Andrew in 2001. Most of the households in Kingston (93.6%) and St. Andrew (86.2%) used between 1 and 3 rooms for sleeping, with the one bedroom being the most popular in Kingston (54.4%) and St. Andrew (36.1%).

Table 4-18 Percentage households by rooms occupied

NUMBER OF ROOMS OCCUPIED	% HHOLDS KINGSTON	% HHOLDS -ST. ANDREW	% HOUSEHOLDS SIA
1	43.0	23.6	45.3
2	22.3	21.8	22.8
3	17.7	20.6	20.2
4	7.3	13.1	5.4
5	3.6	8.3	2.4
6	1.8	4.7	1.0
7	1.1	2.5	0.7
8	0.6	1.4	0.4
9	0.2	0.7	0.1
10 & OVER	0.2	0.9	0.1
NOT REPORTED	2.1	2.3	1.6

(Source: STATIN Population Census 2001)

Table 4-19 Percentage households by rooms slept in

NUMBER OF ROOMS SLEPT IN	% HOUSEHOLDS – KINGSTON	% HOUSEHOLDS – ST. ANDREW	% HOUSEHOLDS SIA
1	54.4	36.1	57.0
2	30.9	32.5	32.6
3	8.3	17.6	6.3
4	3.0	7.8	1.8
5 & OVER	3.0	4.8	2.0
NOT REPORTED	0.4	1.2	0.3

(Source: STATIN Population Census 2001)

In 2001, there were approximately 13,388 housing units, 28,832 private dwellings and 29,708 households the study area. The average dwelling in each housing unit was 2.15 and the average household to each dwelling was 1.03. The average household size was 3.27 persons/household.

A comparison of the SIA and national and regional ratios indicate that they were generally similar except for the higher national households/dwelling ratio and the lower local (SIA) average household size (Table 4.19).

Table 4-20 Comparison of national, regional and local housing ratios

	JAMAICA	KINGSTON	ST.ANDREW	SIA
Dwelling/Housing Unit	1.2	1.96	1.4	2.15
Households/Dwelling	1.03	1.04	1.05	1.03
Average Household Size	3.48	3.41	3.38	3.27

Separate housing accounted for 57.8 % of the housing units in the SIA in 2001. Approximately thirty eight percent (37.8%) was attached housing and 2.1 % part of a commercial building, 1.4% did not state the type of housing unit, 0.6% other, and 0.3% improvished housing.

With the exception of the attached category which was higher in the SIA, and higher St. Andrew data for detached housing and generally lower percentages for the other categories the other categories were either similar or lower to what obtained in the parishes.

In 2001, approximately eighty eight percent (88.3 %) of the households in the SIA occupied between 1 and 3 rooms, 8.8 % between 4 and 6 rooms, 1.3 % occupied seven or over rooms and 1.6% did not state how many rooms they occupied (Table 4.17). Table 4.18 depicts the number of rooms that households used for sleeping within the SIA in 2001. Most of the households (95.9%) used between 1 and 3 rooms for sleeping, with the one bedroom being the most popular (57.0%).

The average household size was higher than both that of the parish and the nation. The fact that the majority of households in the SIA occupied one room for sleeping suggests that there was some level of overcrowding occurring in the households.

4.10.8 Infrastructure

Electricity

In the study area in 2001, approximately 96.3 % and 1.3 % of the households used electricity and kerosene respectively. Those not reporting what type of lighting they used were 2.2% and those using other means for providing lighting to their households accounted for 0.2%.

The proposed development is estimated to consume approximately 1,033.62 kilowatts per day. Table 4.20 outlines the power demand by activity/equipment.

Table 4-21 Power demand by activity/ equipment

ACTIVITY/SOURCE	ESTIMATED ELECTRICITY CONSUMPTUION (Kw/day)
T2000 Treatment Equipment	144
Electric Boiler	576
Mechanical Washing machine	185.6
Compressor	10.72
Air Dryer Device	4
Radioactivity Measurement Device	1.6
Cooling System	16
Weighing Platform (receptor & indicator)	0.74
Weighing Platform Printer	0.96
Other Employee Use (office, toilets & shower) & Contingency	94
TOTAL	**1,033.62**

It is not anticipated that there will be any problems as it relates to the supply of electricity to the proposed development (Appendix H).

Telephone/Telecommunications

The parish of Kingston is served with land lines provided by Cable and Wireless Jamaica Limited and Flow. Wireless communication (cellular) is provided by Cable and Wireless, Digicel Jamaica Limited, MiPhone and Mega Phone.

It is not anticipated that there will be any problems as it relates to the provision of telephone service to the proposed development.

Water Supply

Approximately 90.4 % of the households in the study area in 2001 received water from the National Water Commission, 5.1 % received water from private means, 1.8% had other means, 2.7% did not report what means they received their water and none from spring/rivers.

Table 4.21 contains the estimated water consumption in the parishes of Kingston and St. Andrew and within the SIA in 2001 and 2007. It also estimates the future consumption in the year 2032.

Table 4-22 Estimated Water Consumption (in Litres per Day)

Location	2001	2007	2032
Kingston & St. Andrew	148,023,643.00	149,743,395.70	157,450,485.80
Study Area	22,099,003.12	21,983,171.92	21,600,247.60

Based on these estimates, the expected demand for water supply by the proposed development is not expected to have any potential negative impact on water supply for the area.

Wastewater Treatment

Past, current and future estimation of sewage generation are outlined in Table 4.22 .

Table 4-23 Estimated Sewage Generation (in Litres per Day)

Location	2001	2007	2032
Kingston & St. Andrew	118,418,914.40	119,794,716.60	125,960,388.60
Study Area	17,679,202.50	17,586,537.54	17,280,198.08

In 2001, approximately 71.2% of the households within the study area disposed of their sewage by an inappropriate and inadequate manner (Table 4.23).

Table 4-24 Comparison between the parish and the study area by sewage disposal methods as a percentage of the households

METHOD OF DISPOSAL	LOCATION	
	Kingston & St. Andrew (%)	Study Area (%)
Water Closet	85.6	92.7
Pit Latrine	10.8	3.0
No established means	1.7	0.7
Not Reported	1.9	3.6

(Source: STATIN Population Census 2001)

A higher percentage of households in the study area compared to those within the parish use water closets to dispose of their sewage. There was a lower percentage of households in the study area using pit latrines, having no established means of disposing of their sewage or did not report their means of sewage disposal when compared to the parish statistics.

The building of the proposed medical waste treatment facility development is not expected to have a negative impact, as the development will be linked to the existing sewer system. A copy of the NWC agreement letter to supply water and connect to the existing sewer system is found in Appendix I.

Solid Waste Generation and Disposal

The National Solid Waste Management Authority does solid waste collection in this area. This service is provided free for the households within the area. The waste is transported to the Riverton disposal site in Kingston which is located approximately 7.0 km (≈ 4.3 miles) from the proposed medical waste treatment facility.

Private contractors do collection of solid waste from the hospitals, health centres and commercial entities within the SIA. This service is provided to these facilities for a fee, which is dependent

on the frequency of collection and waste volume. This waste is also transported to the Riverton dump.

It is estimated that households in the study area generated approximately 73 tonnes of solid waste in 2001. Based on the decline of the population, it has been estimated that at the time of this study approximately 72.6 tonnes of solid waste was being generated and it is expected that within the next twenty five years if the population growth rate remains the same to be approximately 71.3 tonnes.

The 2001 census data indicated that approximately 82.4% of the households in the parishes of Kingston and St. Andrew had their garbage collected by public means (Metropolitan Parks and Markets Waste Management Limited), with a higher percentage (90.3%) in the SIA. It also showed that the next preferred method of disposal in the SIA was by dumping (Table 4.24). All the other categories of garbage disposal in the SIA were lower than the National and regional figures except the category of those not reporting the method of garbage disposal.

Table 4-25 Percentage households by method of garbage disposal

DISPOSAL METHOD	Jamaica (%)	Kingston & St. Andrew (%)	SIA (%)
Public Collection	47.7	82.4	90.3
Private Collection	0.5	0.5	0.2
Burn	43.0	9.9	1.0
Bury	1.2	0.4	0
Dump	6.0	4.5	7.0
Other Method	0.3	0.2	0.1
Not reported	1.3	2.1	1.4

(Source: STATIN Population Census 2001)

The operation of the proposed development is not expected to have a negative impact on the collection and disposal of solid waste within the SIA as storage of waste will be done onsite and collection and disposal at the Riverton disposal site will be done by private contractors.

Roads and Transportation

Roads within the Southeast Health Region are in various state of repair. The healthcare facilities within the region are all accessible by the road network (Figure 4.18). Most are in close proximity to main roads (class one or two). The distances from healthcare facilities to the main roads are listed in Table 4.25 and Table 4.26. However, some of these facilities have access to these main roads through a series of parochial roads.

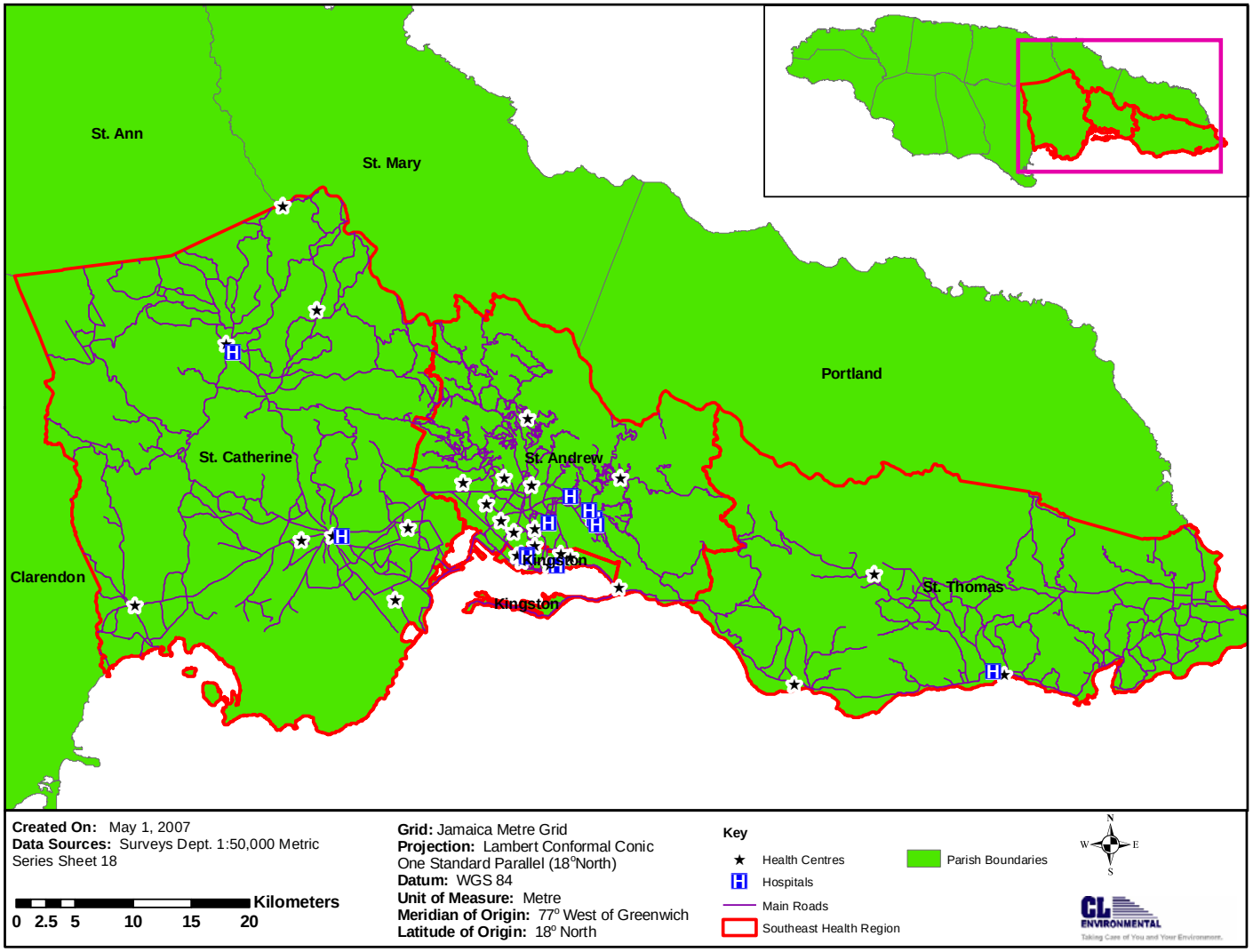

Figure 4-18 Map depicting major roads and health facilities within the Southeast Health Region

Table 4-26 Hospitals in Southeast Health Region with Distances from Main Roads

PARISH	FACILITY TYPE	CENTRE NAME	OWNERSHIP	ROAD	DISTANCE (m)
Kingston and St. Andrew	Type S Specialist	Victoria Jubilee	Public	Main Road Class 1	149.2
Kingston and St. Andrew	Type A	Kingston Public	Public	Main Road Class 1	152.1
Kingston and St. Andrew	Type S Specialist	Bellevue	Public	Main Road Class 1	338.7
Kingston and St. Andrew	Type A	Mona Rehabilitation	Public	Main Road Class 2	121.2
Kingston and St. Andrew	Type S Specialist	National Chest	Public	Main Road Class 2	439.8
Kingston and St. Andrew	Type S Specialist	Bustamante	Public	Main Road Class 2	61.7
Kingston and St. Andrew	Type S Specialist	Sir John Golding	Public	Main Road Class 2	53.9
Kingston and St. Andrew	Type S Specialist	Hope Institute	Public	Main Road Class 2	189.5
St. Catherine	Type C	Linstead	Public	Main Road Class 1	125.8
St. Catherine	Type B	Spanish Town	Public	Main Road Class 1	213.0
St. Thomas	Type C	Princess Margaret	Public	Main Road Class 1	60.5

Table 4-27 Health Centres in Southeast Health Region with Distances from Main Roads

PARISH	FACILITY TYPE	CENTRE NAME	OWNERSHIP	FEATURE	DISTANCE (m)
Kingston and St. Andrew	Type 5 Health Centre	Windward Road	Public	Main Road Class 1	108.0
Kingston and St. Andrew	Type 3 Health Centre	Glen Vincent	Public	Main Road Class 1	142.0
Kingston and St. Andrew	Type 3 Health Centre	Mary Issa (VOUCH)	NGO	Main Road Class 2	134.8
Kingston and St. Andrew	Type 3 Health Centre	Norman Gardens	Public	Main Road Class 2	157.4
Kingston and St. Andrew	Type 3 Health Centre	Rollington Town	Public	Main Road Class 2	433.9
Kingston and St. Andrew	Type 3 Health Centre	Olympic Gardens	Public	Main Road Class 2	46.5
Kingston and St. Andrew	Type 3 Health Centre	Social& Preventative Medicine	Public	Main Road Class 2	54.5
Kingston and St. Andrew	Type 3 Health Centre	Edna Manley	Public	Main Road Class 2	35.7
Kingston and St. Andrew	Type 3 Health Centre	Duhaney Park	Public	Main Road Class 2	344.2

PARISH	FACILITY TYPE	CENTRE NAME	OWNERSHIP	FEATURE	DISTANCE (m)
Kingston and St. Andrew	Type 3 Health Centre	Hagley Park	Public	Main Road Class 2	115.7
Kingston and St. Andrew	Type 3 Health Centre	Sunrise	Public	Main Road Class 2	110.3
Kingston and St. Andrew	Type 3 Health Centre	Stony Hill	Public	Main Road Class 1	294.2
Kingston and St. Andrew	Type 3 Health Centre	Majesty Gardens	Public	Main Road Class 1	131.9
Kingston and St. Andrew	Type 3 Health Centre	Denham Town	Public	Main Road Class 1	253.2
Kingston and St. Andrew	Type 3 Health Centre	Gordon Town	Public	Main Road Class 2	89.1
Kingston and St. Andrew	Type 5 Health Centre	Maxfield Park	Public	Main Road Class 2	47.2
Kingston and St. Andrew	Type 3 Health Centre	Harbour View	Public	Main Road Class 1	138.7
Kingston and St. Andrew	Type 5 Health Centre	Comprehensive	Public	Main Road Class 1	
Kingston and St. Andrew	Type 3 Health Centre	Operation Friendship	Public	Main Road Class 1	
St. Catherine	Type 3 Health Centre	Linstead	Public	Main Road Class 1	518.5
St. Catherine	Type 4 Health Centre	St. Jago Park	Public	Main Road Class 1	112.2
St. Catherine	Type 3 Health Centre	Sydenham	Public	Main Road Class 1	146.7
St. Catherine	Type 3 Health Centre	Greater Portmore	Public	Main Road Class 1	2391.2
St. Catherine	Type 3 Health Centre	Old Harbour	Public	Main Road Class 1	40.7
St. Catherine	Type 3 Health Centre	Riversdale	Public	Main Road Class 2	679.9
St. Catherine	Type 3 Health Centre	Christian Pen	Public	Main Road Class 1	496.9
St. Catherine	Type 3 Health Centre	Guys Hill	Public	Main Road Class 2	551.5
St. Thomas	Type 3 Health Centre	Morant Bay	Public	Main Road Class 1	52.6
St. Thomas	Type 3 Health Centre	Yallahs	Public	Main Road Class 1	11.9
St. Thomas	Type 3 Health Centre	Trinityville	Public	Main Road Class 2	8648.4

Transportation within the study area is provided by a fleet of buses (Jamaica Urban Transit Company Limit), route taxis and "robot taxis" (unlicensed).

In the vicinity of the Kingston Public Hospital, taxis tend to park illegally to drop off and pickup passengers. This causes a "bottleneck" in the traffic flow within this area along Princess and North Street.

Transportation of the medical waste will be done by two specialized collection vehicles (trucks). Access to the site will be along Drummond Street. It is anticipated that these trucks will make anywhere between one (1) and two (2) trips to the treatment facility per day. Table 4.27 illustrates the preliminary collection zones.

Parking

The site current provides for informal parking for approximately 150 staff and visitor cars for KPH and VJ. KPH does however have additional staff parking in the main parking lot of the Hospital premises for approximately 160 staff and visitor cars as well as parking lots for senior management in designated areas.

Table 4-28 Preliminary Collection Zones

Healthcare Facilities	Waste Generation (kg/day)[(c)]	# of bins required for collection/day (5days/wk) (calculated)[(b)]	# of bins to be placed or collected/day with allowance poor segregation	# of bins to be placed for collection plus extra storage [(e)]	Time to fill all bins placed at facility (days)	Preliminary Collection Zone **	Number of Bins collected per Collection Schedule day*			Est'd. load time @ HCF (mins)[(d)]
							5 days/ week	3 days/ week	2 day/ week	
Victoria Jubilee[(a)]	127	2.96	5	15	1.69		5			25
National Chest	47	1.10	6	12	5.47	E			6	30
Bustamantee	189	4.41	8	24	1.81	E	8			40
Kingston Public Hospital [(a)]	317	7.40	11	33	1.49		11			55
Sir John Golding	50	1.17	2	4	1.71	D			2	10
Princess Margaret	83	1.94	8	16	4.13	A			8	40
Spanish Town	225	5.25	8	24	1.52	F	8			40
Linstead	13	0.30	2	3	6.59	B			2	10
Hope Institute	18	0.42	2	3	4.76	D			2	10
National Public Health Laboratory & Blood Bank	74	1.23	4	12	3.24	E		4		20
			56	**146**						

** Recommended Collection Schedule*

*** Based on estimated transportation, collection and loading and off loading times*

[(a)] Will be transported directly to the facility in the dedicated bins via a cross ram (over head bridge) linking the hospital to the facility and car park

[(b)] Include allowance for waste generated on weekends

[(c)] Based on 2005 bed complement & occupancy level; waste generation of 1 kg/bed/day

[(d)] Assumed 5 minutes/bin for collection at facility with easy drive access to storage area

[(e)] Assumed 2 - 3 days days extra storage capacity

Health Centers - Types 3, 4 & 5

Type	Healthcare Facilities	Waste Generation (kg/day)	# of bins required for collection/week (calculated)[(b)]	# of bins to be placed or collected/day with allowance poor segregation	# of bins to be placed for collection plus extra storage	Time to fill all bins placed at facility (days)	Preliminary Collection Zone **	Number of Bins collected per Collection Schedule day*			Est'd. load time @ HCF (mins)
								5 days/ week	3 days/ week	2 day/ week	
3	Stony Hill	10	0.83	1	2	6	D			1	10
3	Social & Preventitive Medicine	10	0.83	1	2	6	D			1	10
3	Duhaney Park	10	0.83	1	2	6	B			1	10
3	Edna Manley	10	0.83	1	2	6	D			1	10
3	Glen Vincent	10	0.83	1	2	6	C			1	10
3	Gordon Town	10	0.83	1	2	6	D			1	10
3	Hagley Park	10	0.83	1	2	6	C			1	10
3	Harbour View	10	0.83	1	2	6	A			1	10
5	Maxfield Park*	20	1.67	3	5	9	C			3	30
3	Norman Gardens	10	0.83	1	2	6	C			1	10
3	Olympic Gardens	10	0.83	1	2	6	F			1	10
3	Majesty Gardens	10	0.83	1	2	6	C			1	10
3	Rollington Town	10	0.83	1	2	6	C			1	10
3	Sunrise	10	0.83	1	2	6	D			1	10
3	Denham Town	10	0.83	1	2	6	C			1	10
5	Comprehensive*	20	1.67	3	5	9	D			3	30
5	Windward Road*	20	1.67	3	5	9	C			3	30
3	Mary Issa (VOUCH)	10	0.83	1	2	6	C			1	10
3	Operation Freindship	10	0.83	1	2	6	B			1	10
3	Old Harbour	10	0.83	1	2	6	B			1	10
3	Christian Pen	10	0.83	1	2	6	F			1	10
3	Greater Portmore	10	0.83	1	2	6	F			1	10
3	Linstead	10	0.83	1	2	6	B			1	10
3	Riversdale	10	0.83	1	2	6	B			1	10
3	Sydenham	10	0.83	1	2	6	B			1	10
4	St. Jago Park (treatment site)*	20	1.67	3	5	9	B			3	30
3	Morant Bay	10	0.83	1	2	6	A			1	10
3	Yallahs	10	0.83	1	2	6	A			1	10
3	Trinityville	10	0.83	1	2	6	A			1	10
				37	**70**						
				93	**216**						

** Type 4 or 5 Health Center*

*** Based on estimated transportation, collection and loading and off loading times*

Health Care

Within the Southeast Health Region there are nine (9) hospitals and thirty (30) health centres that will be serviced by the proposed treatment facility. This represents approximately 28% of the hospitals and approximately 8% of the health centres in Jamaica. The University Hospital of the West Indies was excluded on the basis on their ownership status and current plans to implement its own on-site steam sterilization and shredding treatment system.

Table 4.28 lists the names and types of the hospitals within the Southeast Health Region and Figure 4.19 depicts the locations of these hospitals. Table 4.29 lists the names and types of the health centres within the Southeast Health Region and Figure 4.20 depicts the locations of these health centres.

Table 4-29 List of hospitals within the Southeast Health Region

PARISH	FACILITY TYPE	CENTRE NAME	OWNERSHIP	NO. OF BEDS
Kingston and St. Andrew	Type S Specialist Hospital	Victoria Jubilee	Public	213
Kingston and St. Andrew	Type S Specialist Hospital	National Chest	Public	100
Kingston and St. Andrew	Type S Specialist Hospital	Bustamante	Public	244
Kingston and St. Andrew	Type A Hospital	Kingston Public	Public	455
Kingston and St. Andrew	Type S Specialist Hospital	Hope Institute	Public	34
Kingston and St. Andrew	Type A Hospital	Sir John Golding	Public	54
St. Catherine	Type B Hospital	Spanish Town	Public	290
St. Catherine	Type C Hospital	Linstead	Public	49
St. Thomas	Type C Hospital	Princess Margaret	Public	124

Source: Hospital Monthly Statistics Report, Jan – Dec 2005

In addition to the hospitals there are two labs that will be included in the list of facilities that waste will be collected from and treated at the Medical Waste Treatment Facility. These are the National Public Health Lab and the National Blood Bank.

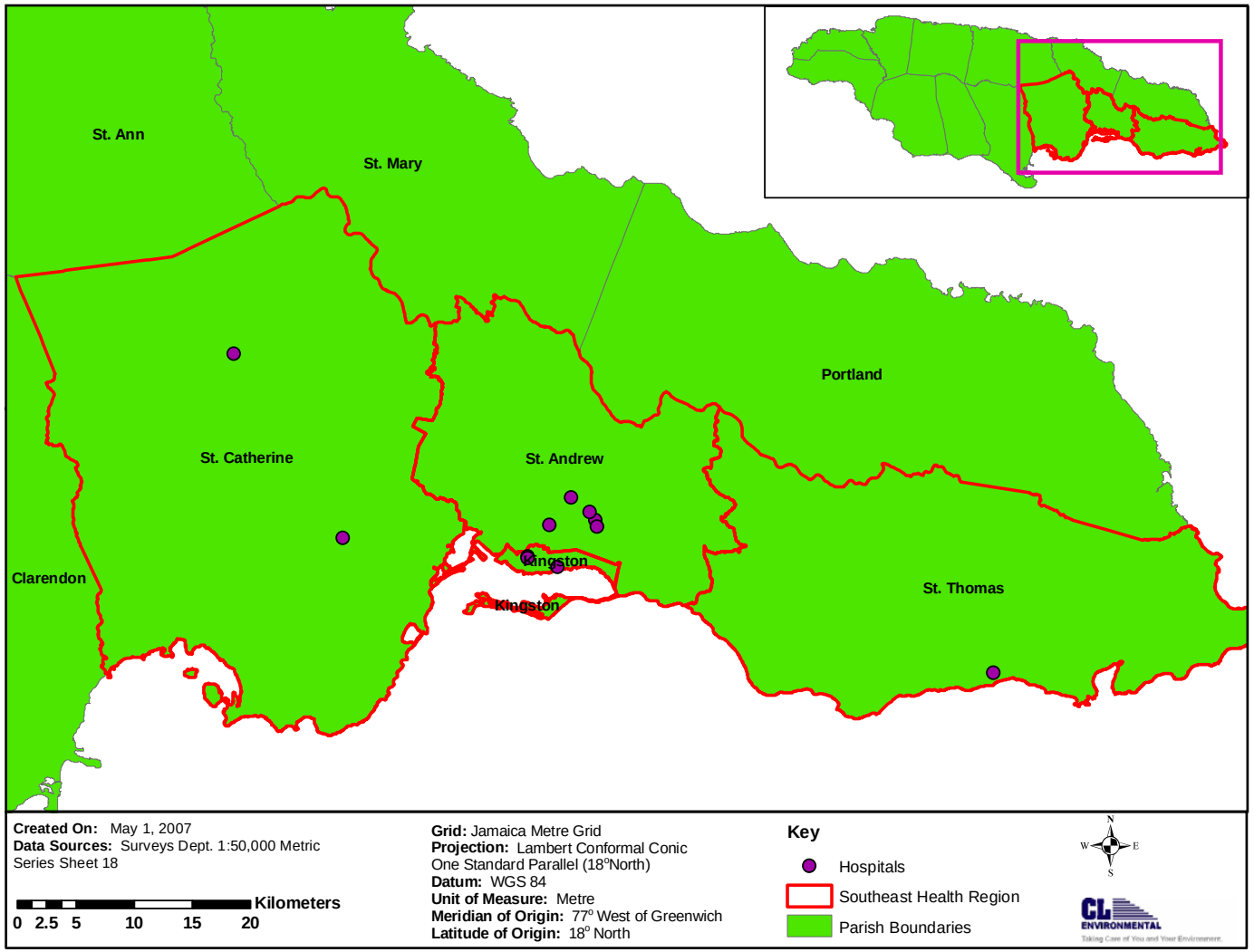

Figure 4-19 Hospitals within the Southeast Health Region

Table 4-30 List of health centres by type in the Southeast Health Region

PARISH	FACILITY TYPE	CENTRE NAME	OWNERSHIP
St. Catherine	Type 3 Health Centre	Christian Pen	Public
Kingston and St. Andrew		Comprehensive	
Kingston and St. Andrew	Type 3 Health Centre	Denham Town	Public
Kingston and St. Andrew	Type 3 Health Centre	Duhaney Park	Public
Kingston and St. Andrew	Type 3 Health Centre	Edna Manley	Public
Kingston and St. Andrew	Type 3 Health Centre	Glen Vincent	Public
Kingston and St. Andrew	Type 3 Health Centre	Gordon Town	Public
St. Catherine	Type 3 Health Centre	Greater Portmore	Public
St. Catherine	Type 3 Health Centre	Guys Hill	Public
Kingston and St. Andrew	Type 3 Health Centre	Hagley Park	Public
Kingston and St. Andrew	Type 3 Health Centre	Harbour View	Public
St. Catherine	Type 3 Health Centre	Linstead	Public
Kingston and St. Andrew	Type 3 Health Centre	Majesty Gardens	Public
Kingston and St. Andrew	Type 3 Health Centre	Mary Issa (VOUCH)	NGO
Kingston and St. Andrew	Type 5 Health Centre	Maxfield Park	Public
St. Thomas	Type 3 Health Centre	Morant Bay	Public
Kingston and St. Andrew	Type 3 Health Centre	Norman Gardens	Public
St. Catherine	Type 3	Old Harbour	Public

PARISH	FACILITY TYPE	CENTRE NAME	OWNERSHIP
Kingston and St. Andrew	Health Centre Type 3	Olympic Gardens	Public
Kingston and St. Andrew	Health Centre Type 3	Operation Freindship	NGO
St. Catherine	Health Centre Type 3	Riversdale	Public
Kingston and St. Andrew	Health Centre Type 3	Rollington Town	Public
Kingston and St. Andrew	Health Centre Type 3	Social & Preventitive Medicine	Public
St. Catherine	Health Centre Type 4	St. Jago Park	Public
Kingston and St. Andrew	Health Centre Type 3	Stony Hill	Public
Kingston and St. Andrew	Health Centre Type 3	Sunrise	Public
St. Catherine	Health Centre Type 3	Sydenham	Public
St. Thomas	Health Centre Type 3	Trinityville	Public
Kingston and St. Andrew	Health Centre Type 5	Windward Road	Public
St. Thomas	Health Centre Type 3	Yallahs	Public

Source: Ministry of Health Monthly Clinical Summary Report, Jan – Dec 2005

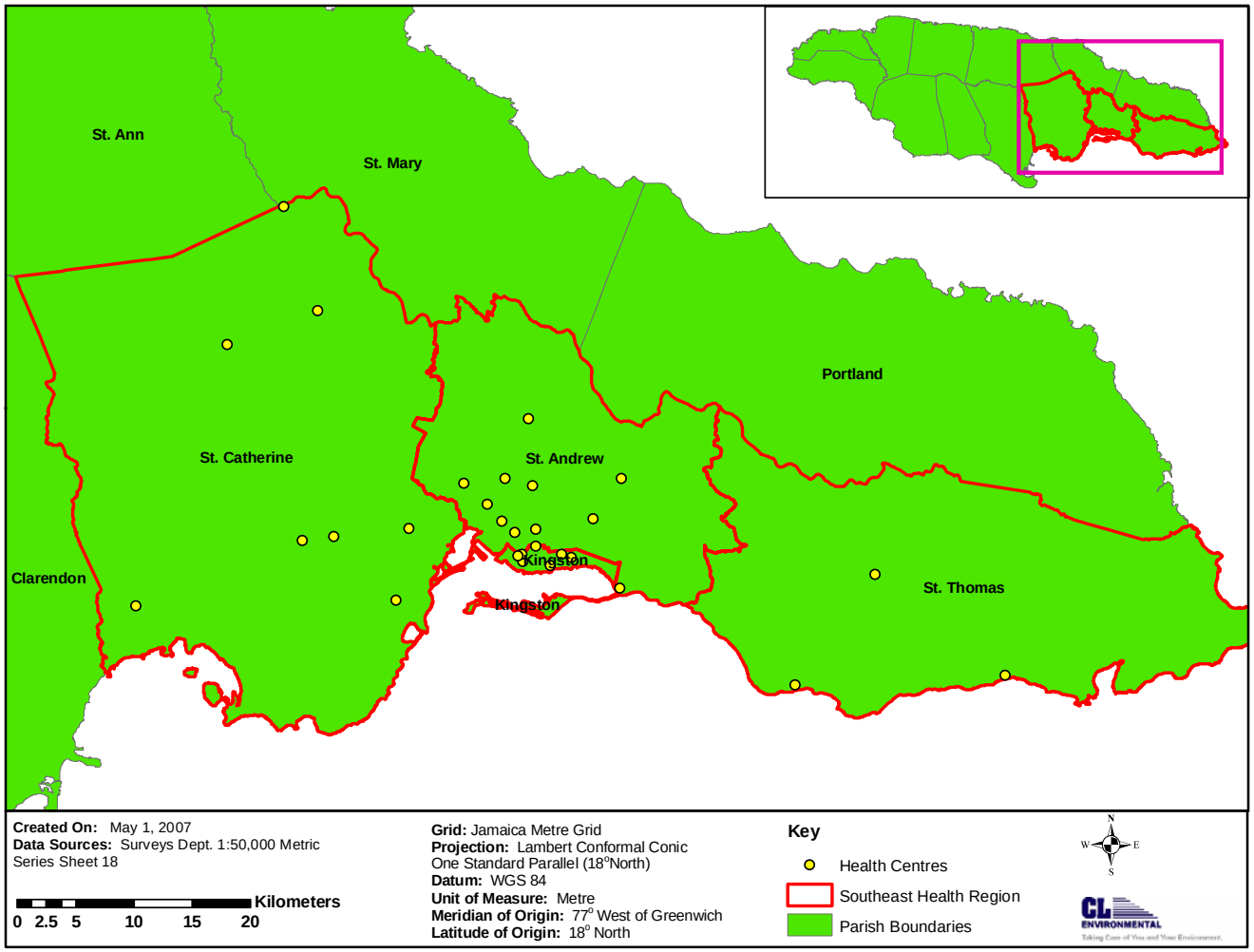

Figure 4-20 Health Centres within the Southeast Health Region

CL Environmental Co. Ltd.
clenviro@cwjamaica.com

The closest hospitals to the proposed site are the Kingston Public (Type A) and the Victoria Jubilee (Type S) Hospitals. The type services provided by the hospitals within the Southeast Health Region are listed in Table 4.30.

Table 4-31 Hospital types and services provided*

HOSPITAL TYPE	SERVICES PROVIDED
A (approximately 300 – 500 beds; staffed by consultants and specialists; provides a wide range of specialist secondary, tertiary care services and chronic care facilities)	Anaesthesiology; Cardiology; Cardiothoracic Surgery; Casualty/Emergency (24 hour); Dermatology; Ear, Nose & Throat; General Medicine; General Surgery; Gynaecology, Haematology, Immunology; Intensive Care; Microbiology; Neonatology, Neurology; Neurosurgery; Nuclear Medicine Obstetrics; Ophthalmology; Orthopaedics, Paediatric Medicine and Surgery; Pathology & Laboratory; Plastic Surgery; Psychiatry; Radiology; Radiotherapy; Respiratory; Urology.
B (approximately 150 – 300 beds; staffed by consultants and specialists)	Anaesthesiology; Casualty/Emergency; Dermatology; Ear, Nose & Throat; General Medicine; General Surgery; Gynaecology, Obstetrics; Ophthalmology; Orthopaedics; Paediatric Medicine and Surgery; Pathology & Laboratory; Psychiatry; Radiology; Urology.
C (approximately 50 – 150 beds; provides basic inpatient and out patient care)	Basic Laboratory; Basic X-Ray; Casualty/Emergency Resuscitation; General Medicine; Obstetrics; Paediatric Medicine and Surgery.
SPECIALIST (specialises in the management of a single aspect of health care)	Psychiatry; Paediatric Medicine and Surgery; Oncology; Rehabilitation Centre; Cardio Pulmonary/Respiratory; Obstetrics & Gynaecology.

**Adapted from the Public Health Care System, July 1, 1994*

The closest health centre is the Slipe Pen Road health centre which is a Type 5 comprehensive clinic. The type services provided by the different health centres within the Southeast Health Region are listed in Table 4.31.

Table 4-32 Health centre types and services provided*

HEALTH CENTRE TYPE	NUMBER ISLANDWIDE	LEVEL OF PERSONNEL	AREA SERVED	SERVICES PROVIDED
V	3	Medical Officer, some specialist, nursing care, Dentist	High density urban areas	Comprehensive health centre providing a variety of specialty outpatient care and services and PHC able to deal with large number of people
IV	4	Combination of Type III Centre and Parish Health Office	Capital Town	Provide all the services of Type III at a sophisticated level with the addition of certain specialist services STD, Dermatology, Psychology, AN High Risk, Child Guidance
III	70	Doctor, Dentist, Nurse Practitioner Public Health Nurse, Public Health Inspector, Registered Nurse	District Head Quarters	Curative, Child Health, Dental, Nutrition, Antenatal, Postnatal, Hypertensive, Diabetic, Family Planning, Mental Health
II	87	Public Health Nurse, Public Health Inspector, Registered Nurse, Doctor and Dentist visit	10,000 – 20,000 population	Curative preventive and promotive, Child Health, Dental, Nutrition, Antenatal, Postnatal, Hypertensive, Diabetic
I	181	Midwife, Community Health Aide	4,000 – 5,000 population	Midwife, Child Health, Antenatal, Postnatal, Family Planning, Community Health Aide home visits
Community Hospital	5	As for Type III	Isaac Barrant, Buff Bay, Alexandria, Ulster Spring,	As for Type III with maternity and observation wards

Rural Maternity Centre	9	Midwife	Chapleton Selected Areas	Maternity Child Health

**Adapted from the Public Health Care System, July 1, 1994*

Leading Causes of Hospital Discharges[15]

Available data indicated that obstetric conditions are the leading cause of discharge from public hospitals within the Southeast Health Region. Injures (intentional and unintentional) are the second leading cause of discharge, while diseases of the respiratory system (mainly asthma) is ranked the third. Cardiovascular conditions and gastrointestinal diseases accounted for the remaining conditions in the top five leading causes of discharge. This trend was observed over the period 1996 to 2002.

In 2002, hypertension and diabetes are the main cause of visits to curative clinics at health centres. Respiratory tract infections and skin disease accounted for the second and third highest number of visits respectively. Sexually transmitted infections, musculo-skeletal disorders and injures accounted for the remaining reasons for visits to health centres. Over the period 1990 10 1999, the Southeast Health Region experienced the largest rate of increase (85%) in respiratory track infections. However, there was a 5% decline in visits between 1999 and 2002. Asthma accounted for 50% of total respiratory tract infection.

The ranking of respiratory tract infections as one of the main cause of visits to hospitals and health centres highlights the importance of this disease condition and its burden on the health sector within the region.

The construction and operation of the proposed waste disposal facility is expected to have a positive impact on the health delivery system as it will dramatically improve the disposal of infectious waste from the health care facilities within the Southeast Health Region and by extension nationally.

[15] Ministry of Health (2005). *Epidemiological Profile of Selected Health Conditions and Services in Jamaica 1990-2002.*

4.10.9 Other Services

Fire Station

There are two (2) fire stations within the SIA. They are York Park and Trench Town. York Park is located approximately 500m (≈ 0.3 miles) north northeast of the proposed development site. Trench Town is located approximately 1.5 km (≈ 0.9 miles) north west of the proposed site (Figure 4.21).

York Park fire station would be responsible for responding to any fires at the proposed Southeast Regional Medical Waste Treatment Facility. Currently, this station has one (1) fire truck and one (1) water tanker. This truck has a capacity of 5,000 litres (≈ 1,100 imp. gals.). In addition, there are several working fire hydrants located on the Kingston Public Hospital compound and in close proximity to the proposed site.

The proposed development will have its own fire control system with a series of fire extinguishers, and smoke detectors and alarms.

It is not anticipated that there will be any problems as it relates to a fire event.

Police Station

There are five (5) police stations within the SIA. These are West Street, Kingston West (Denham Town), Elleston Road. Kingston Central and Cross Roads (Figure 4.22). The Denham Town police station is responsible for policing the proposed site area.

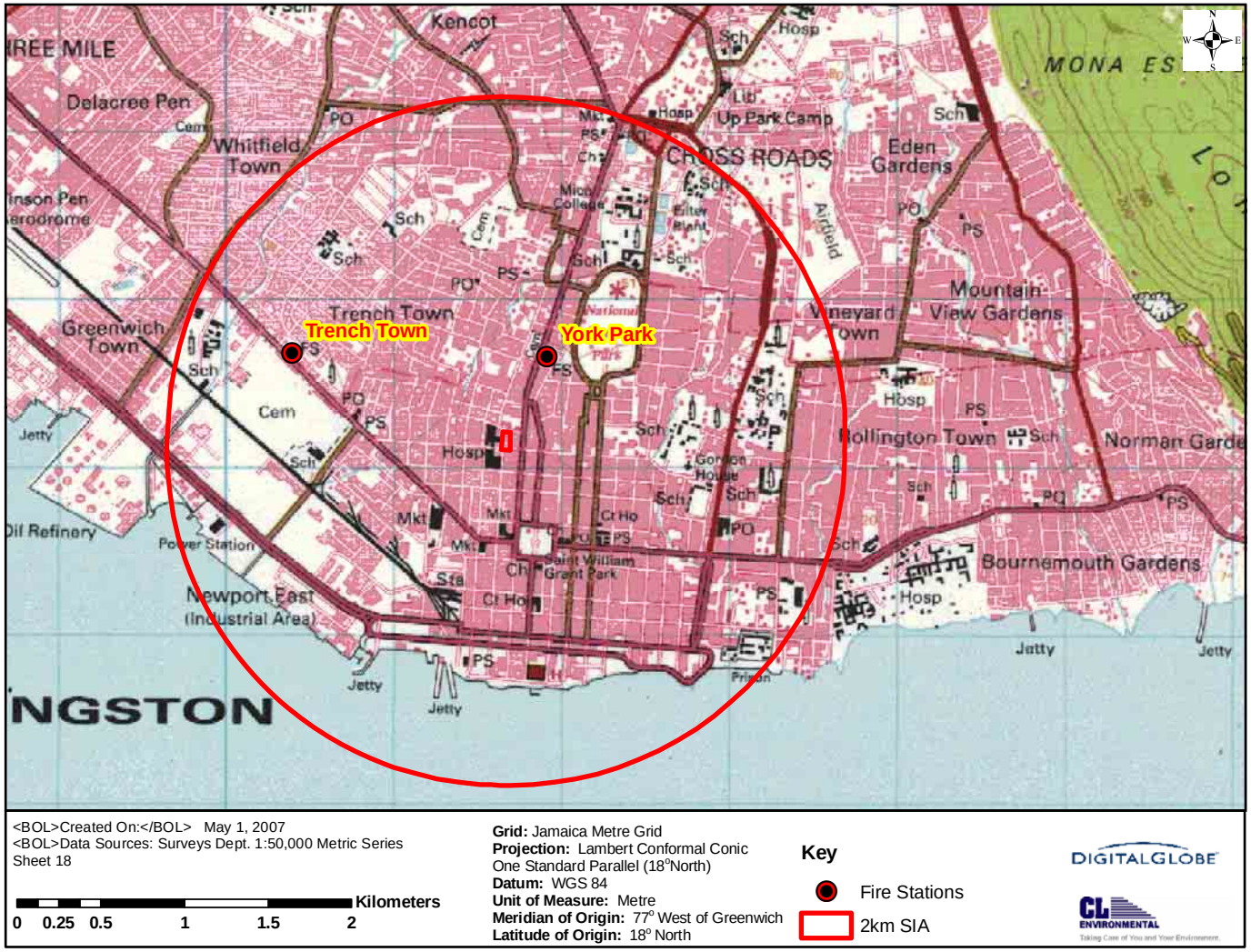

Figure 4-21 Locations of Fire Stations within the SIA

Figure 4-22 Locations of Police Stations within the SIA

4.10.10 Community Consultation and Perception

For the purposes of the community perception the area of interest was revised from the SIA to an area demarcated by Blount and Bond Streets to the west, Charles Street to the south, King Street to the east and Bowery Road and William Street to the north (Figure 4.23). This area was chosen as the area that persons would most likely be impacted from operation of the Medical Waste Treatment facility.

Luke Lane

Nine households were interviewed on Luke Lane on June 22, 2007. The nine households represented the majority of the households.

Of these nine households, 78% of the respondents were aware that an incinerator was present at Kingston Public Hospitals and Victoria Jubilee Hospitals and/or the National Laboratory and Blood Bank. Of the seventy eight-percent, 43% of the respondents indicated that they were affected by the presence/use of the incinerator. They said that they were affected mainly by smoke which blows across to Luke Lane. The respondents indicated that the impact of the smoke from the incinerator was most noticeable in the mornings and in the evening specifically 4:00 and 5:00pm. During the time the field team administered the questionnaire within the community, a black plume of smoke was observed at approximately 7:50 am, in the direction of the incinerator at KPH/VJH, although it at the time it did not blow in the direction of Luke Lane.

On the issue of garbage being disposed of at the proposed site, the respondents indicated that waste was from Luke Lane and KPH/VJH. The residents indicated that the location is not ideal for waste disposal, but they dispose of their garbage at the site because the garbage truck does not drive along their street to collect waste, therefore they take it to the nearest place that the garbage truck collects from. They were also cognizant of the associated health risks (such as vermin infestation) caused by improper garbage disposal. They also stated that children play in the garbage and the stench and smoke from burning the garbage was causing some impact.

Of the households interviewed, only one respondent (11%) was aware of the proposed Medical

Waste Treatment Facility project and indicated that information was received through the news.

Regarding the possible effect of the proposed waste treatment facility, respondents indicated that they did not think the facility would affect them. While one respondent indicated no impact, he continued by explaining that the facility will improve the area especially as it related to public health.

Other general comments received were:

- Sometimes children play with syringe and pills from the KPH waste.
- Better garbage collection needed.
- Containers put on North Street are too small for the volume of garbage generated on Luke Lane.
- Better housing solutions needed. Option to relocate to a better area or upgrade existing housing infrastructure to make homes more habitable.
- Wastewater is a problem, gray water runs on to roadway from yard not into a sewer.
- Children will not have the car park as a play area.
- Area has a crime problem.

General Observations:

- Elderly persons were observed rummaging through the garbage for food.
- Pedestrian traffic through the site is moderate.

Other Communities

All persons interviewed from the surrounding communities were aware of the existing incinerator at the Kingston Public Hospitals and Victoria Jubilee Hospitals and/or the National Laboratory and Blood Bank. Of this, 68% commented that they were affected by the presence of the incinerator and

in particular the smoke, black soot, odour and health effects. Seventy eight percent (78%) of interviewees indicated that the effects are most noticeable at a specific time of day. Times given included midday, morning and evening hours.

Approximately 52% of persons interviewed believed that the car park is an ideal location for the disposal of garbage, whilst 41% believed it was unsuitable and 6% did not respond. Those that did not believe the location was ideal commented that the disposal of garbage at the car park is unhealthy and an eyesore.

Only 22% of those interviewed were aware that the MOH is proposing to construct a medical waste treatment facility at the existing car park area and indicated that this was via the news and word of mouth from friends. 83% did not believe that the proposed facility would affect them, whilst 11% thought that the facility would affect them negatively and 6% were not sure. Odour, health effects and noise were stated as potential negative effects.

Other comments received included:

- Crime and violence in the area.
- More employment needed, especially for youth.
- Desire for development of housing.
- Need for more frequent collection of garbage.

KPH Staff

The main concerns from the senior management of KPH were;

- Who will manage the facility?
- Where will they dispose or store their domestic/general waste since the proposed development is going to take away their present storage area?

- Security of the facility and car park.
- Lighting of the area.
- Traffic flow for the ambulances wanting to get to the hospitals.
- Back-up water supply for the proposed facility as they say they experience water lock offs.
- Parking, as the proposed Medical Waste Treatment Facility will take away a section of the existing park for both visitors and staff.

The medium to long term plans for the KPH as it relates to expansion and the increase in services offered.

4.10.11 Aesthetics

The proposed development has the potential to improve the aesthetics of the existing area as the proposed building will reduce the unsightly condition that now exists with the solid waste disposal on the site. The proposed building can be painted to blend in and improve the surroundings. Plate 4.8 gives an example of what the building will look like.

Plate 4.8 Example of the type of building for the Medical Waste Treatment Facility

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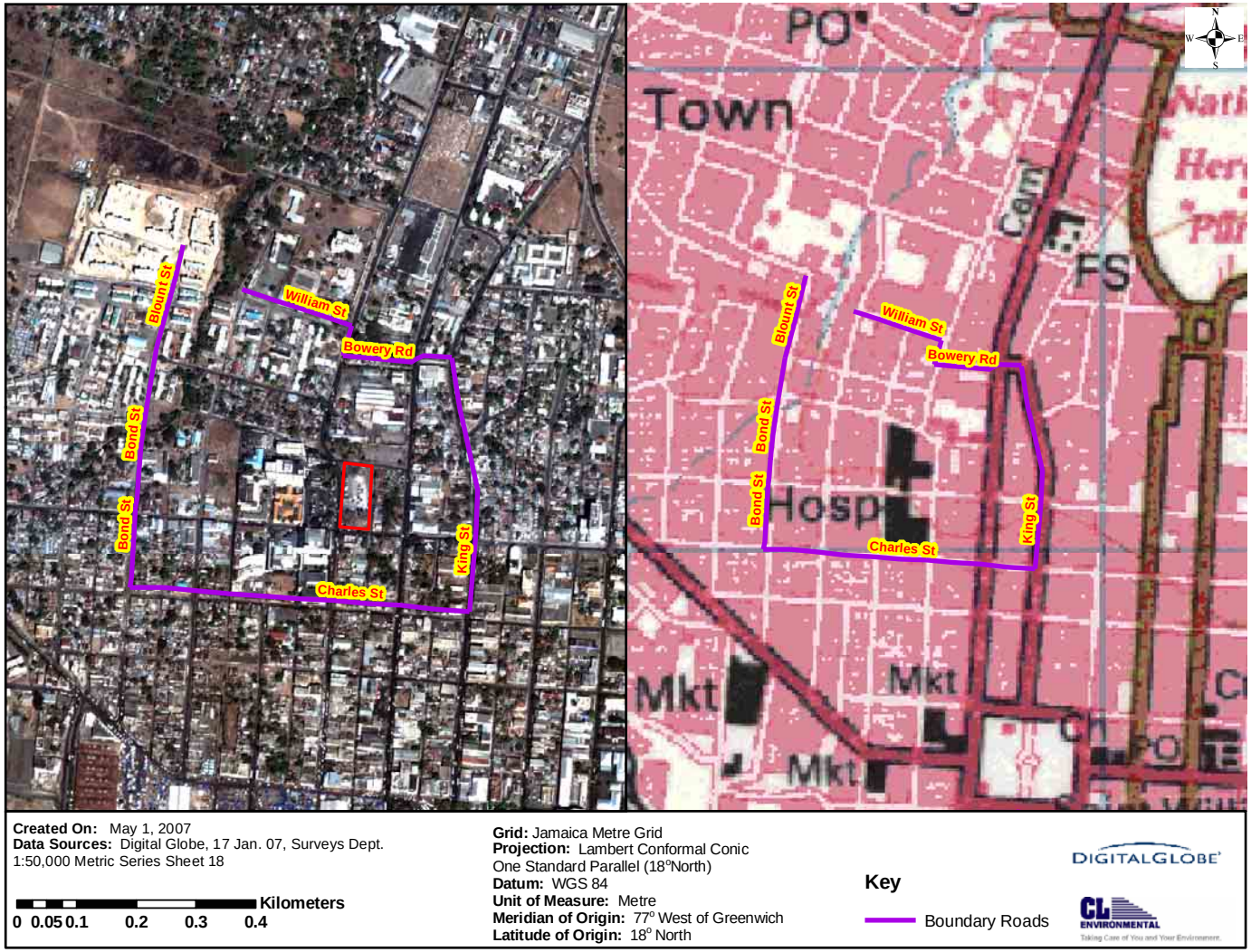

Figure 4-23 Revised area of interest for the purposes of the community perception

5.0 ENVIRONMENTAL IMPACTS

An environmental impact is defined as any change to an existing condition of the environment. The nature of the impacts may be categorised in terms of:

- Direction - positive or negative
- Duration - long or short term
- Location - direct or indirect
- Magnitude - large or small
- Extent - wide or local
- Significance - large or small

To systematically identify the impacts associated with the proposed development, an impact matrix was constructed which arrayed the main project activities against the relevant environmental factors. This matrix is shown in Table 5.1 and Table 5.2

Table 5-1 Impact Matrix for Site Preparation and Construction

ACTIVITY/ IMPACT	DIRECTION		DURATION		LOCATION		MAGNITUDE		EXTENT		SIGNIFICANCE	
	Pos	Neg	Long	Short	Direct	Indirect	Major	Minor	Wide	Local	Large	Small
1. **Site Preparation**												
Retain Vegetation	x		x		x			x		x		x
Vegetation Removal		x		x	x			x		x		x
Increased soil erosion		x		x		x		x		x		x
Noise		x		x	x			x		x		x
2. **Cut, Fill & Levelling**												
Generated solid waste		x		x	x			x		x		x
Dust		x		x	x			x		x		x
3. Material Transport												
Dusting & spillage		x		x	x			x		x		x
Traffic congestion, road wear		x		x	x			x		x		x
Routing along either Princess or Orange Street		x		x	x			x		x		x
4. Improper Material Storage												
Dusting		x		x	x			x		x		x
Suspended solid runoff		x		x	x			x		x		x
5. Construction Works												
Noise		x		x	x			x		x		x
Dust		x		x	x			x		x		x
Visual intrusion		x	x		x			x		x		x
Refuelling of vehicles and fuel storage onsite		x		x	x			x		x		x
Repair of vehicles onsite		x		x	x			x		x		x
6. Construction Crew												
Sewage generation		x		x	x			x		x		x
Solid waste generation		x		x	x			x		x		x
Emergency response		x		x	x			x		x		x
7. Employment												
Job creation	x			x	x			x		x		x

Table 5-2 Impact Matrix for Operational Phase

ACTIVITY/ IMPACT	DIRECTION		DURATION		LOCATION		MAGNITUDE		EXTENT		SIGNIFICANCE	
	Pos	Neg	Long	Short	Direct	Indirect	Major	Minor	Wide	Local	Large	Small
1. Water supply/Consumption												
Sustainable supply	x		x			x		x	x			x
Water conservation methods	x		x		x		x			x		x
2. Wastewater generation/Disposal												
Sewage		x	x			x		x		x		x
Bins wash water		x	x			x		x		x		x
Autoclave Cooling Water		x	x			x		x		x		x
Truck washdown		x	x			x		x		x		x
3. Air Emissions												
Odour		x		x		x		x		x		x
Infectious emissions		x		x		x		x		x		x
4. Medical Waste Treatment and Disposal												
Reduction in smoke nuisance	x		x		x		x			x	x	
Improved Medical waste segregation	x		x		x		x		x		x	
Improved medical waste treatment	x		x		x		x		x		x	
Improved medical waste disposal	x		x		x		x		x		x	
5. Transportation/ Traffic												
Traffic congestion		x	x			x		x		x		x
Noise		x	x			x		x		x		x
6. Emergency Response												
Emergency response		x	x		x			x		x		x
7. Landscaping												
Improved aesthetics	x		x		x		x			x		x
8. Security Lights												
Light nuisance to residents		x	x			x		x		x		x
Visual intrusion		x	x		x		x			x		x
9. Occupational Health & Safety												
Noise exposure from equipment		x	x		x			x		x		x

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ACTIVITY/ IMPACT	DIRECTION		DURATION		LOCATION		MAGNITUDE		EXTENT		SIGNIFICANCE	
	Pos	Neg	Long	Short	Direct	Indirect	Major	Minor	Wide	Local	Large	Small
Exposure to harmful substances during the medical waste treatment process		x	x		x			x		x		x
Exposure to harmful substances from accidents and spills		x	x		x			x		x		x
Indoor Air Quality		x	x			x		x		x		x
9. Employment												
Job creation	x		x		x			x		x		x

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5.1 Site Preparation and Construction

5.1.1 Noise Pollution

The proposed medical waste treatment plant construction will involve the removal of the existing asphalt, earthwork, building construction and landscaping. It is anticipated that construction activities will take place seven (7) days per week for a period of 16 weeks.

Excavation of the foundation will be the first step. Bulldozers and front-end loaders will first remove the existing asphaltic concrete then excavate the soil and load it onto trucks for transport to an approved landfill for disposal. It is anticipated that approximately two to four truckloads of debris will be removed per hour. After the excavation works have been completed, concrete trucks will arrive at the site with pre-mixed concrete and pump it into the site to form the foundation and part of the building walls. Foundation work will use equipment such as excavators, bulldozers, loaders, backhoes, tractors, hammers, motorized concrete buggies, concrete pumps, jack hammers, pneumatic compressors, a variety of small (mostly hand-held) tools and concrete trucks. It is estimated that foundations and below-grade construction of the proposed buildings will last for approximately 5 weeks.

Construction of the exterior enclosure or "shell" (superstructure) of the buildings will include construction of the framework (installation of steel frame beams and columns), floor decks, facade (exterior walls and cladding) and roof construction. These activities will require the use of equipment such as tower cranes, derricks, compressors, front-end loaders, concrete pumps, on-site bending jigs, welding machines and a variety of hand-held tools, in addition to delivery trucks bringing construction materials to, and waste from, the site.

Interior construction and finishing of the building will include the construction of interior walls, installation of lighting fixtures, and interior finishes (flooring, painting, etc.), as well as mechanical electrical work and installation of the various equipment. Exterior and interior work will last another 11 weeks. Equipment used during interior construction would likely include exterior hoists, pneumatic equipment, delivery trucks, and a variety of small hand-held tools.

Table 5.3 lists noise emissions from typical construction equipment. The data from this will be used to estimate the potential noise impact from the construction of the proposed waste treatment plant.

Table 5-3 Typical noise emission levels for construction equipment

Equipment	Noise Level at 15m (dBA)
Air Compressor	81
Asphalt Spreader (paver)	89
Asphalt Truck	88
Backhoe	85
Bulldozer	87
Compactor	80
Concrete Spreader	89
Concrete Mixer	85
Concrete Vibrator	76
Crane (derrick)	88
Delivery Truck	88
Diamond Saw	90
Dump Truck	88
Front End Loader	84
Hoist	76
Motor Crane	83
Jackhammer	88
Roller	80
Shovel	82
Truck	88

Sources: Patterson, W.N., R.A. Ely, and S.M. Swanson, "Regulation of Construction Activity Noise," Bolt Beranek and Newman, Inc., Report 2887, for the Environmental Protection Agency, Washington, D.C., November 1974 and New York State Department of Environmental Conservation, "Construction Noise Survey," Report No. NC-P2, Albany, NY, April 1974.

The types of noises emitted from the equipment are considered intermittent noise.

Mitigation

i. Use equipment that has low noise emissions as stated by the manufacturers.

ii. Operate noise-generating equipment during regular working hours (e.g. 7 am – 7 pm) so as to reduce the potential of creating a noise nuisance during the night.

iii. Construction workers operating equipment that generates noise should be equipped with noise protection. A guide is workers operating equipment generating noise of ≥ 80 dBA (decibels) continuously for 8 hours or more should use ear muffs. Workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.

iv. Maintain pneumatic tools in optimum condition and keep air lines from leaking

v. Fit silencers or mufflers

vi. Keep power saw blades sharp

vii. Use vibration damped blades

viii. Clamp material to be cut

ix. Use partial acoustic enclosures, which can easily be moved around the site.

x. Fit efficient silencers or exhausts fitted on jack hammers, excavators, back hoes, dumpers etc. In extreme noise sensitive areas such as this so called 'critical residential type mufflers' can be fitted as a replacement of existing exhausts. Noise reduction of about 15dB(A) can be achieved this way.

xi. Hire compressors with acoustical grade casings.

xii. Keep enclosure panels on compressors closed.

5.1.2 Air Quality

Impacts

Site preparation and construction has the potential to have a two-fold direct negative impact on air quality. The first impact is air pollution generated from the construction equipment and

transportation. The second is from fugitive dust from the site road, cleared areas and raw materials stored on site. Fugitive dust has the potential to affect the health of construction workers and the resident population and the vegetation.

Mitigation

i. Area should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter days, this frequency should be increased.

ii. Minimize cleared areas to those that are needed to be used.

iii. Cover or wet construction materials such as marl to prevent a dust nuisance.

iv. Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.

5.1.3 Employment

Impacts

During this phase, an average of 16 trades men and 12 labourers will be utilized. This is a positive impact.

Mitigation

Not required.

5.1.4 Solid Waste Generation

Impacts

During this construction phase of the proposed project, solid waste generation may occur mainly from two points:

i. From the construction campsite.

ii. From construction activities such as site clearance and excavation.

Mitigation

i. Skips and/or bins should be strategically placed within the construction site.

ii. The skips and bins should be adequately designed and covered to prevent access by vermin and minimise odour.

iii. The skips and bins at the construction site should be adequately covered to prevent a dust nuisance.

iv. The skips and bins at the construction site should be emptied regularly to prevent overfilling.

v. Disposal of the contents of the skips and bins should be done at an approved disposal site. The Riverton dump is recommended. Appropriate permission should be sought.

5.1.5 Wastewater Generation and Disposal

Impacts

With every construction campsite comes the need to provide construction workers with showers and sanitary conveniences. The disposal of the wastewater generated at the construction campsite has the potential to have a minor negative impact. No significant environmental impacts were identified from this activity.

Mitigation

i. Provide portable sanitary conveniences for the construction workers for control of sewage waste. A ratio of approximately 25 workers per chemical toilet should be used.

ii. Showers will be provided for the workmen. It will be tied to the sewer system.

5.1.6 Storage of Raw Material and Equipment

Impacts

Raw materials, for example sand and marl, used in the construction of the proposed development will be stored onsite. There will be a potential for them to become air or waterborne. Stored fuels and the repair of construction equipment has the potential to leak hydraulic fuels, oils etc.

Mitigation

i. Raw materials that generate dust should be covered or wet frequently to prevent them from becoming air or waterborne.

ii. Raw material should be placed on hardstands surrounded by berms.

iii. Equipment should be stored on impermeable hard stands surrounded by berms to contain any accidental surface runoff.

iv. Bulk storage of fuels and oils should be in clearly marked containers (tanks/drums etc.) indicating the type and quantity being stored. In addition, these containers should be surrounded by berms to contain the volume being stored in case of accidental spillage.

5.1.7 Transportation of Raw Material and Equipment

Impacts

The transportation and use of heavy equipment and trucks is required during construction. Trucks will transport raw materials and heavy equipment. This has the potential to directly impact traffic flow along Drummond, Orange or Princess Streets. Access roads from the construction site will prove challenging as they enter Princess Street/Slipe Pen Road at points close to a corner which will make it difficult for heavy vehicles such as trucks to enter the traffic flow.

Mitigation

i. Adequate and appropriate road signs should be erected to warn road users of the construction activities. For example reduced speed near the construction site access road. This should be done in conjunction with the Ministry of Transport and Works.

ii. Raw materials such as marl and sand should be adequately covered within the trucks to prevent any escaping into the air and along the roadway.

iii. Trucks transporting raw materials should be made to enter the proposed site through one access point and leave through another. The trucks should be parked on the proposed site until they are off loaded. This will prevent the build up of trucks along Drummond, Orange or Princess Streets.

iv. Heavy equipment should be transported early morning (12 am – 5 am) with proper pilotage.

v. The use of flagmen should be employed to regulate when trucks have to enter and exit the construction site.

5.1.8 Aesthetics

Impacts

The proposed development will have some visual impact on the aesthetics of the location. It is anticipated that it will improve the existing aesthetics.

Mitigation

i. Ensure that the proposed development is painted in a colour that blends in with the existing environment.

5.1.9 Emergency Response

Impacts

Construction of the proposed medical waste treatment plant will involve approximately 28 construction workers. There is the possibility of accidental injury, which may be either minor or major accidents.

Mitigation

i. A lead person should be identified and appointed to be responsible for emergencies occurring on the site. This person should be clearly identified to the construction workers.

ii. The construction management team should have onsite first aid kits and make arrangements for a nurse and doctor at Kingston Public Hospital to be on call for the construction site. Prior arrangements should be made with the Kingston Public Hospital to accommodate any eventualities.

iii. Material Safety Data Sheets (MSDS) should be store onsite.

5.2 Operations

5.2.1 Earthquake Hazard

Impact

The proposed area experiences greater than 20 events with intensities of MM VI or greater occurring per century. Earthquakes of this intensity can cause damage to property.

Mitigation

i. Proposed structures to be constructed at the site are low-rise and this implies a moderate to low earthquake hazard with respect to life and property.

ii. To minimize earthquake impact it is recommend that the buildings at the site should be designed and constructed to withstand moderate to large earthquakes.

iii. An emergency response plan to address natural and man-made disaster and possible evacuation is required by NEPA and should be developed in close consultation with the Office of Disaster Preparedness and Emergency Management (ODPEM).

5.2.2 Drainage

Impact

The land for the project area is totally paved at present. In addition, the project (which will consist of a building) will not increase the impermeable area of the storm water catchment. The runoff hydrograph for the catchment is therefore expected to remain the same. No adverse changes in the existing hydrological regime that could cause flooding are therefore expected.

Storm water quality could be affected by the proposed washing operations of the trucks that will deliver the containerized medical waste. Runoff will contain more oils and grease from the washing operations and from the general pavement.

Mitigation

It is therefore recommended that the following mitigation measures be adopted:

i. Properly sloped and channelled surface drainage for capturing all surface runoff from the wash area.

ii. Incorporate an oil-water separator in the site drainage before discharge to the local storm water sewers. The separator should have a silt and grease trap compartment. See Figure 5.1 for an example.

iii. Monitoring and Record-keeping of deliveries and the condition of containers or bags of the deliveries.

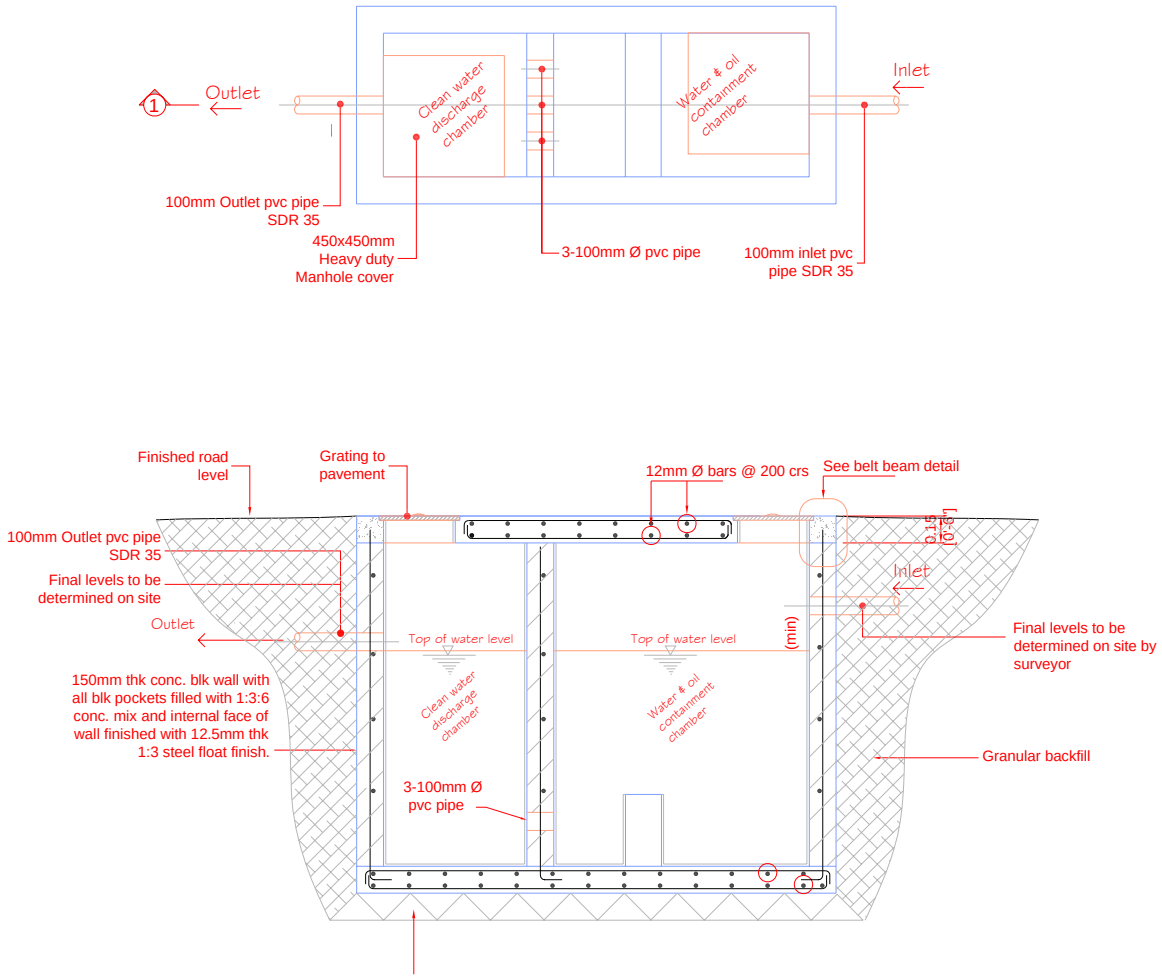

Figure 5-1 Typical Oil-water separator

5.2.3 Medical Waste Treatment and Disposal

It is projected that approximately 2 tonnes (2,022 kg) of waste will be treated/16 hour day, 5 days per week during the operation of the proposed development. This is based on operators working in two 8-hour shifts. This can be increased if needs be to 4.32 tonnes/day by adding a third 8-hour shift. The proposed building is designed to accommodate an additional 200kg/hr treatment equipment in the future if necessary, which could bring the maximum future capacity of 8.6 tonnes /day based on three (3) 8-hour shifts.

These options have the potential to increase the employment labour force, traffic, the release of infectious agents and equipment malfunctioning frequencies.

The operation of the development has the potential of significantly improving the process of medical waste treatment (reduced use of incinerators) and disposal.

Mitigation

i. Provision of adequate and appropriate storage bins and bags for the categories of medical waste.

ii. Monitor the type of medical waste being delivered to the waste treatment facility.

iii. Ensure that the staff at the health facilities, those transporting the medical waste and those at the medical waste treatment plant are adequately trained and are provided with the relevant Personal Protective Equipment (PPE).

iv. Ensure that the schedule of preventative maintenance is followed and that adequate amounts of spare parts are stocked in house so as to enable speedy repairs.

v. Ensure that the treated medical waste is collected on time and is disposed at an approved disposal site such as the Riverton disposal site.

5.2.4 Employment

Impact

During this phase, an average of fourteen (14) staff will be needed for the proper operation of the medical waste treatment plant. This staff compliment will more likely be increased if and when the third shift and or the second waste treatment equipment is added. This has the potential to be a positive impact.

Persons engaged in this phase will require training, which will result in an increase of persons with training in medical waste collection, treatment and disposal.

Mitigation

Not required

5.2.5 Water Supply and Consumption

National Water Commission personnel (discussions with Mr. Ian Bennett) personnel have indicated that there is sufficient water in the area for the proposed development. The developers should however approach NWC formally for a Water Certificate to this effect.

Given a 12 – 14 hours per day operation, a total daily water consumption of 7,800 liters per day can be expected for the proposed facility.

Mitigation

Notwithstanding the foregone and given the critical nature of the facility, it is proposed that the following mitigation measures be put in place:

i. A minimum of a four-day water storage tank be installed at the facility, given the importance of the services to be provided on a national level. This would be equivalent to a 29,672 litres (6,600 Imperial gallons/8,500 US Gallons) tank.

ii. Pressure washing equipment for wash down areas

iii. Low flow water fixtures should be employed where possible.

5.2.6 Wastewater Generation and Disposal

Impacts

The operation of the medical waste treatment facility will necessitate the generation of wastewater from four main sections;

i. Sterile residual steam,

ii. Low risk cooling water of the treatment equipment,

iii. Discharge waters from the cleaning and disinfecting of the waste containers, trucks and the treatment area; and

iv. Effluent from toilets and washrooms.

These liquid effluents (i – iii) will be drained into a common tank before final discharge to the sewage system. This buffer tank will be sized at 1 cubic meter and will allow cooling down the water temperature between 2 cycles (2 hours). That is, the low risk cooling water which is usually at temperatures of 65°C – 70°C will be cooled down to 26 °C – 28 °C prior to being discharged. It will also allow testing including bacterial before the effluent is discharged to the sewer.

The cooling water is generated as water is sprayed onto the outside wall of the inner chamber of the sterilization unit to cool down the system at the end of the treatment cycle. This water, at **no** time, comes into contact with the waste before, during or after treatment and is therefore not contaminated in any way.

Effluent from toilets, washing rooms etc. will be directly discharge into sewer drain.

Mitigation

i. Ensure that the buffer tank and the black and grey water systems are linked to the public sewers running in proximity to the proposed development.

ii. Conduct periodic testing of liquid effluent in the buffer tank for volatile organic compound (VOC), bacterial content and heavy metals.

iii. Allow for the installation of a gas chlorination system at the start of the holding tank system.

vi. The holding tank should have a minimum retention time of 2 days.

vii. Baffles should be incorporated to allow for oil and grease removal (if necessary) and plug flow conditions in the holding tank.

viii. A routine monthly monitoring programme should be implemented for the steam and wash down water. The programme should be focused on the microbial characteristics of the water, including: helminthes, protozoa, bacterial, viral presence, using plate methods.

5.2.7 Transportation/Traffic

Impact

The operation of the proposed medical waste treatment plant requires that medical waste collection vehicles (trucks) make anywhere between 1 to 3 trips to the facility per day. This increases the potential for accidents along Orange, Drummond and Princess Streets. It also has the potential to become a noise nuisance to the residents in close proximity (Luke Lane).

Mitigation

i. Design the access road so that one can see clearly in both directions along Drummond street upon exiting the development.

ii. Add adequate and appropriate signs along the roadway in proximity to the proposed site.

iii. Drivers of medical waste collection vehicles (trucks) should undergo intense defensive driving training.

iv. Limit medical waste collection trucks delivery to off-peak periods, to minimise traffic hindrance and delays.

v. Limit medical waste collection trucks delivery to between 7am and 7pm to minimise the potential for them becoming a noise nuisance.

vi. Reduce the use or eliminate the use of horns, engine revving or unnecessary throttling of these trucks in vicinity or on the proposed compound.

5.2.8 Emergency Response

Impact

The operation of the proposed medical waste treatment plant will involve workers and guests, who may become ill or have accidents. In addition, disasters such as earthquakes, hurricanes and fires are real possibilities. Additionally, the transportation of the medical wastes from the various health care facilities some of which are 56 km (≈ 35 miles) away from the plant increases the potential for accidents.

Mitigation

i. Have first aid and spill clean-up kits located in various sections of the plant and collection vehicles.

ii. Make prior arrangements with health care facilities such as Kingston Public hospital to accommodate any eventualities.

iii. Staff should be trained in Cardiopulmonary resuscitation (CPR).

iv. Coordinate with mutual aid organisations/agencies such as with the local fire brigade.

v. Adhere to procedures outlined in the Contingency/Emergency Plan outlined in Section 3.4.3.

vi. Adequate provisions should be made for fire-fighting. Such provisions might include:

- Ensuring that the nearby hydrant on the public road is operational and located sufficiently close for fire fighting needs (<100 metres).

- Supply and locate in clearly marked areas dry chemical extinguishers. Special care should be tank to locate extinguishers appropriately near the boiler unit.

5.2.9 Air Pollution

Impact

The operation of an autoclave has the potential to release unpleasant odour, infectious agents and hazardous pollutants. Depending on different factors, unpleasant odor may result from the operation of the facility.

There are no harmful air emissions emitted from the treatment equipment. The T2000 steam sterilization treatment system limits air emissions by their close-loop air handling system, thus limiting fugitive air emissions. The term fugitive air emission refers to the undesirable escape of potential pathological organisms into the air. The T2000 Ecodas steam sterilization treatment system avoids fugitive air emissions because they do not vent or drain directly into the atmosphere. It employs a vacuum process to remove air, thus creating a closed system which uses of 138ºC (280ºF) steam to pull the vacuum and to instantly kill any microorganisms. Used steam is vented into a condensate tank where it will be mixed with cooling water which never comes into contact with the treated or untreated waste. The condensate and cooling water will be flushed directly into the buffer tank prior to discharge into the sanitary drain for final treatment at the wastewater treatment plant.

Mitigation

i. To reduce the odour impact some solutions include;

    a. Roof aeration system positioned vertically to the equipment (air vent or air extractor) to prevent odors appearing at the opening of the equipment for unloading,

    b. Storage of the untreated and treated waste in closed bins,

    c. Daily removal of treated waste; and

    d. If necessary, the use of deodorizer or odor reducing agents such as some enzyme-based odor removers, which may be added to the condensate or sprayed around the autoclave door when it is opened (to minimize odors).

ii. Spills of untreated waste and or equipment failure may result in infectious agents being released;

    a. Good safety planning (including compliance with the *Health Facilities Infection Control - Policies and Procedures*),

    b. Ensure that the autoclave is properly maintained and monitored,

    c. Carry out random checks for achievement of sterilization by placing *Bacillus stearothermophilus* spores in the centre of a load to be autoclaved, spores strips or equivalent methods to ensure that the autoclave is achieving the optimum sterilization. If the spores are destroyed then the conditions for sterilization has been met.

    d. Proper protective equipment; and

    e. Worker training can prevent.

iii. The release of hazardous or radioactive materials;

    a. Ensure proper segregation of the medical waste at the source (health facility),

    b. Ensure that workers (especially he transporters and those at the medical waste treatment facility) are trained to identify improperly segregated waste; and

    c. Ensure that the radioactive scanner installed at the medical waste treatment plant is always in proper working order included properly calibrated.

5.2.10 Noise Pollution

The operation of the proposed Medical Waste Treatment facility will involve noise generated from the autoclave and grinder operation and other activities related to the functioning of the facility such as the washing of the waste bins.

Six scenarios were investigated to determine what impact if any, the operations, would have on the immediate surroundings. Three of the scenarios are based on the possible expansion of the facility to include an additional treatment equipment.

These scenarios were;

i. The shredder operating with all the doors closed (Figure 5.1)

ii. The shredder operating with all the doors opened (Figure 5.2)

iii. The shredder operating with only the delivery doors opened (Figure 5.3)

iv. Two shredders operating with all the doors closed (Figure 5.4)

v. Two shredders operating with all the doors opened (Figure 5.5) and

vi. Two shredders operating with only the delivery doors opened (Figure 5.6)

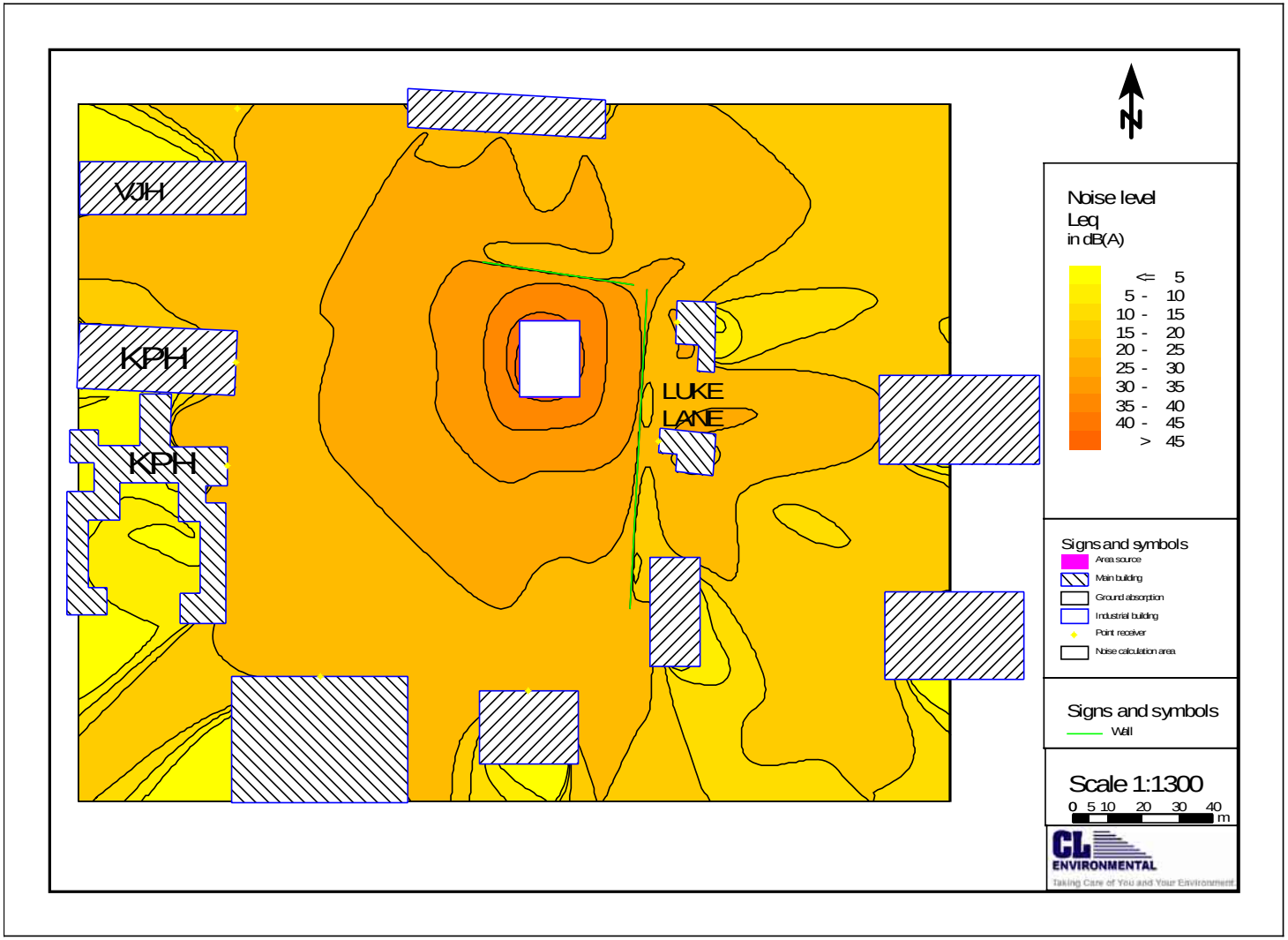

Figure 5-2 Modeled results of the shredder operating with all the doors closed

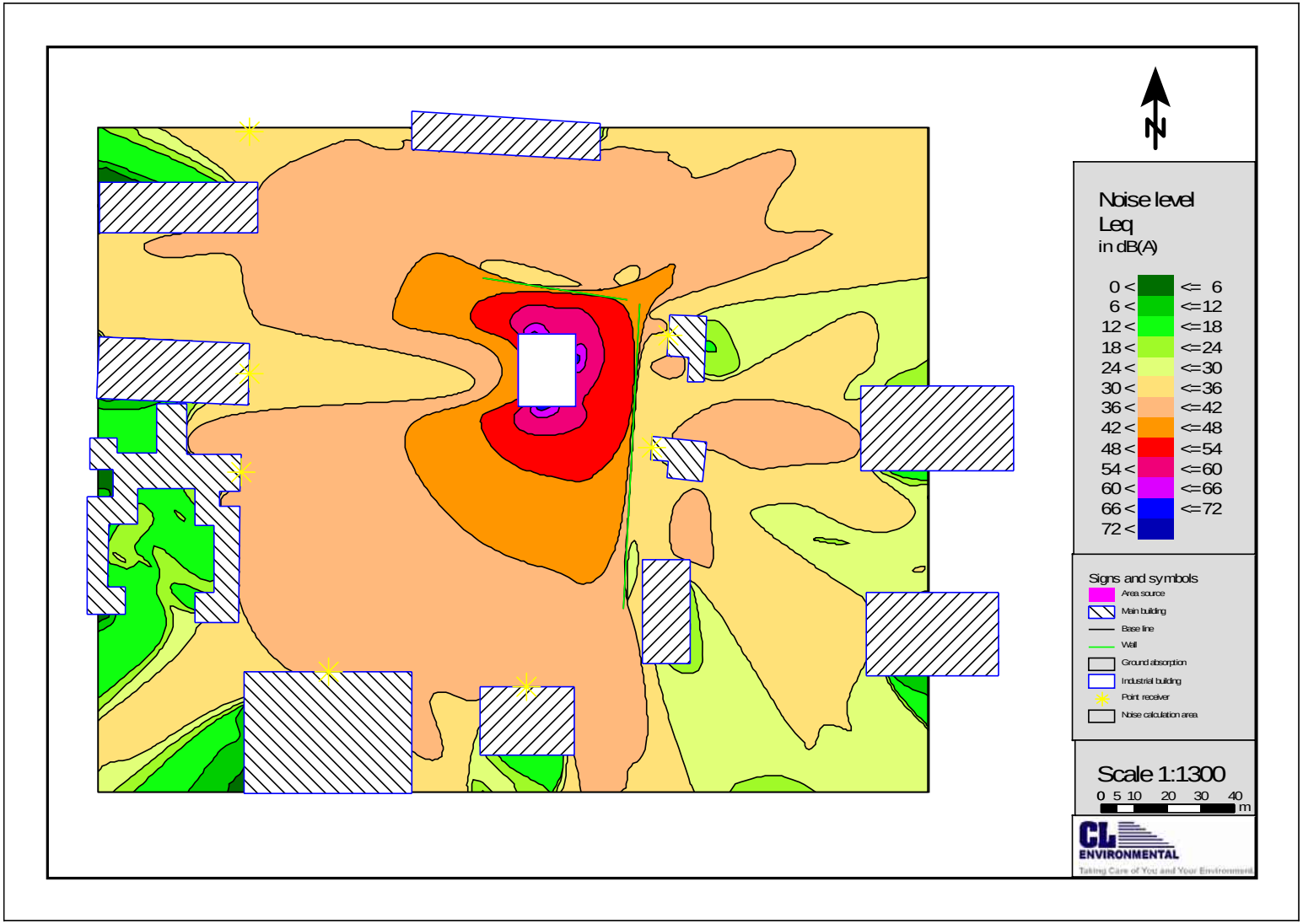

Figure 5-3 Modeled results of the shredder operating with all the doors opened

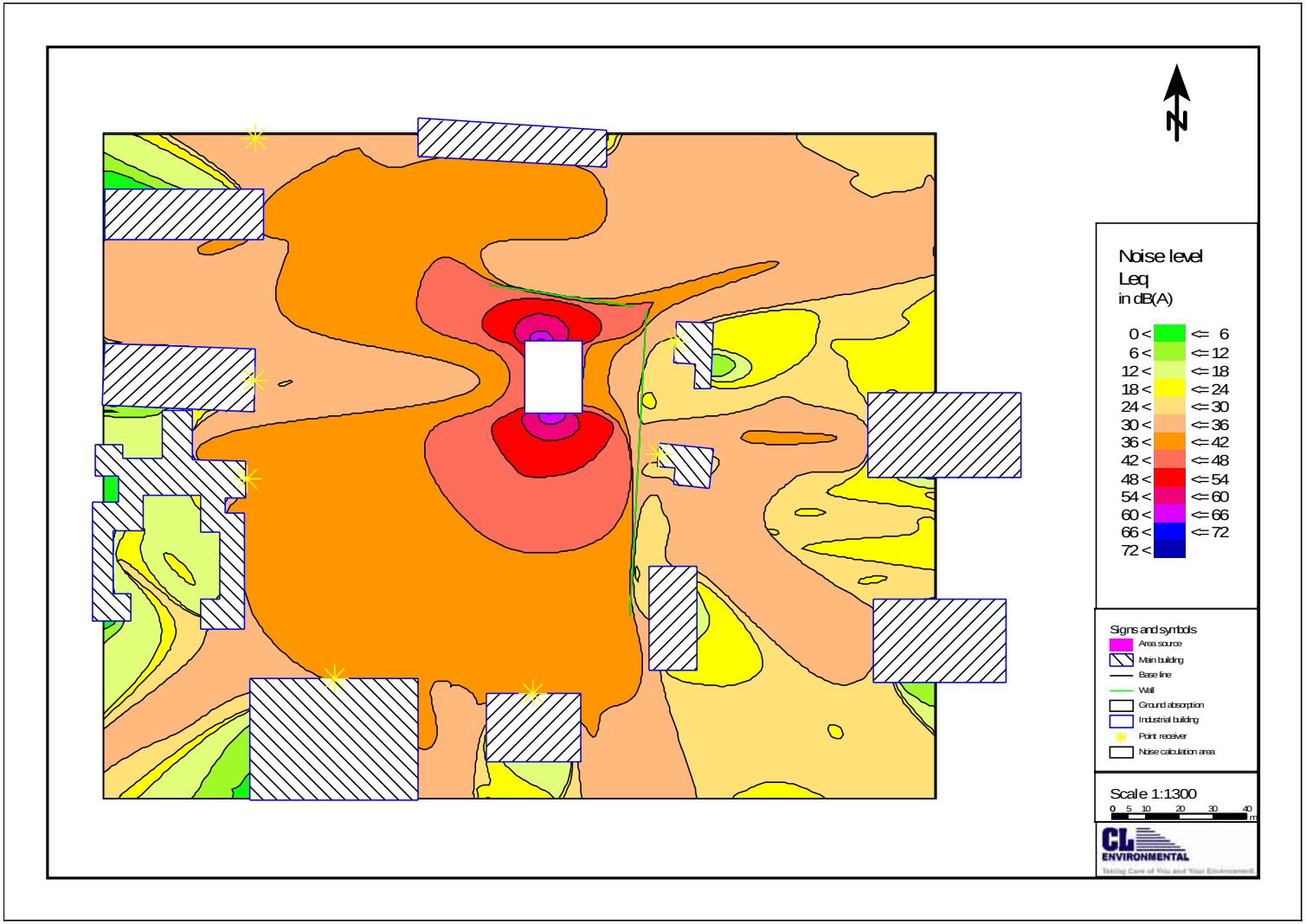

Figure 5-4 Modeled results of the shredder operating with only the delivery doors opened

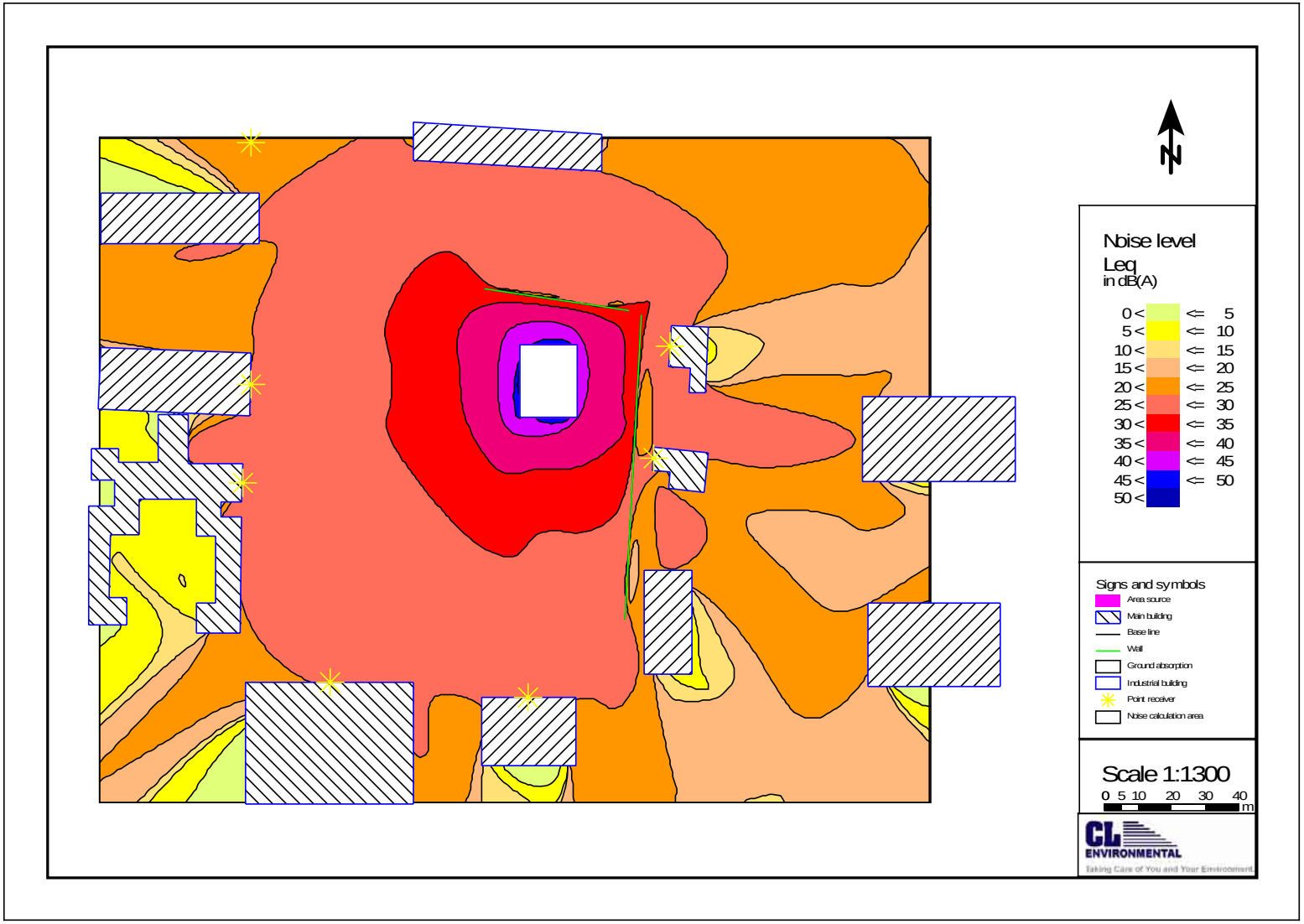

Figure 5-5 Modeled results of two shredders operating with all the doors closed

CL Environmental Co. Ltd.
clenviro@cwjamaica.com

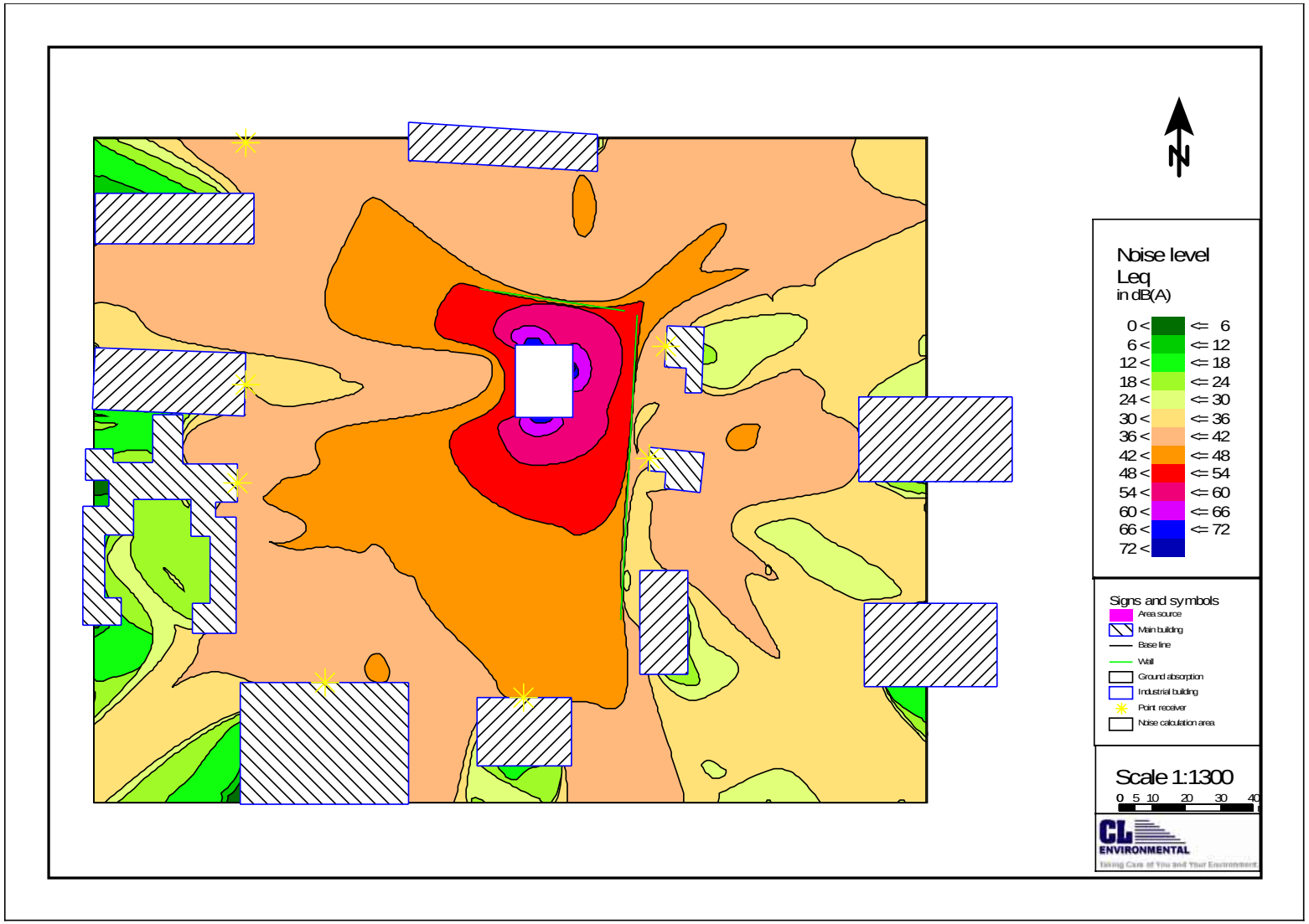

Figure 5-6 Modeled results of two shredders operating with all the doors opened

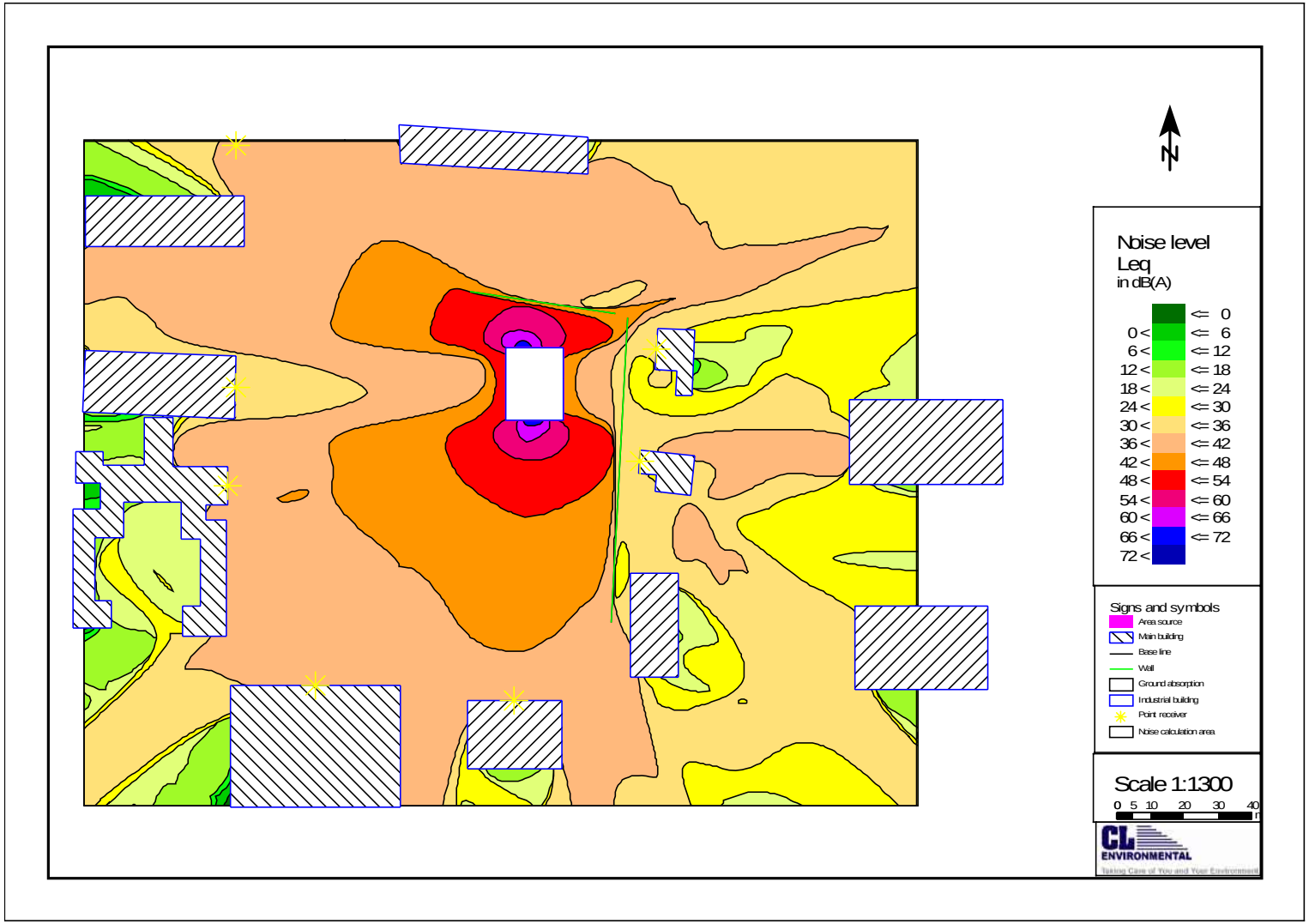

Figure 5-7 Modeled results of two shredders operating with only the delivery doors opened

The modelled data indicated that the potential noise impact from the operation varied with each option investigated. It showed that most impact occurred when all the doors to the facility where open (Table 5.4).

When compared to the NEPA standard of 40 dBA for Quiet Zones, two locations would be out of compliance (Table 5.4). These locations are the church and the residences along Luke Lane. Although the modelled noise levels at the Kingston Public Hospital is within the noise standard, the levels obtained when there are two shredders are sufficiently close to have a potential impact.

Mitigation

i. Ensure that the equipment are properly maintained.

ii. Ensure that the boundary walls to the east and the north of the proposed site are maintained.

iii. Operate the facility with the doors closed (unless the the environmental noise testing proves that the noise levels are in acceptable ranges) especially if the facility is expanded to two shredders to minimize any potential negative noise impacts form the operation.

iv. Trucks and other vehicles entering the facility should not use horns or the engines revved unnecessarily.

Table 5-4 Predicted noise impact from the proposed development for various location

	LEQ (dBA)						
Name	**Floor**	**1 Shredder all Doors Closed**	**1 Shredder all Doors Opened**	**1 Shredder only Delivery Doors Opened**	**2 Shredders all Doors Closed**	**2 Shredders all Doors Opened**	**2 Shredders only Delivery Doors Opened**
Church	1	23.4	40.3	39.6	26.4	43.3	42.6
	2	23.2	39	38.5	26.2	42	41.5
Houses North West	1	19.7	34	33	22.7	37	36
	2	19.9	34	33	22.9	37	36
Kingston Bldg North	1	22	36.3	35.9	25	39.3	38.9
	2	22.1	36.2	35.7	25.1	39.2	38.7
	3	22.1	36.2	35.7	25.1	39.2	38.7
	4	22.2	36.3	35.8	25.2	39.3	38.8
Kingston Bldg South	1	21.4	35.7	34.8	24.4	38.8	37.8
	2	21.4	35.7	34.6	24.4	38.7	37.6
	3	21.4	35.8	34.7	24.4	38.8	37.7
	4	21	35.8	34.6	24	38.9	37.6
	5	21.1	35.8	34.6	24.1	38.8	37.6
	6	20.4	34.6	33.3	23.4	37.6	36.3
Luke Lane 1	1	25	37.6	26	28	40.6	29
	2	28	45.8	33.8	31	48.8	36.8
Luke Lane 1	1	24.7	37	33.6	27.7	40	36.6
	2	29.1	46.8	43.5	32.1	49.8	46.5
Victoria Jubilee Hospital	1	21.4	31.4	30.8	24.4	34.4	33.8
	2	21.6	31.3	30.6	24.6	34.3	33.6
	3	21.7	32	30.7	24.7	35.1	33.7
	4	21.8	32.5	31	24.8	35.6	33.9
	5	22	32.1	30.4	25	35.2	33.4

5.2.11 Occupational Health and Safety

Impact

For autoclaving, the primary worker health and safety issues are physical safety, potential exposure to infectious agents and improperly disposed hazardous or radioactive materials, possible heat stress, ergonomics issues and noise exposure.

Mitigation

i. Physical safety associated with waste handling, moving and lifting waste always has the potential for worker injuries. Design the facility to minimize the need for manually lifting and moving waste containers reducing the potential for injuries. Loading and off-loading of the collection vehicles, the treatment equipment and washing machine will be done by an automated mechanical lifting systems.

ii. Training and avoiding work situations that reward unsafe behaviours can further reduce risks.

iii. Provide workers with proper protective equipment (PPE), and worker training can prevent potential worker exposures to infectious agents.

iv. Properly segregate regulated medical waste to reduce potential for exposure to hazardous or radioactive materials.

v. Waste collection and waste treatment workers should be trained to identify visually potentially improperly disposed materials and to set aside red bags containing such materials for proper management.

vi. Ensure that the automated systems to measure radiation levels in each container, separating out contaminated wastes for proper management are in proper working order.

vii. Workers handling the medical waste (transporters and medical waste treatment facility staff) should wear radioactive detection badges. Workers maximum measured exposures to ionizing radiation ≈ 300 mrem/year.

viii. Operate autoclave in well-ventilated areas to minimize worker exposure.

ix. Hot weather or indoor autoclave operation can create uncomfortably hot working conditions (heat stress). Ventilation, scheduling, and other measures should be implemented to avoid hot working conditions, as they often cause workers to avoid using personal protective equipment.

x. When hot working conditions cannot be avoided, attention should be paid to ensure workers and supervisors follow heat stress precautions (e.g., water consumption, cooling breaks).

xi. Some autoclave equipment, particularly when operated indoors, may exceed safe noise exposure levels (85 dBA over an 8 hour work day). In such cases, a hearing conservation program should be implemented.

xii. Medical waste delivery trucks should not be left to idle in delivery or collection bays as this could result in a build up of carbon dioxide and carbon monoxide levels within the indoor air in the waste treatment facility.

xiii. Management oversight of autoclaves can minimize worker safety risks by ensuring that employees have proper training for normal operations and for incidents like spills, and that staff follow operational procedures carefully.

6.0 CUMULATIVE IMPACTS

6.1 Noise

6.1.1 Impact

The cumulative noise impact takes into account all the existing background noise sources. Noise from the new noise source (the proposed facility) is then added to the existing noise levels to determine what if any impact this new development would have on the surrounding community.

The modelled levels of the noise impact from the proposed development are generally significantly lower (> 10 dBA) than the baseline levels. At those levels, the noise from the operation of the proposed facility will not add to the baseline noise levels. However, the addition of an additional treatment equipment has the potential to impact negatively on the immediate vicinity such as the residence along Luke Lane.

6.1.2 Mitigation

i. The facility should be operated with the doors closed unless an environmental noise assessment indicates that the noise levels are within acceptable levels.

ii. Ensure that the perimeter wall to the north and east of the property is maintained.

iii. Noise performance testing should be conducted on the autoclave after installation to ensure that it is performing (noise output) to specification.

iv. Before installing an additional autoclave and shredder, environmental noise testing should be conducted with the facility operating at varying load especially at full load.

7.0 ANALYSIS OF ALTERNATIVES

The discussion and analysis of alternatives in Environmental Impact Assessments should consider other practicable strategies that will promote the elimination of negative environmental impacts identified. This section is a requirement of the National Environment and Planning Agency (NEPA), and is critical in consideration of the ideal development with minimal environmental disturbance.

This report has identified the major environmental impacts noted by scientific experts. The Ministry of Health (MOH) project team and the consulting scientists worked together, utilising findings of these impacts to analyse possible options for the final development.

The following alternatives have been identified and have been discussed with the Ministry of Health as means of reducing environmental effects. They are discussed in further detail below:

- The "No-Action" Alternative
- The proposed Development as described in the EIA
- The proposed Development as described in the EIA but at another location west of the proposed site
- Using an incinerator to treat the medical waste collected
- Using an alternative technology to treat the medical waste collected

7.1 The "No-Action" Alternative

The "no action" alternative is required to ensure the consideration of the original environment without any development. This is necessary for the decision-makers in considering all possibilities.

The development will have a minimal effect on the physical environment.

The no-action alternative **should** minimize the effects on flora identified and the existing condition of the parking lot. This is not, however, a guarantee.

In terms of the social environment, the "no-action" alternative would eliminate the job opportunities and the possibility of improving the solid waste storage and disposal that is currently occurring on the site including the existing burning of garbage piles on the property. It would also eliminate the opportunity of improving the aesthetics of the area and possibility of reducing the atmospheric and environmental pollution caused by the incinerators operated by the KPH and NPHL (which currently impacts negatively on the surrounding communities).

7.2 The Proposed Development as described in the EIA

The impacts and mitigation measures for this alternative are discussed in detail throughout this report. The positive impacts have been identified in social, environmental and health opportunities for the local area, as well as a positive impact on the national health system.

This alternative will have minimal impact on the physical environment and has considered the necessary measures to almost eliminate the identified issues of noise.

7.3 The Proposed Development as described in the EIA at another location (Bumper Hall)

That location is approximately 2 km (≈ 1 mile) west of the proposed location as described in the EIA. It is in proximity to the Remand Centre (prison) located off Spanish Town Road (Figure 7.1).

The distance from the Kingston and Victoria Jubilee hospitals would be the least economical option as together both hospitals produce 55.8% of the hospital waste within the Southeast Medical Region. The unit cost for the overall treatment of the medical waste would increase due to the additional cost for transportation of the waste from both hospitals to this location.

Additionally, this site is part of the lands reserved for the May Pen Cemetry. It would also necessitate the removal of approximately 0.3 hectares (≈ 0.7 acres) of vegetation..

Figure 7-1 Alternative area at Bumper Hall for the siting of the Medical Waste Facility

7.4 Using an incinerator to treat the medical waste collected

The trend worldwide is to move away from incinerators for the treatment of medical waste. A medical waste incinerator releases into the air a wide variety of pollutants including dioxins and furans, metals (such as lead, mercury, and cadmium), particulate matter, acid gases (hydrogen chloride and sulfur dioxide), carbon monoxide, and nitrogen oxides. These emissions have serious adverse consequences on worker safety, public health and the environment. Dioxins, for example, have been linked to cancer, immune system disorders, diabetes, birth defects, and other health effects. Medical waste incinerators are a leading source of dioxins and mercury in the environment.

Ash remaining at the bottom of an incinerator after burndown often contains heavy metals that may leach out. Dioxins and furans may also be found in the bottom ash. Sometimes low-level radioactive waste is incinerated; the ash residue may also contain traces of radioactive isotopes. This ash must be treated as hazardous waste.

Cost is another key factor in the consideration of medical waste disposal. In evaluating the costs of incineration, decision-makers should take into account, among others, capital and operating costs of the incinerator plus scrubber and other pollution control devices; the cost of secondary chamber retrofits for old incinerators; the costs of periodic stack testing, continuous monitoring, operator training and qualification; and the costs of maintenance and repair especially in relation to refractory wear or failure.

Many communities oppose incineration as plumes of smoke from a hospital incinerator stack stands as a frequent reminder of that facility's environmental impact on the surrounding community. The public's concern for a clean environment and increasing community opposition to incineration should be paramount factors in deciding whether or not to install or continue operating a medical waste incinerator. Choosing a cleaner non-incineration technology demonstrates the health care organization's commitment to protecting public health and the environment.

http://www.noharm.org/library/docs/Non-Incineration_Medical_Waste_Treatment_Te_3.pdf

7.5 Using alternative technology to treat the medical waste collected

7.5.1 Mechanical/Chemical Disinfection

Chemical agents such as chlorine have been used for some time as disinfectant for medical products, although the application to large volumes of infectious wastes generated by hospitals and laboratories is more recent. This type of technology has been available since mid 1980s is referred to as "mechanical/chemical" because of mechanical maceration and chemical disinfection. The residue is discharged to a sewer.

Test results reported to date find the process using chlorine beach, to be an effective disinfectant for medical wastes contaminated with vegetable bacteria and viruses but less effective against spore-forming bacteria. Maceration of the medical waste involving high speed hammermill blades and or shredders, requires the use of copious amounts of water to keep the unit from overheating as well as to disinfect the waste, water is introduced along with the disinfectant (usually chlorine-based/ during the maceration phase (Figure 7.2).

Concern has been raised over the level of metals, organics and other contaminants that may be in the sewer discharge. The percentage of dissolved solids in the discharge into the sewer is high (up to 10,000 ppm) also the mechanical nature of the equipment with so many moving parts, means it could require a high level of maintenance.

Capital costs are about US$350,000.00.

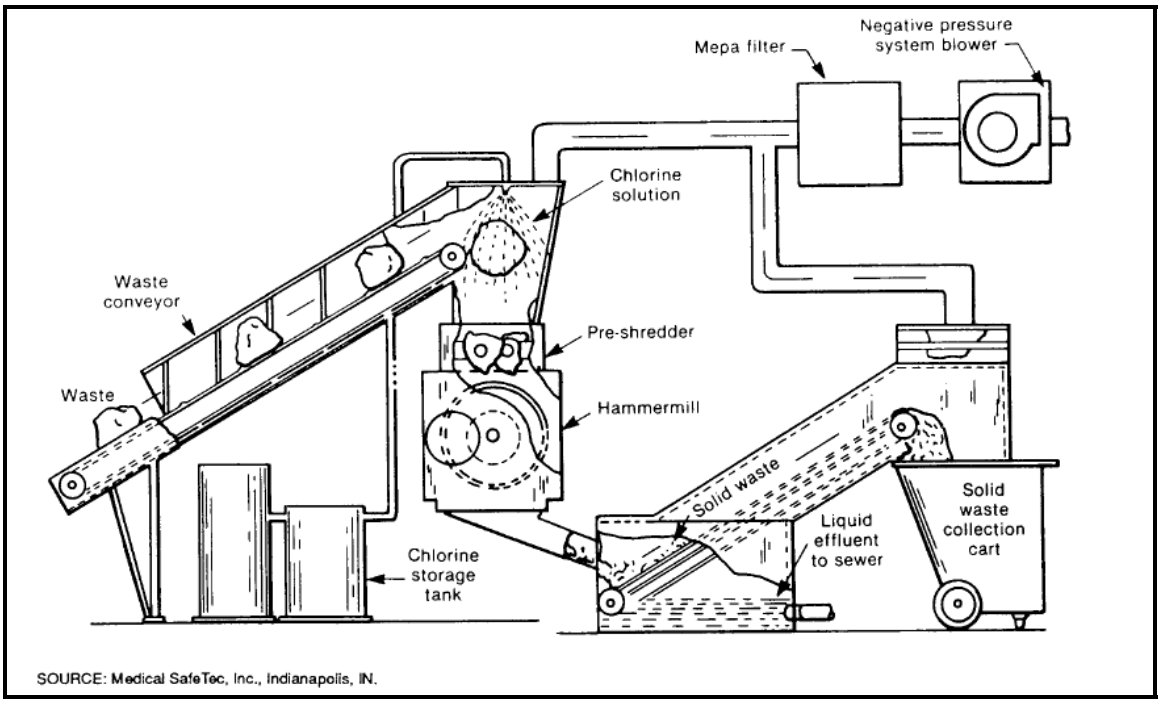

Figure 7-2 Mechanical/Chemical disinfection unit

7.5.2 Microwave

The application of microwave technology to disinfect medical waste was introduced in Europe several years ago. The technology is from West Germany. Powered by electricity, the unit shreds the waste in a controlled environment; the waste then enters the chamber for exposure to microwaves. The disinfection process takes place through microwave heating, which occurs inside the waste material (unlike other thermal treatment methods which heat wastes externally) and wetting and shredding the waste to facilitate heating and steam penetration of the waste. The material is discharged to a storage bin for ultimate disposal (Figure 7.3

Capital costs are about US$500,000.00.

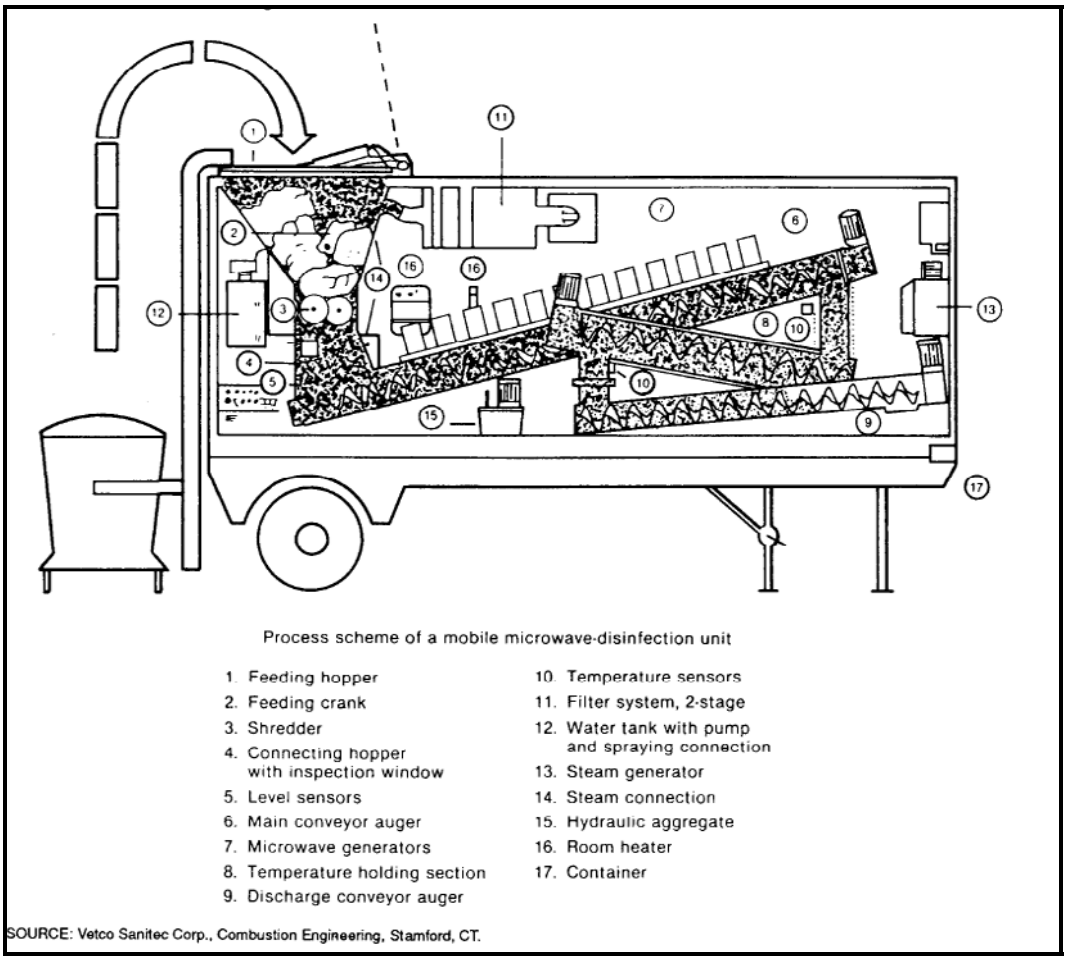

Figure 7-3 Mobile Microwave Medical Waste Disinfection Unit

7.5.3 Irradiation

A common practice is to treat medical products with radiation for sterilization purposes. The high cost of cobalt used in the process and high operating costs have discouraged commercial ventures from using the technology for medical waste management. Questions have been raised about the actual process of radiating the material and achieving adequate disinfection. Gamma radiation sterilizes infectious waste by penetrating the waste and inactivating microbial contaminants (Figure 7.4).

Potential risks of this alternative treatment technology are primarily associated with the possibility of radiation exposure to workers.

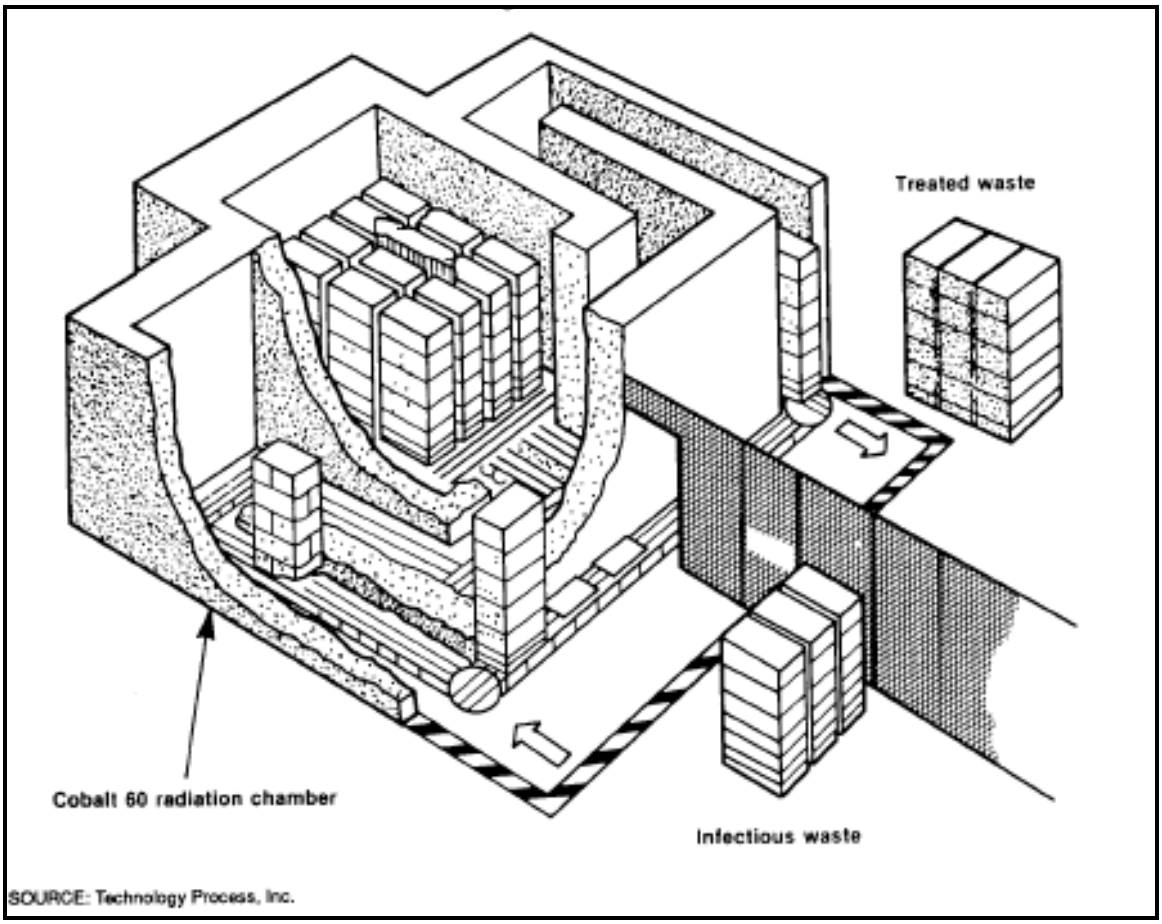

Figure 7-4 Irradiation Unit

7.6 Overview of Alternative Analysis

Based on the above, the most environmentally and economically sound alternative is the development as proposed in the EIA.

8.0 ENVIRONMENTAL ACTION PLAN

8.1 Monitoring

8.1.1 Monitoring during Site Preparation of the Proposed Medical Waste Treatment Facility

- Daily inspections to ensure that construction activities are not being conducted outside of regular working hours (e.g. 7 am – 7 pm). In addition, a one off noise survey should be undertaken to determine the environmental noise from construction equipment noise emission.

  The project engineer / construction site supervisor should monitor the construction work hours. A Contracted Third Party should conduct the noise survey. NEPA should conduct spot checks to ensure that the hours are being followed.

  The noise survey should be conducted by C.L Environmental Co. Ltd. or any other suitable qualified company or individual. The noise survey is estimated to cost approximately **J$56,000**.

- Daily monitoring to ensure that the cleared areas and access roads creating a dust nuisance.

  The project engineer / construction site supervisor should monitor the site clearance. NEPA should conduct spot checks to ensure that this stipulation is followed. In addition, the public within the area can be used to provide additional surveillance.

  It is not anticipated that this exercise will incur additional costs.

- Undertake daily inspections of trucks carrying solid waste generated from site clearance activities to ensure that they are not over laden as this will damage the public thoroughfare and onsite lead to soil compaction.

  No additional cost is anticipated for this exercise.

- Daily monitoring of vehicle refuelling and repair should be undertaken to ensure that these exercises are carried out on hardstands. This is to reduce the potential of soil contamination from spills. Spot checks should be conducted by NEPA.

  No additional cost is anticipated for this exercise.

8.1.2 Monitoring During the Construction Phase of the Proposed Medical Waste Treatment Facility

- Daily inspection of site clearance activities to ensure that they are following the proposed building plan and to ensure that site drainage and wastewater system are being constructed as planned. Check and balance should be provided by NEPA and the Kingston and St. Andrew Parish Council.

  No additional cost is anticipated for this exercise.

- Persons selling food to the construction workers should be in designated areas.

  The Parish Council may perform this exercise. It is recommended that this exercise be conducted at least weekly.

  No additional cost is anticipated for this exercise.

- Daily inspections to ensure that construction activities are not being conducted outside of regular working hours (e.g. 7 am – 7 pm).

  The project engineer / construction site supervisor should monitor the construction work hours. NEPA should conduct spot checks to ensure that the hours are being followed. The noise survey should be conducted by C.L Environmental Co. Ltd. or any other suitable qualified company or individual.

  The monitoring of the construction work hours is not expected to incur any costs.

- Daily monitoring to ensure that fugitive dust from cleared areas, access roads and raw materials are not being entrained in the wind and creating a dust nuisance.

  The project engineer / construction site supervisor should monitor the construction area and routes that the trucks are taking. NEPA should conduct spot checks to ensure that this stipulation is being followed. In addition, the public within the area can be used to provide additional surveillance. Additionally, a Contracted Third Party should conduct monthly particulate measurements to ascertain if the levels are complying with standards.

  It is anticipated that the particulate measurements will incur an estimated cost of approximately **J$67,500**.

- Undertake daily inspections of trucks carrying raw material to ensure that they are not over laden as this will damage the public thoroughfare.

  No additional cost is anticipated for this exercise.

- Conduct daily inspections to ensure that trucks carrying raw materials and heavy equipment are parked at the designated area on the proposed site so as to prevent traffic congestion.

  No additional cost is anticipated for this exercise.

- Conduct daily inspections to ensure that flagmen are in place and that adequate signs are posted along the roadway.

  No additional cost is anticipated for this exercise.

- Undertake daily assessment of the quantity of solid waste generated and keep records of its ultimate disposal. Additionally, solid waste generation and disposal of the campsite should also be monitored.

  No additional cost is anticipated for this exercise.

- Weekly assessment to determine that there are adequate numbers of portable toilets (approximately one per twenty five workers) and that they are in proper working order. This will ensure that sewage disposal will be adequately treated.

  No additional cost is anticipated for this exercise.

- Monitor and approve the suppliers and sources of local materials. Inspection of quarry and licences should be conducted to ensure that they are legal. Copies of this licences should be kept on file.

  No additional cost is anticipated for this exercise.

- Where possible, construction crews should be sourced from within the study area. This will ensure that the local community will benefit from the investment.

  No additional cost is anticipated for this exercise.

8.1.3 Monitoring During the Operational Phase of the Proposed Medical Waste Treatment Facility

- Undertake monthly inspection of drainage and wastewater systems to ensure that they are in proper working order to negate potential detrimental environmental impacts from malfunctioning infrastructure, example grease traps.

  No additional cost is anticipated for this exercise.

- Undertake daily assessment of the quantity of solid waste generated and keep records of its ultimate disposal. This is to ensure that the skips and bins do not become overfilled and to ensure that the treated medical waste is dispose at the recommended disposal site.

  No additional cost is anticipated for this exercise.

- Where possible, employees for the operation of the facility should be sourced from within the study area. This will ensure that the local community will benefit from the investment.

No additional cost is anticipated for this exercise.

- Undertake quarterly monitoring of the wastewater effluent in the buffer tank for volatile organic compound (VOC), bacterial content and heavy metals to ensure that compliance with regulatory standards.

  It is anticipated that wastewater monitoring of VOC, bacterial content and heavy metals will incur an estimated cost of approximately $47,000.00 per sampling event.

- The use of parametric monitoring (monitoring of time, temperature, pressure, and heat sensitive indicators) validated against biological indicators (Bacillus *stearothermophilus)* should be undertaken quarterly in the first year and annually thereafter to validate biological inactivation efficacy at Level IV treatment (8 $\log_{10}$ reduction).

  No additional cost is anticipated for conducting the parametric monitoring, but the biological monitoring is anticipated to incur an estimated cost of approximately $15,000.00 per sampling event.

8.2 Reporting Requirements

8.2.1 Noise Assessment

A quarterly report in the first year of operation of the Medical Waste Facility then annual reports shall be prepared a Contracted Party. This report shall include the following data:

i. Dates, times and places of test.

ii. Test Method used.

iii. Copies of instrument calibration certificates.

iv. Noise level measurements in decibels measured on the A scale (dBA) and wind direction.

v. Noise levels measured in low, mid and high frequency bands (dBL)

vi. A defined map showing each location clearly outlined where noise measurements are taken.

vii. Any other relevant information (such as unusual local noise source).

viii. Evaluation of data, discussions and statement giving a professional opinion of the noise impact.

A. The reports shall be submitted to Medical Waste Facility Manager or his designate and NEPA.

B. In the event that emissions do not meet the required criteria, investigations shall be carried out and corrective actions were necessary taken.

C. Reports will be maintained on file for a minimum of three years.

8.2.2 Parametric Monitoring of Treatment Equipment

A monthly report will summarize the treatment parameters of the treatment equipment.

This report shall include the following data:

i. Dates and times;
ii. Temperature and Pressure diagrams and the Sterilisation FO factors;
iii. Any alarms; and,
iv. Evaluation of data, discussions and statement giving a professional opinion.

A. The reports shall be submitted to Medical Waste Facility Manager or his designate, the Environmental Health Unit, NSWMA and NEPA.

B. In the event that emissions do not meet the required criteria, investigations shall be carried out and corrective actions taken were necessary.

C. Reports will be maintained on file for a minimum of three years.

8.2.3 Biological Monitoring of Solid Waste

A quarterly report (in the first year and annually thereafter) that summarize the results of biological monitoring of solid waste (treatment efficacy) with *Bacillus stearothermophilus,* spores strips or equivalent methods to verify the composition of treated waste.

This report shall include the following data:

i. Dates, times and places of test;
ii. Test Method used; and,
iii. Evaluation of data, discussions and statement giving a professional opinion.

D. The reports shall be submitted to Medical Waste Facility Manager or his designate, the Environmental Health Unit, NSWMA and NEPA.

E. In the event that emissions do not meet the required criteria, investigations shall be carried out and corrective actions taken were necessary.

F. Reports will be maintained on file for a minimum of three years.

8.2.4 Waste Water Effluent Quality

A quarterly report will summarize the results of water quality monitoring during the operation of the proposed project.

This report shall include the following data:

i. Dates, times and places of test.
ii. Test Methods used.
iii. Copies of instrument calibration certificates.
iv. A defined map showing each location clearly outlined where the water samples are taken.
v. Any other relevant information (such as weather).
vi. Evaluation of data, discussions and statement giving a professional opinion of the water quality results.

A. The reports shall be submitted to Medical Waste Facility Manager or his designate, the Environmental Health Unit, NSWMA, NWC and NEPA.

B. In the event that the water quality data do not meet the required criteria, investigations shall be carried out and corrective actions were necessary taken.

C. Reports will be maintained on file for a minimum of three years.

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- http://www.jnht.com/monuments.php

APPENDICES

Appendix A The Approved Terms of Reference

TERMS OF REFERENCE (TOR) FOR AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE SOUTHEAST REGIONAL MEDICAL (INFECTIOUS) WASTE TREATMENT FACILITY

1.0 Terms of Reference

The Environmental Impact Assessment should include but not be limited to the following:

1) Objectives

2) Complete description of the existing site proposed for development.

3) Significant environmental issues of concern through the presentation of baseline data which should include social, cultural and heritage considerations. Assess public perception of the proposed development.

4) Policies, Legislation and Regulations relevant to the project.

5) Likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and their relative importance to the design of the development's facilities.

6) Mitigation action to be taken to minimise predicted adverse impacts and quantify associated costs.

7) Monitoring Plan which should ensure that the mitigation plan is adhered to.

8) Alternatives to the project that could be considered at that site or at any other location.

9) Conclusions

TO ENSURE THAT A THOROUGH ENVIRONMENTAL IMPACT ASSESSMENT IS CARRIED OUT, IT IS EXPECTED THAT THE FOLLOWING TASKS BE UNDERTAKEN:

Task #1. Description of the Proposed Project

This section will provide a comprehensive description of all components of the project and will include but not be limited to

- Types of waste to be treated at the facility
- Type and characteristics of the treatment system to be used
- Scope of service and operating capacity
- Operations aspects of the system/facility
- Period of the system operation
- Waste/ trade effluent discharges
- Persons to be employed during the construction and operation of the facility.

The description of the project will also note areas to be reserved for construction, areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment. This should involve the use of maps, site plans, aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, ancillary buildings, as well as pre-construction, construction, and post construction plans.

For projects to be done on a phased basis it is expected that all phases be clearly defined the relevant time schedules provided and phase maps, diagrams and appropriate visual aids be included.

The plans for providing utilities, waste disposal and other services, sewage treatment system and treated effluent disposal, storm water collection and disposal should also be outlined.

Building architectural design and integration with the character of the area should be addressed.

Task #2. Description of the Environment

Baseline studies, data collection and interpretation

This task involves the generation of baseline data which is used to describe the study area as follows:

i) physical environment

ii) biological environment

iii) socio-economic and cultural constraints.

It is expected that methodologies employed to obtain baseline and other data be clearly detailed.

Baseline data should include:

(A) Physical

i) A **detailed description** of the existing soil and geology, landscape and aesthetic appeal**.** Special emphasis should be placed on storm water run-off, drainage patterns, effect on groundwater.

ii) **Climatic conditions and air quality** in the area of influence including particulate emissions from stationary and mobile sources, NOx, SOx, wind speed and direction, precipitation, relative humidity and ambient temperatures.

iii) **Noise levels** of undeveloped site.

iv) Obvious sources of **pollution** existing and extent of contamination.

v) Availability of **solid waste** management facilities.

(B) Biological

Present a detailed description of the flora and fauna (terrestrial) of the area. Migratory species and wild food crop plants should also be considered. Generally, species dependence, habitats/niche specificity, community structure and diversity ought to be considered.

(C) Socio-economic & cultural

Present and projected population; present and proposed land use; planned development activities, issues relating to squatting and relocation, housing demand and supply) community structure, economic base/employment, distribution of income, goods and services; utilities; recreation; public health and safety; cultural peculiarities, aspirations and attitudes should be explored. The historical importance of the area should also be examined. While this analysis is being conducted, it is expected that an assessment of public perception of the proposed development be conducted. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires.

Task #3 - Legislative and Regulatory Considerations

Outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. The examination of the legislation should include at minimum, legislation such as the NRCA Act, the Public Health Act, the National Solid Waste Management Act, the Town and Country Planning Act, Building Codes and Standards, Development Orders and Plans, the Medical Waste Management Policy (draft) and the appropriate international convention/protocol/treaty where applicable.

Task #4 – Identification and Assessment of Potential Impacts

- **Identify and analyse** the major environmental and public health issues of concern and indicate their relative importance.
- **Identify and analyse** potential impacts, and cumulative as they relate to, (but are not restricted by) the following:

  - change in drainage pattern

  - flooding potential

  - landscape impacts of excavation and construction

- pollution of potable, surface and ground water
- Air pollution
- wastewater generation and disposal (trade effluent)
- socio-economic and cultural impacts.
- hazard vulnerability
- noise
- odour
- spillage of contaminated medical waste (at treatment facility and collection trucks)
- occupational health and safety issues
- solid waste (hazardous and non-hazardous)
- visual impacts, including view from the main road.

- **Distinguish** between significant positive and negative impacts, reversible or irreversible direct and indirect, long term and immediate impacts. Identify avoidable as well as irreversible impacts.
- **Characterize** the extent and quality of the available data, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should be represented in matrix form with separate matrices for pre and post mitigation scenarios.

Task #5 – Impact Mitigation

Prepare guidelines for avoiding, as far as possible, any adverse impacts and cumulative impacts due to proposed usage of the site and utilising of existing environmental attributes for optimum development. Quantify and assign financial and economic values to mitigating methods.

Task #6 – Environmental Management and Monitoring

Design a plan to monitor implementation of mitigatory or compensatory measures and project impacts during construction and occupation/operation of the units/facility. An **Environmental Management Plan** for the long term operations of the site should also be prepared.

An **outline monitoring programme should be included in the EIA**, and a detailed version submitted to NEPA for approval after the granting of the permit and prior to the commencement of the development.

At the minimum the monitoring programme and report should include:

- Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit/license(s) granted.
- The activity being monitored and the parameters chosen to effectively carry out the exercise.
- The methodology to be employed and the frequency of monitoring.
- The sites being monitored. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- Frequency of reporting to NEPA
- Raw data collected. Tables and graphs are to be used where appropriate
- Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
- Recommendations
- Appendices of data and photographs if necessary.

Task #7 – Project Alternatives

Examine alternatives to the project including alternative sites and the no-action alternative. This examination of project alternatives should incorporate the use, history of the overall area in which the site is located and previous uses of the site itself.

Task #8 – Emergency Response Mechanism

Prepare an outline plan to deal with all emergency response situations that may occur at the facility and during transportation as well as how to address the issue of accidental releases and emergency such as in the event of natural disasters.

Material Safety Data Sheets (MSDS) will be provided for all chemicals handled on site.

Task #9 – Public Participation/Consultation Programme

Conduct a public presentation on the findings of the EIA to inform, solicit and discuss comments from the public on the proposed development.

- Document the public participation programme for the project.
- Describe the public participation methods, timing, type of information to be provided to the public, and stakeholder target groups.
- Summarise the issues identified during the public participation process
- Discuss public input that has been incorporated into the proposed project design; and environmental management systems

The EIA Report

All findings must be presented in the **EIA report** and must reflect the headings in the body of the TORs, as well as references. Ten (10) hard copies and an electronic copy of the report should be submitted.

The report should include an appendix with items such as maps, site plans, the study team, photographs, and other relevant information.

Outline of a Typical EIA Study

The EIA Methodology

Data Collection and Analysis

Data Sources

Description of the Existing Environment – Baseline Studies

Basic Checklist of Critical Aspects to be considered in EIA-Physical Environment Biological Environment Human Environment

Description of the Proposed Project

Legislative and Regulatory Framework

Potential Impacts, direct and indirect

Prediction of Impacts

Positive Impacts

Negative Impacts

Cumulative Impacts

Public/Community Involvement and Review

Mitigation Measures

Consideration of Alternatives

Environmental Management of the Project

Environmental Quality Objectives

Training

Outline Monitoring Plan

The EIA Team

Outline of a Typical EIA Report

The report should contain an introduction explaining the need for, and context of the project. This document should have the following basic aspects included in the Table of Contents, unless specified otherwise in the Terms of Reference.

Executive Summary

Description of the Proposed Project in detail

Policy, Legal and Administrative Framework

Description of the Existing Environment

- Physical
- Biological
- Human/Social

Beach Modification

Identification and Analysis of Alternatives

Identification and Assessment of Potential Environmental Impacts

- Positive Impacts
- Cumulative Impacts

Recommended Mitigation Measures

Natural Hazard Risk

Public Involvement

Environmental Management and Monitoring

- Environmental Quality Objectives
- Training
- Draft Outline Monitoring Programme

List of References

Appendices including:

Reference documents

Photographs/ maps

Data Tables

Terms of Reference

Composition of the consulting team

Notes of Public Consultation sessions

Appendix B The EIA Team

Carlton Campbell (MPhil.) – Socioeconomics, Noise Survey, Water Quality and Air Quality Sampling

Prof Edward Robinson – The Marine Geology Unit, University of the West Indies - Geology

Christopher Burgess – CEAC Solutions Ltd. - Infrastructural (water supply, sewerage & drainage) and Coastal Assessment (storm surge, coastal erosion etc)

Technical Assistants - Karen McIntyre (Bsc.), Janette Manning (M. Phil. Pending)

Appendix C ECODAS Certificates

Process of Shredding and Sterilization of Clinical Waste

ECODAS CERTIFICATES OF QUALITY AND SAFETY

28 rue Sébastopol – F – 59100 ROUBAIX
E-mail : contact@ecodas.com
Internet : www.ecodas.com
Tél. : (33) 3.20.70.98.65
Fax : (33) 3.20.36.28.05

S.A.S. au capital de 38 112.25 € - R.C. 2000 B 102 Roubaix

ECODAS *Process of Shredding and Sterilization of Clinical Waste*

Service Expertises en
Hygiène hospitalière

INSTITUT PASTEUR DE LILLE
FONDATION RECONNUE D'UTILITÉ PUBLIQUE

CONCLUSION GÉNÉRALE :

L'efficacité antimicrobienne de l'appareil LAJTOS TDS/1000 a été testé au cours de deux types d'essais :

- essais "traitement de porte-germes"

sur Staphylococcus aureus, Enterococcus hirae, E. coli, Pseudomonas aeruginosa, Mycobacterium smegmatis, Aspergillus niger, Bacillus subtilis, Enterovirus Polio 1, Orthopoxvirus de la vaccine :

- essais "traitement de déchets"
  sans stockage, et après stockage de 4 semaines.

Aucun développement microbien n'a pu être observé, au cours des deux types d'essais avec l'appareil LAJTOS TDS/1000.

Fait à Villeneuve d'Ascq,
le 14 février 1994

Responsable Technique
Françoise MARSY

Docteur C. KREMBEL

1, rue du Professeur Calmette - B.P. 245 - F 59019 Lille Cedex
Tél. 20.87.78.00 - Télécopie 20.87.79.06 - SIRET 783 696 834 00010 - APE 731Z

ECODAS *Process of Shredding and Sterilization of Clinical Waste*

TRANSLATION FROM FRENCH

DOCUMENT ISSUED FROM INSTITUT PASTEUR DE LILLE REGARDING THE RESULTS OF TRIALS MADE WITH TREATED CARE WASTE

GENERAL CONCLUSION

The antimicrobial efficiency of the equipment **LAJTOS TDS 1000** was tested through two types of trials :

- Trials : « **Germs Treatment** »

on Staphylococcus aureus, Enteroccoccus hirae, E. coli, Pseudomonas aeruginosa, Mycobacterium smegmatis, Asperfillus niger, Bacillus subtilis, Enterovirus Polio 1, Orthopoxvirus from vaccine,

- Trials : « **Waste Treatment** »
  Without stockage, and after 4 weeks stockage.

No microbian development was revealed during the two types of trials with the equipment **LAJTOS TDS 1000.**

Villeneuve d'Ascq,
The 14th of February, 1994

Technical Department

Françoise MARSY Doctor C. KREMBEL

ECODAS *Process of Shredding and Sterilization of Clinical Waste*

Institut Pasteur de Lille

Service d'Expertises en Hygiene Hospitaliere

Expérimentation menée du 12 Novembre 1993 au 17 Décembre 1993

L'appareil LAJTOS TDS utilise le principe de stérilisation à la vapeur pour banaliser des déchets hospitaliers à risque. Il permet d'obtenir par la méthode des porte-germes une réduction du nombre de cellules vivantes de 10^6 pour :

Staphylococcus aureus CNCM 53154
Enterococcus hirae CNCM 5855
Escherichia coli CNCM 54127
Pseudomonas aeruginosa CNCM A 22
Mycobacterium smegmatis CNCM 9326
Aspergillus niger CNCM 1431-83
Bacillus subtilis CNCM 7718
Enterovirus Polio 1
Orthopoxvirus de la vaccine

Fait à Villeneuve d'Ascq, le 17 Octobre 1997

Responsable technique
F. MARSY

Chef de Service
Docteur C. KREMBEL

Fondation reconnue d'utilité publique

1, rue du Professeur Calmette
BP 245 - 59019 Lille cedex
France
Tél. 03 20 87 78 00
Fax 03 20 87 79 06

3615 Pasteur Lille
Internet :
http://www.pasteur-lille.fr
SIRET 783 496 834 00010
APE 7312

Domaine du Certia
369, rue Jules Guesde - BP 39
59651 Villeneuve d'Ascq cedex
Tél. 03 20 43 89 29
Fax 03 20 43 89 31

ECODAS *Process of Shredding and Sterilization of Clinical Waste*

Institut Pasteur de Lille

Service d'Expertises en Hygiène Hospitalière

Villeneuve d'Ascq, le 13 Mars 1998

Monsieur DOMIN
COSMOLYS
Epi de Soïl
351, rue Ambroise Paré
59120 LOOS

Contrôle de décontamination
Prélèvements du 10 Mars 1998

Type d'appareil :	TDS 1000 LAJTOS
n° de cycle :	3167
Durée du cycle :	10 h 37 - 11 h 28

Principe
Déposer dans l'appareil des spores de Bacillus contenues dans des tubes fermés par du coton hydrophile.

Résultats
TDS 1000 Test 1 = Absence de germes
Test 2 = Absence de germes

Témoin laboratoire 1 :	$2,7.10^6$/ml	Témoin site 1 :	10^6/ml
Témoin laboratoire 2 :	2.10^6/ml	Témoin site 2 :	8.10^6/ml
Témoin laboratoire 3 :	$3,5.10^6$/ml	Témoin site 3 :	2.10^6/ml

Conclusion
Réduction de 10^6 spores de Bacillus, après passage dans l'appareil TDS 1000 à 138°C.

Responsable technique
F. MARSY

Chef de Service
Docteur C. KREMBEL

Fondation reconnue d'utilité publique
1, rue du Professeur Calmette
BP 245 - 59019 Lille cedex
France
Tél. 03 20 87 78 00
Fax 03 20 87 79 06

3615 Pasteur Lille
Internet :
http://www.pasteur-lille.fr
SIRET 783 696 434 00010
APE 7312

Domaine du Certia
369, rue Jules Guesde - BP 39
59651 Villeneuve d'Ascq cedex
Tél. 03 20 43 89 29
Fax 03 20 43 89 31

Process of Shredding and Sterilization of Clinical Waste

RÉPUBLIQUE FRANÇAISE

MINISTÈRE DU TRAVAIL
ET DES AFFAIRES SOCIALES

DIRECTION GÉNÉRALE DE LA SANTÉ

Place de Fontenoy – 75350 PARIS 07 SP
Tél. : 46.62.40.00

MINISTÈRE DE L'ENVIRONNEMENT

DIRECTION DE LA PRÉVENTION
DES POLLUTIONS ET DES RISQUES
---
20 avenue de Ségur – 75302 PARIS 07 SP
Tél. : 42.19.20.21

04 JAN. 1996

LE MINISTRE DU TRAVAIL ET DES AFFAIRES SOCIALES
et
LE MINISTRE DE L'ENVIRONNEMENT

à

MESDAMES ET MESSIEURS
LES PREFETS
DES REGIONS
Directions Régionales
des Affaires Sanitaires
et Sociales

A l'attention des ingénieurs
sanitaires régionaux
(pour information)

MESDAMES ET MESSIEURS
LES PREFETS
DES DEPARTEMENTS
Directions Départementales
des Affaires Sanitaires
et Sociales

A l'attention des ingénieurs
sanitaires départementaux
(pour exécution)

Objet : Circulaire n° 9609 relative à la mise en oeuvre du procédé Lajtos TDS 300 de désinfection des déchets contaminés des établissements hospitaliers et assimilés

MOTS-CLES : Procédé – Désinfection – Déchet d'activités de soins – Lajtos TDS

TEXTES DE REFERENCE : Circulaire n°53 du 26 Juillet 1991 relative à la mise en oeuvre des procédés de désinfection des déchets contaminés des établissements hospitaliers et assimilés

Circulaire n° 48 du 15 juillet 1994 relative à la mise en oeuvre du procédé Lajtos TDS de désinfection des déchets contaminés des établissements hospitaliers et assimilés

COPIE POUR INFORMATION

... / ...

ECODAS *Process of Shredding and Sterilization of Clinical Waste*

2

Par la circulaire n°53 du 26 juillet 1991 nous vous informions de notre volonté d'étendre les possibilités de traitement des déchets contaminés des établissements hospitaliers et assimilés à d'autres procédés que la seule incinération exigée par les réglements sanitaires départementaux.

Les Etablissements LAJTOS S.A. – 28 rue de Sébastopol, 59100 Roubaix avaient présenté en 1993 leur procédé TDS 1000 de volume utile 1 m³. L'appareil avait suivi une procédure expérimentale d'évaluation de sa capacité à décontaminer les déchets d'activités de soins à risque infectieux. Il avait obtenu un avis favorable du Conseil supérieur d'hygiène publique de France le 19 mai 1994 et fait l'objet de notre circulaire du 15 juillet 1994 citée en référence. Cette circulaire prévoyait que toute modification des caractéristiques de l'appareil devait faire l'objet d'un nouveau dossier, et le cas échéant, d'un nouvel avis du CSHPF.

Les Etablissements LAJTOS S.A. ont ainsi présenté un nouvel appareil, le TDS 300 de volume utile 300 litres, qui constitue un appareil similaire au TDS 1000 avec une réduction de capacité. En application de la circulaire du 15 juillet 1994, nous avons l'honneur de vous faire connaître que le TDS 300 vient d'être soumis à une procédure expérimentale visant à vérifier que ses paramètres de fonctionnement sont les mêmes que ceux de l'appareil TDS 1000.

Le 22 juin 1995, le Conseil Supérieur d'Hygiène Publique de France a rendu un avis favorable à l'utilisation de ce procédé pour le pré–traitement des déchets d'activités de soins à risque infectieux, sous réserve du respect de certaines modalités ; vous trouverez cet avis joint en annexe. L'objet de cette circulaire est de mettre en oeuvre le contenu de cet avis.

Le Conseil Supérieur d'Hygiène Publique de France, a constaté que les paramètres de fonctionnement du TDS 300 sont les mêmes que ceux du TDS 1000. Les déchets issus de cet appareil présentent donc, de façon fiable, un niveau de contamination microbiologique inférieur à celui des ordures ménagères. Les déchets ainsi pré–traités peuvent être éliminés soit par incinération, soit par enfouissement dans un centre d'enfouissement technique, suivant les modalités habituelles relatives aux résidus urbains ; il conviendra d'exclure les techniques de compostage en raison des caractéristiques physico–chimiques et organiques de ces déchets.

En complément des produits déjà interdits et rappelés dans la circulaire du 26 juillet 1991 citée en référence, les toxiques volatils ne doivent pas être soumis à ce procédé.

Nous vous rappelons qu'il conviendra de nous faire parvenir, sous le double timbre, les arrêtés de dérogation que vous pourriez être amenés à prendre et de suivre avec une attention particulière le fonctionnement de telles installations, compte–tenu de leur caractère novateur.

... / ...

Process of Shredding and Sterilization of Clinical Waste

ANNEXE
À LA CIRCULAIRE DU

Avis relatif au procédé LAJTOS TDS 300
de désinfection de déchets d'activités de soins

Considérant les éléments contenus dans le dossier n° V9501 remis par le pétitionnaire et les paramètres de fonctionnement suivants : température 138 °C, durée 10 min, pression 3,8 bars, du nouvel appareil Lajtos TDS 300 de capacité utile 300 litres, fonctionnant sur le même principe que l'appareil Lajtos TDS 1000 ;

Considérant les obligations d'établir un nouveau dossier et le cas échéant d'obtenir un nouvel avis du Conseil supérieur d'hygiène publique de France lorsqu'un procédé de désinfection fait l'objet d'une modification portant sur ses paramètres de fonctionnement ou sur ses capacités de traitement ;

Considérant les essais effectués sur la machine Lajtos TDS 1000 de volume utile 1 m³ ayant prouvé l'efficacité anti-microbienne du procédé qui assure ainsi une désinfection des déchets d'activités de soins à risque infectieux les amenant à un niveau de contamination inférieur à celui des déchets ménagers ;

Considérant la circulaire des ministres chargés de la santé et de l'environnement n° 48 du 15 juillet 1994, établie après avis favorable du Conseil supérieur d'hygiène publique de France du 19 mai 1994, relative à la mise en œuvre du procédé Lajtos TDS 1000 de désinfection des déchets contaminés des établissements hospitaliers et assimilés ;

Considérant que les résultats des essais effectués du 15 au 16 juin 1995 à la clinique du Val de Lys à Tourcoing (Nord) ont prouvé que les paramètres de désinfection du procédé Lajtos TDS 300 sont les mêmes que ceux du procédé Lajtos TDS 1000, et que par conséquent son efficacité anti-microbienne est assurée ;

... / ...

APPROVALS

IQNet

THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

IQNet and AIB-VINÇOTTE International

hereby certify that the organization

ECODAS S.A.S.
Rue Sébastopol 28
59 100 ROUBAIX (France)

has implemented and maintains a
QUALITY MANAGEMENT SYSTEM
which fulfills the requirements of the following standard
EN ISO 9001:2000

Further clarifications regarding the scope of this certificate and the applicability of EN ISO 9001:2000 requirements may be obtained by consulting the organization

for : Design, manufacturing, installation, sales and maintenance of Medical Waste Treatment Machines using shredding and steam sterilization

Issued on : Juillet 10, 2006
Validity date : Juillet 6, 2009

Registration number : BE-00 1428b

IQNet

VINÇOTTE

Dr. Fabio Roversi
President of IQNet

ir. P. OLIVIER
Chairman Certification Committee

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TÜV CERT

TÜV

TÜV Rheinland Group

CERTIFICATE

Quality-Assurance System

acc. to European Directive 97/23/EC

Certificate No.: 01 202 F/Q-05 20176

Name and address of manufacturer:	**ECODAS** 28, rue Sébastopol 59100 ROUBAIX France

The TÜV CERT Certification Body for Pressure Equipment hereby certifies that the above - mentioned manufacturer operates a quality system according to the European Directive 97/23/EC. The manufacturer has the permission to affix the following CE marking to pressure equipment described and manufactured in accordance to the scope covered by this Quality-Assurance System:

CE 0035

Approved acc. to Directive 97/23/EC:	QA-System (Module D) The QS-Modules E1, E and D1 of the Directive are performed by Module D
Audit Report No.:	**F/Q-05 20176**
Scope:	Sterilization Machines for Hospital Waste of Type ECODAS T300-T1000-T2000
Plant:	**ECODAS** 28, rue Sébastopol 59100 ROUBAIX France
Valid until:	May 2008

Cologne, June 16., 2005

TÜV Rheinland Group Notified Body TÜV 0035 Industrie Service GmbH

TÜV CERT-Certification Body
for Pressure Equipment

Dr.-Ing. U. Marx

Notified Body, ID-No. 0035

TÜV Industrie Service GmbH
Am Grauen Stein
51105 Köln

Tel. ++49-221/806-0
Fax ++49-221/806-1354
e-mail tuevat@de.tuv.com

Member of CEOC

CONFEDERATION EUROPEENNE D'ORGANISMES DE CONTRÔLE

Rev 3

THE NATIONAL BOARD
OF
BOILER & PRESSURE VESSEL INSPECTORS
Certificate of Authorization

This is to certify that

ECODAS
28 RUE SEBASTOPOL
ROUBAIX, 59100
FRANCE

is authorized to apply the "NB" mark and register boilers, pressure vessels, or other pressure retaining items with the National Board in accordance with its provisions.
The scope of Authorization is limited to items manufactured in accordance with:

ASME *Stamp(s):* *U*

ISSUE DATE: **May 3, 2006**

EXPIRATION DATE: **April 3, 2009**

Executive Director

NB 137 Rev. 6

Translations of French Governmental Approvals

1/ Circular 9609, January 8th 1996, relative to the implementation of the LAJTOS 300 of disinfection process of the contaminated waste issued from hospitals and comparable establishments.

2/ Circular 48, July 15th 1994, regarding the implementing of disinfection process for contaminated waste issued from hospitals and assimilated establishments.

3/ Circular 98-533, August 19th 1998, regarding the implementation of Medical Dual System and Lajtos TDS 2000 process about the disinfection of the contamined hospital waste issued from hospitals and assimilated establishments.

The original approvals (in French language) are available on request.

1/ Decree 97-1048, November 6th 1997, relative to the elimination of contaminated waste and assimilated waste and anatomic parts and changing the code of Public Health.

2/ Circular 911-2000, May 25th 2000, relative to the elimination of contaminated waste and assimilated waste and to the regulations of registered installations for the environmental protection.

Both of these documents are available in French or English language on request.

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Translated Copy
Refer to original

FRENCH REPUBLIC

Ministry of Employment and social services

General Direction of Health

1, Place de Fontenoy - 75350 PARIS 07 SP
Tél : 46.62.40.00

Ministry of Environment

Direction for Prevention from pollution and risks
20 avenue de Ségur - 75302 PARIS 07 SP
Tél : 42.19.20.21

MINISTRY OF EMPLOYMENT AND SOCIAL SERVICES
and
MINISTRY OF ENVIRONMENT
to

Mrs and Messrs
the prefects of districts
Regional Direction of
Health and social services

To the districts health consultants
(for information)

Mrs and Messrs
the prefects of departments
Departmental Direction of
Health and Social Services

To the department consultants
(for execution)

Object : Circular n° 9609 relative to the implementation of the lajtos TDS 300 of disinfection process of the contaminated wastes issued from hospitals and comparable establisments.

KEY- WORDS : Process - Disinfection - Wastes from medical care acts - Lajtos TDS

REFERENCE TEXTS : Circular n° 53 of the 26, july 1991 relative to the implementation of the disinfection processes of contaminated wastes issued from hospitals and comparable establisments.
Circular n° 48 of the 15, July 1994 relative to the implementation of the Lajtos TDS disinfection process of contaminated wastes issued from hospitals and comparable establisments.
-

By the circular n° 53 of July 26, 1991 we informed you of our wish to extend the posibilities of treatment of the contaminated wastes issued from hospitals and comparable establisments to further processes other than only incineration required by the departmental health rules.

The Lajtos Ltd Company - 28 rue de Sébastopol , 59100 Roubaix had presented in 1993 its TDS 1000 process of which live load is 1 cubic meter. The equipment was subjected to an experimental procedure of evaluation of its capacity to decontaminate the wastes issued from medical care acts with an infectious risk. The French High Coucil of Public Health approved the use of the process on the 19, May 1994 and its characteristics were presented in the circular of July 15, 1994 quoted in reference. That circular held that any modification of the characteristics of the equipment had to be subjected to a new procedure, and if the case arises , a further opinion of the French High Council of Public Health.

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So the Lajtos S.A Company presented a new equipment, the TDS 300 of which live load is 300 liters, which constitute the same equiment as the TDS 1000 with a reduction of capacity. In application of the circular of the July 15, 1994, we have the honour to announce you that the TDS 300 has just been subjected to an experimental procedure which aims at controling that the functioning parameters are the same of those of the TDS 1000.

On June 22, 1995 the French High Council of Public Health approved the use of this process for the pre-treatment of the wastes issued from medical care acts with an infectious risk, subject to the respect of certain modes; you will find enclosed that notice in annex. The purpose of this circular is to implement the content of this notice.

The French High Coucil of Public Health noticed that the functioning parameters of the TDS 300 are the same as those of the TDS 1000. The wastes issued from that equipment present, in a reliable way, a microbiological
contamination degree inferior to that of household wastes. In this way, the pre treated wastes can be eliminated either by incineration or by burying in a technical burying center, according to the usual modes relative to the urban wastes, it will be advisable to exclude the marking techniques because of the physico- chemical ond organic characteristics of these wastes.

In addition to the products already prohibited and mentioned in the circular of the July 26, 1991 quoted in reference, the volatile toxins can not be subjected to this process.

We remind you that it will be advisable to send us the dispension decrees that you could be led to take and to follow with a particular care the functioning of such equipments, because of their innovative feature.

This is the reason why we ask you to send us in the next six months after such an installation , a report which shows its insertion in the waste elimination procedure.

Would you be so kind as to, let us informed about the dificulties that the implementation of this circular could meet.

For the Minister and by delegation
The General Director of Health,

Jean- François Girard

For the Miniter and by delegation
the director of the prevention
for polution or risks, delegated to major risks.

Gustave Defrange.

ANNEX TO THE CIRCULAR

Notice relative the LAJTOS TDS 300 of disinfection of wastes issued from medical care acts.

Considering the elements of the file n° V9501 delivered by the petitioner and the following functioning parameters : temperature 138°C, duration 10 minutes, pressure 3,8 bars, of the new Lajtos TDS 300 equipment with a live load of 300 liters, functioning as the equipment Lajtos TDS 1000;

Considering the obligations to draw up a new file and if the case arises to obtain a further opinion of the French High Coucil of Public Health when a new disinfection process is subjected to a modification concerning its functioning parameters or its treating capacities,

Considering the trials made on the machine Lajtos TDS 1000 with a live load of 1 cubic meter having proved the anti-microbic efficiency of the process which provides a disinfection of the wastes issued from medical care acts in order to have a degree of contamination inferior to that of household wastes;

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Considering the circular of the Ministers of Health and Environment n° 48 of the 15, July 1994, instituted after the consent of the French High Coucil of Public Health on May 19, 1994, relative to the implementation of the Lajtos TDS 1000 disinfection process of contaminated wastes issued from hospitals and comparable establisments;

Considering that the results of the trials made from the 15 to the 16, June 1995 at the private hospital Val de Lys of Tourcoing (North) proved that the disinfection parameters of the Lajtos TDS 300 process are the same as those of the Lajtos TDS 1000 process, consequently its anti-microbic efficiency is ensured;

the Coucil after hearing of the industrialist and debate,

1- gives its consent to the use of the LAJTOS TDS 300 process of which the file has been presented by the LAJTOS Ltd Company - 28 rue Sébastopol, 59100 Roubaix - for the disinfection of the wastes issued from medical care acts with an infectious risk (in the meaning of the regulations in force and particularly the circular n°53 of Juky 26, 1991);

2- requires that

- any modification concerning the functioning parameters or the treatment capacities must be subjected to a new study and if the case arises the opinion of the Council;

- the cleaning of the lower chamber of the machine must be done once a day;

- the recordings of the functioning parameters must be kept in order to be consulted by the authorities concerned;

3- underlines that :

- the site of implantation and the explotation conditions must conform to the regulations in force relative to the health and safety rules;

- the use of this equipment needs a physical separation between the upper levels of loading of the wastes issued from medical care acts with an infectious risk and the lower levels of the unloading of contaminated wastes;

- the introduction of the wastes into the machine beeing manual, consequently it requires precautions in matter of work safety(notably buy using packages for the wastes issued from medical care acts with an infectious risk and a volume inferior or equal to 50 liters permiting their untroduction in the machine without manual packing down) and disinfection of the loading zone.

Translated Copy
Refer to original

CIRCULAR NR 48 DATED THE 15th of July, 1994
****

MINISTRY OF SOCIAL AFFAIRS
OF HEALTH AND OF THE TOWN

THE MINISTER OF HEALTH

General Direction of Health

MINISTRY OF ENVIRONMENT

Prevention Direction of
Pollutions and Risks

Circular nr 48 dated the 15th of July, 1994, regarding the implementing of disinfection process for contaminated waste issued from hospital establishments and assimilated.
(This text has not been published in Official Newspaper).

Reference : Circular nr 53 dated the 26th of July, 1991, regarding the implementing of disinfection process for contaminated waste issued from hospital establishments and assimilated.

The minister of the nation, minister of social affairs, of Health and of the Town, and the minister of environment, to Messrs the prefects of districts (for information) ; the prefects of departments (for execution).

In the circular nr 53, we informed you of our will to extend the possibilities of treatment of waste issued from hospital establishments and assimilated, to other means as only incineration.

In applying of this text, we have the honour to let you know that LAJTOS TDS process, offered by the Society LAJTOS S.A., 28, rue Sébastopol, 59100 ROUBAIX, has just been submitted to such an evaluation settlement. The machine on which the trials have been made is the LAJTOS TDS.1000, the useful volume of which being 1 cubic meter. On the 19th of May, 1994, the High Public Hygiene Council of France approved the using of this process for a pre-treatment of medical care acts waste, subject to respect of certain modalities ; you will find this notice herewith annexed. The purpose of this circular is to implement the content of this notice.

The High Council noticed that the waste issued from this machine has a micrologic contamination degree inferior to this of household waste, and in a reliable way. The so pre-treated waste may be destroyed, either by incineration , or by putting in waste discharges, as per the usual modalities regarding the urban waste. It will suit to exclude stamping technical because of physico-chemical and organic specificities of these waste.

In additive to the prohibited products described in the mentioned circular, the volatile poisons must not be submitted to this process.

We remind you, that in accordance to our hereabove mentioned circular, it will suit to send to our respective ministerial departments, the derogation decrees that you could have to pass, and to follow with a particular care, the working of such equipments, considering their innovating feature.

It is why, we ask you to send also to our respective ministerial departments, and this, into the six months after the installation of such a machine, to report upon its insertion in the waste elimination chain.

Please, let us informed of the difficulties that you could meet in the implementing of this circular.

For the minister and by delegation :
For the general Director of Health :

The director of prevention of the pollutions
and the risks, delegated to major risks

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ANNEXE

TO THE CIRCULAR Nr 48 DATED THE 15th OF JULY, 1994

HIGH PUBLIC HYGIENE COUNCIL OF FRANCE

Department Evaluation of the environment risks on the Health

Session of the 19th of May, 1994

Advice regarding the LAJTOS TDS process for medical care acts waste decontamination

Considering the information included in the file nr V.9407 receive from the petitioner and the following working parameters : temperature 138° Celsius, time 10 minutes, pressure 3,8 bars ;

Considering the results of the trials on LAJTOS TDS 1000 machine (useful volume of 1 cubic meter), made from the 19th of November, 1993 to 19th of February, 1993, on working place in Centre Hospitalier Général de ROUBAIX (59), the micobiologic analysis being realised by INSTITUT PASTEUR DE LILLE (Department Expert Valuation in hospital hygiene) ;

Considering that antimicrobial efficacy of the process assures a disinfection of contaminated medical care acts waste, bringing them to a contamination degree inferior to this of household waste,

The Council :

1°) Gives an approval to the using of LAJTOS TDS process, the file of which has been presented by the Society LAJTOS S.A., 28, rue Sébastopol, 59100 ROUBAIX, for disinfection of contaminated medical care acts waste (as per effected regulations and particularly the circular nr 53 dated the 26th of July, 1991) ;

2°) Asks that :

- Any alteration regarding the working parameters or treatment capacities will be subject to a new file and, eventually to a new advice of the Council ;

- The cleaning of the inferior chamber of the machine has to be made once a day ;

- The registrations of working parameters must be kept in the purpose to be consulted by qualified authorities :

3°) Precises that :

- the installation place and the working conditions must be in accordance to the effected regulations regarding hygiene and safety ;

- The using of this machine needs for the loading, either two levels, or an elevator :

- The introduction of the waste in the machine being manual, it needs special care regarding work safety and disinfection of the loading place.

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Translated Copy
Refer to original

Circular D.G.S./V.S. nr 98-533 dated the 19th August 1998

FRENCH REPUBLIC

SOLIDARITY AND EMPLOYMENT MINISTRY	ENVIRONMENT AND TERRITORY DEVELOPMENT MINISTRY
HEALTH GENERAL MANAGEMENT	**POLLUTIONS AND RISKS** PREVENTION MANAGEMENT

THE SOLIDARITY AND EMPLOYMENT MINISTRY
and
THE ENVIRONMENT AND TERRITORY DEVELOPMENT MINISTRY
To

MS AND MRS THE REGION PREFECTS	MS AND MRS THE DEPARTMENT PREFECTS
Health and Welfare Social Regional Management	Health and Welfare Social Departmental Management
For the attention of regional sanitary engineers engineers (for information)	For the attention of departmental sanitary (for implementation)

Subject: Circular D.G.S./V.S. nr 98-533 dated the 19th August 1998 regarding the implementation of MEDICAL DUAL SYSTEME and LAJTOS T.D.S. 2000 process about the disinfection of the contaminated hospital waste issued from hospital establishments and assimilated.

Key words : Disinfection process – Contaminated hospital waste – diffuse sector -LAJTOS T.D.S. – MEDICAL DUAL SYSTEME.

Texts of reference :	**Decree nr 97-1048 dated 6th November 1997 regarding the elimination of contaminated hospital waste and assimilated and anatomical specimen.** Departmental sanitary rule (articles 88 and 164). Circular nr 53 dated 26th July 1991 regarding the implementation of process about the disinfection of the contaminated hospital waste issued from hospital establishments and assimilated. Circular nr 48 dated 15th July 1994 regarding the implementation of LAJTOS T.D.S. 1000 process about the disinfection of the contaminated hospital waste issued from hospital establishments and assimilated. Circular nr 96-09 dated 8th January 1996 regarding the implementation of LAJTOS T.D.S. 300 process about the disinfection of the contaminated hospital waste issued from hospital establishments and assimilated.

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The decree nr 97-34 dated 15th January 1997, changed by the decree nr 97-1205 dated 19th December 1997, notifies that "the individual administrative decisions taking part into the field of competencies about the civil administrations of State, except of these regarding the public agents, are made by the prefect". For the solidarity and employment ministry, the derogation from this rule form the subject of the decree nr 97-1185 dated 19th December 1997, which does not mention the approval of the disinfection of hospital waste machines, provided by the decree nr 97-1048 dated 6th November 1997 This approval comes within the remit of the prefect.

However, this provision will come into force after the publishing of the order regarding the approval procedure of the disinfection machines, provided by the above-mentioned decree dated 6th November 1997. In the waiting of this publishing, the provisions of the departmental sanitary rule remains applicable and accordingly, the possibility of departing from the incineration obligation of hospital waste, by order of the prefect, taken to apply the article 164 of this rule. The circular dated 26th July 1991 explains that the prefects can take an order of departure for the disinfection machines being formed the subject of the French High Council of Public Health (C.S.H.P.F). approval.

I inform you that the C.S.H.P.F. approved the using of the T.D.S. 2000 processes (LAJTOS firm) and MEDICAL DUAL SYSTEM (introduced by Mr LEVY and Mr BETTOUN).

The T.D.S. 2000 machine

This machine, introduced by LAJTOS S.A.- 28, rue de Sebastopol – 59100 ROUBAIX – was approved by the French High Council of Public Health (C.S.H.P.F). during the meeting of 1st October 1997 (published in the official form from the solidarity and employment ministry nr 97/48 of 16th December 1997).

We remind you that the T.D.S. 1000 and T.D.S. 300 processes from the LAJTOS LTD company have already received an approval by the French High Council of Public Health (C.S.H.P.F) on 15th July 1994 and 8th January 1996 respectively and formed the subject of circulars nr 48 dated 15th July 1994 and nr 96-09 dated 8th January 1996.

The waste accepted upon this kind of installation is the hospital waste with an infectious risk precised at the article R.44-1 of the public health code
On the other hand, it is strictly forbidden to include the cytotoxics products used for the treatment of the cancers.

The MEDICAL DUAL SYSTEM process (M.D.S.) :

The MEDICAL DUAL SYSTEM process (M.D.S.) offered by Mr LEVY et Mr BETTOUN was approved by the French High Council of Public Health (C.S.H.P.F) during the meeting of 17th March 1998. You will find this advice enclosed herewith.

This process, for cutting waste, is adapted to the professionals needs of diffuse sector (whose monthly production is inferior or equal to five kilogrammes per month). It associates a thermic disinfection (at least 180 ° C everywhere during 30 minutes) and a change of the aspect about the waste by their inclusion in the wax. The French High Council of Public Health (C.S.H.P.F) approved this principle, during the meeting of 1st October 1997 (published in the official form from the solidarity and employment ministry nr 97/48 of 16th December 1997).

The C.S.H.P.F. noticed that the parameters of working of T.D.S. 2000 and M.D.S. enable to obtain a level of microbiological contamination inferior to the level of household rubbish, in a reliable way. The pre-treated waste can be eliminated either by incineration, or by putting in landfill site, according to the usual modes regarding the urban waste. We have to exclude the composting techniques because of the features and the origin of these wastes.

Thank you for letting us inform about difficulties you could come up against the implementation of this circular.

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Appendix D Reference List of Treatment Unit Installations

ECODAS

ENGINEERED SOLUTIONS FOR HEALTHCARE & THE ENVIRONMENT

Updated on October 27th 2006

OUR REFERENCES

FRANCE		
Ajaccio – Corse	Sanicorse	T 1000
Aurillac (15)	Henri Mondor Hospital	T 1000
Kremlin Bicêtre (94)	CHU de Bicêtre (Ourry)	T 2000
Laval (53)	Séché Eco Industrie	2*T 1000 1*T 2000
Lille (59)	Esterra – Vivendi/Suez	4*T 2000
Limoges (87)	Centre Hospitalier Régional et Universitaire	4*T 2000
Loos (59)	Cosmolys	T 1000 T 2000
Lyon (69)	CR Léon Bérard	2*T300
Nevers (58)	Escospace (Sita) – Suez	T 1000
Nogent sur Oise (60)	Onyx – Vivendi	T 2000
Pau (64)	Bearn Environnement – Groupe Séché	2*T 2000
Paris (75)	Groupe Hospitalier Pitié Salpêtrière (Ourry)	2*T 2000
Plaisir (78)	Axène – Cepur	T 2000
Pontoise (95)	CH René DUBOS (Dalkia – Vivendi)	T 2000
Roubaix (59)	Centre Hospitalier de Roubaix	2*T 1000
Saint Brieuc (22)	Centre Hospitalier Y. Le Fool (April 2007)	T 2000
Saint Flour (15)	Saint Flour Hospital	T 300
Saint Genis les laval (69)	Steam – Tecmed	2*T 2000
Tourcoing (59)	Clinique du Val de Lys	T 300
Voivres Les Le Mans (72)	MBM	T 300
ALGERIA		
Alger	Hôpital Militaire	T300
Bechar	Hôpital Militaire	T300
Oran	Hôpital Militaire	T300
ARGENTINA		
Mar del Plata	Tecsan	T 2000
BOSNIA		
Doboj	Gleninvest (November 2006)	T 300
BRASIL		
Santana de Parnaiba	Tratalix	2*T 2000
CYPRUS		
Nicosia	Vouros Healthcare	T 300

SHREDDING AND STERILIZATION OF MEDICAL WASTE

ECODAS®
28 rue Sébastopol
59100 ROUBAIX
FRANCE

www.ecodas.com
contact@ecodas.com
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DENMARK		
Odense	Odense Hospital	T 2000
EGYPT		
Alexandria	Onyx Alexandria	3 * T 2000
Benha	Benha Educational Hospital	T 300
Cairo	Ahmed Maher	T 300
Cairo	Cancer Institute	T 300
Cairo	Vaccination Center	T 300
Cairo	Nephrology Center	T 300
Cairo	Ain Shams Hospital	T 300
Cairo	Demerdash Hospital	T 300
Cairo	Al Matarea Educational Hospital	T 300
Cairo	National Institute For Diabetes	T 300
Cairo	Mobarak Police Academy	T 300
Cairo	Heart Institute	T 300
Cairo	El Galaa Hospital	T 300
Cairo	National Physio Therapy and Rehabilitation Institute	T 300
Cairo	Domanhor Hospital	T 300
Cairo	Zagazig Hospital	T 300
Cairo	Searching for Medicine Countries Warm Institute	T 300
Cairo	Elsahel Education Hospital	T 300
Menofeya	Shebien Educational Hospital	T 300
Menofeya	Liver Institute – Menofeya University	T 300
New Cairo	1st collection Hospital	T 300
New Cairo	3rd collection Hospital	T 300
GUIANA		
Cayenne	EGTS	T 300
Cayenne	EGTS	T 2000
HONDURAS		
San Pedro Sula	Hospital Regional Nor-Occidental del IHSS	T 2000
Tegucigalpa	Hospital de Especialidades de la Granja del IHSS	T 2000
HUNGARY		
Budapest	Budapest Hospital	T 1000
IRAN		
Ghaemshahr	Valiasr Hospital	T300

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JAPAN		
Kushiro	Red Cross Hospital	T 300
Tateyama	Awa Ishikai Hospital	T 300
Tokyo	Keiyu Hospital	T 300
Tokyo	Omiya Hospital	T 300
Saiseikai	Saiseikai Hospital	2* T 300
KUWAIT		
Dasman – Koweit City	Al Salam Hospital	T 300
Jabriyah	Royal Hayatt – Al Ghannam Hospital	T 300
LATVIA		
Riga	BAO	T 300
LEBANON		
Beirut	Hôtel Dieu de France	T 300
Rayak	Rayak Hospital	T 300
MOROCCO		
Agadir	Hassan II Hospital	T 300
Al Hoceima	Mohamed V Hospital	T 300
Beni Mellal	Provincial Hospital	T 300
Berkane	Edderrak Hospital	T 300
Bouarfa	Provincial Hospital	T 300
Casablanca	Ben Msik Hospital	T 300
Essaouira	Sisi Mohamed Ben Abdellah Hospital	T 300
Fez	Al Ghassani Hospital	T 300
Kenitra	Provincial Hospital	T 300
Khemisset	Provincial Hospital	T 300
Laayoune	Belmedhi Hospital	T 300
Meknes	Mohamed V Hospital	T 300
Nador	Al Hassani Hospital	T 300
Oujda	Al Farabi Hospital	T 300
Rabat	Research and Medical Analysis Laboratory of Royal Gendarmerie	T 300
Rabat	Military Hospital	T 300
Safi	Mohamed V Hospital	T 300
Sefrou	Mohamed V Hospital	T 300
Settat	Hassan II Hospital	T 300
Tanger	Mohamed V Hospital	T 300
Tan Tan	Hassan II Hospital	T 300
Taza	Hôpital Régional	T 300

3

Tetouan	Civil Hospital	T 300
MEXICO		
Tijuana	BFI STERICYCLE	T 2000
NEW CALEDONIA		
Noumea	Promed	T 2000
POLAND		
Kielce	Wojewodzki Sziptal Zespolony	2 * T 300
Legnica	Wojewodzki Szpital Specjalistyczny y Legnicy	T 300
REUNION ISLAND		
Saint Louis	Ecolys	T 300
Sainte Marie	Nicollin Reunion	T 2000
ROMANIA		
Cernavoda	UNIFY	T 300
RUSSIA		
Kazan	Republican Oncologic Center	T 300
Moscow	Center of Obstetrics and Gynecology	T 300
Moscow	Center of Planning of Family	T 300
Moscow	S. P. BOTKIN Hospital	T 300
St Petersburg	Children's city hospital	T 300
Samara	Oncological Center	T 300
Moscow	Pharmster (December 2006)	3*T 300
SAINT LUCIA		
Saint Lucia	Solid Waste	T 1000
SLOVAKIA		
Brastislava	AGB Ekoservis	T 300
SPAIN		
Majorca	Tremesa group Consenur	T 2000
TUNISIA		
Megrine Coteaux	Le Croissant Vert	T 2000

4

UKRAINE		
Kiev	Kiev Heart Center	T 300
Kiev	Kiev Emergency Hospital	T 300
UNITED KINGDOM		
Reading	White Rose - Stericycle	2 * T 2000

5

Appendix E Approvals

Georgia Department of Natural Resources
Environmental Protection Division
Solid Waste Management Program
4244 International Parkway, Suite 104, Atlanta, Georgia 30354
Noel Holcomb, Commissioner
Carol A. Couch, Ph.D., Director
404/362-2692

December 21, 2004

Mr. Jeff Squalli
CEO & President
ECODAS
28 Rue Sebastopol
59100 Roubaix France

SUBJECT: ECODAS Alternate Technology Biomedical Waste Treatment
Conditional Approval

Dear Mr. Squalli:

The Environmental Protection Division (EPD) has completed its review of the ECODAS alternate biomedical waste treatment technology. Based on the information you have submitted to us, the ECODAS T100, T300 and T2000 models operated at the parameters specified in the approval proposal report #120103 received March 22, 2004, are approved for Level IV treatment of biomedical waste as described in the 'Technical Assistance Manual: State Regulatory Oversight of Medical Waste Treatment Technologies' and contingent on the following:

1. This approval to treat biomedical wastes utilizing the ECODAS technology is limited to the treatment of wastes contaminated with the infecting agents for which efficacy testing has been demonstrated in the proposal report #120103. Treatment of chemotherapy wastes and radiotherapy wastes using the ECODAS technology are excluded.

2. Prior to the installation of any ECODAS unit in the state of Georgia, the Division shall be notified and validation studies documenting compliance with the conditions of this approval must be submitted to EPD for review and approval.

3. During treatment biomedical wastes shall be held at or above the temperature of 138 degrees Centigrade and for a period of time equal to or longer than the ten (10) minute time period demonstrated in the report to achieve decontamination at an organism reduction of 6 Log10 or greater.

Mr. Jeff Squalli
December 21, 2004
Page 2

4. During decontamination operation, recording thermometers shall be placed in the load where the rate of thermal penetration of the biomedical waste load is at a minimum to ensure that a temperature at or above 138 degrees Centigrade is attained throughout the load. The heating time of the load shall be recorded and monitored to ensure that the temperature of each load is at or above 138 degrees Centigrade for a minimum of ten(10) minutes for decontamination of the entire load.

5. Initially, and thereafter, but not less than on an annual basis, installed devices shall be tested to validate biological inactivation efficacy at Level IV treatment.

6. Records of efficacy testing and of each load temperature, heating cycle time, and waste generator name(s), address(es) and telephone number(s) shall be kept for a minimum of three (3) years and shall be available for review by representatives of the Division upon request.

Should you have questions in this regard or need clarification, do not hesitate to contact this office at 404/362-2572.

Sincerely,

Barbara R. Howard

Barbara R. Howard, P.E.
Environmental Engineer 3
Solid Waste Management Program

Bh:/s:landdocs/barbarah/ECODAS Alt TECH Appropval.04
Enclosure

c: EPD District Offices
Ted Jackson
Timothy Earl
Harold Gillespie
File(Biomedical) ECODAS

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

STEVEN E. CHESTER
DIRECTOR

May 30, 2006

Mr. Dave Squalli, Vice President
ECODAS U.S. Division
32 Birch Crescent, Suite 3
Rochester, New York 14607

Dear Mr. Squalli:

SUBJECT: ECODAS Medical Waste Treatment System

This letter will serve to inform you that the Michigan Department of Environmental Quality (MDEQ) has reconsidered your request for approval of the ECODAS medical waste treatment system in the treatment of pathological waste. Based on the data you have submitted and a re-evaluation of the ECODAS treatment process, the MDEQ agrees that the ECODAS system will provide effective treatment in the decontamination of pathological waste. The system is designed to provide more effective treatment then a standard autoclave treatment system due to grinding of the waste prior to the decontamination phase of treatment and due to the increased time, temperature, and pressure parameters that are utilized. Laboratory test results verified that complete and effective treatment is accomplished.

Based on this information, the ECODAS medical waste treatment system is therefore approved for treatment of the following categories of medical waste in Michigan:

1. Cultures and stocks of material contaminated with an infectious waste
2. Blood and blood products and body fluids
3. Sharps
4. Pathological waste

Should you have any questions or comments concerning this approval letter, please contact our office at the number listed below.

Sincerely,

John N. Gohlke

John N. Gohlke, R.S., M.S.A.
Program Specialist
Medical Waste Regulatory Program
Radiological Protection and Medical
Waste Section
Waste and Hazardous Materials Division
517-335-1320

JNG:JK
cc: Mr. Ed Krisiunas, MT, CIC, MPH

CONSTITUTION HALL • 525 WEST ALLEGAN STREET • P.O. BOX 30241 • LANSING, MICHIGAN 48909-7741
www.michigan.gov • (517) 335-2690

STATE OF NEW YORK
DEPARTMENT OF HEALTH
Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Antonia C. Novello, M.D., M.P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissione

October 27, 2004

Mr. Jeff Squalli, President & CEO
Ecodas
28 Rue Sebastopol,
59100 Roubaix, France

Dear Mr. Squalli:

This department has evaluated test data from Ecodas for approval of its Ecodas medical waste treatment process (Units T300, T1000, and T2000) as an alternative regulated medical waste treatment system.

I am pleased to inform you that the Ecodas medical waste treatment process (Units T300, T1000, and T2000) is approved, pursuant to Public Health Law Section 1389-dd (1)(d) and 10 NYCRR Subpart 70, for use in the treatment of regulated medical waste, including 10–50% concentrations of pathological waste, as verified through efficacy studies. This approval is granted for the specific system used in your efficacy studies and should not be construed as a general endorsement of the technology employed, or any other unit or system. Any modifications to the system will require separate approval of the department and may involve further efficacy studies.

Prior to installation of this system in a New York State facility, this department must be notified and validation studies must be submitted for our review.

This approval does not relieve Ecodas, or any person using your system, from obtaining any other approvals that may be required by other State, Federal, or local laws or regulations.

Sincerely,

Lawrence S. Sturman

Lawrence S. Sturman, M.D., Ph.D.
Director, Wadsworth Center

TEXAS DEPARTMENT OF STATE HEALTH SERVICES

EDUARDO J. SANCHEZ, M.D., M.P.H.
COMMISSIONER

1100 W. 49th Street • Austin, Texas 78756
1-888-963-7111 • http://www.dshs.state.tx.us

February 24, 2006

Mr. Dave Squalli
ECODAS U.S. Division Vice President
32 Birch Crescent, Suite 3
Rochester, NY 14607

RE: Alternative Waste Treatment Technology Review Application #2006001

Dear Mr. Squalli,

This department has completed a reviewed of the ECODAS Alternative Waste Treatment Technology. Based upon the documentation submitted to us, the ECODAS T300, T1000, and T2000 models operated within the design specifications is approved as an alternative waste treatment technology for treatment of special wastes from health care-related facilities. The ECODAS T300, T1000, and T2000 models are approved for treatment of the following types of special wastes: animal waste; bulk human blood, blood products, and body fluids; microbiological waste; pathological waste; and sharps, as these terms are defined in 25 Texas Administrative Code (TAC), Part 1, Chapter 1, §1.132.

This approval is in accordance with the requirements of 25TAC §1.135, Performance Standards for Commercially-Available Alternate Treatment Technologies for Special Waste from Health Care-Related Facilities. This approval should not be construed as a general endorsement of the technology employed. This approval is not transferable to any other system. Any modifications of the ECODAS T300, T1000, or T2000 models for which this approval is granted will require a separate application for approval by this department and further efficacy testing.

The ECODAS T300, T1000, and T2000 models have been added to the Alternative Waste Treatment Technology Approval list, a copy of which is enclosed. This approval does not relieve you, or any person, organization, or facility using the ECODAS T300, T1000, or T2000 models from complying with other relevant Texas laws or regulations. If you have any questions about this approval, please contact me at one of the following: Department of State Health Services, ATTN: Michael J. Minoia, 1100 West 49th Street, Mail Code 2826, Austin, Texas 78756; Ph#: (512) 834-6773, extension 2305; Fax#: (512) 834-6707;-or via email at Michael.Minoia@dshs.state.tx.us

Sincerely,

Michael J. Minoia

Michael J. Minoia, R.S., M.P.H.
Policy/Standards/Quality Assurance Unit
Regulatory Services Division

An Equal Employment Opportunity Employer

Appendix F Modified Mercalli Intensity Scale for Earthquakes

Intensity	Description
I	Not felt.
II	Felt by persons at rest on upper floors.
III	Felt indoors—hanging objects swing. Vibration like passing of light trucks.
IV	Vibration like passing of heavy trucks. Standing automobiles rock. Windows, dishes, and doors rattle; wooden walls or frame may creak.
V	Felt outdoors. Sleepers wakened. Liquids disturbed, some spilled; small objects may be moved or upset; doors swing; shutters and pictures move.
VI	Felt by all; many frightened. People walk unsteadily; windows and dishes broken; objects knocked off shelves, pictures off walls. Furniture moved or overturned; weak plaster cracked. Small bells ring. Trees and bushes shaken.
VII	Difficult to stand. Furniture broken. Damage to weak materials, such as adobe; some cracking of ordinary masonry. Fall of plaster, loose bricks, and tile. Waves on ponds; water muddy; small slides along sand or gravel banks. Large bells ring.
VIII	Steering of automobiles affected. Damage to and partial collapse of ordinary masonry. Fall of chimneys, towers. Frame houses moved on foundations if not bolted down. Changes in flow of springs and wells.
IX	General panic. Frame structures shifted off foundations if not bolted down; frames cracked. Serious damage even to partially reinforced masonry. Underground pipes broken; reservoirs damaged. Conspicuous cracks in ground.
X	Most masonry and frame structures destroyed with their foundations. Serious damage to dams and dikes; large landslides. Rails bent slightly.
XI	Rails bent greatly. Underground pipelines out of service.
XII	Damage nearly total. Large rock masses shifted; objects thrown into the air.

Modified from Montgomery, 1995.

Appendix G Noise Calibration Certificate

Page 1 of 1

Certificate of Calibration

Certificate No:10429200QI0110126

Submitted By: C.L. ENVIRONMENTAL CO., LTD.
TOWNHOUSE 21 PERKINS ESTATE
KINGSTON, 19

Serial Number: 0QI0110126
Customer ID:
Model: QC-10
Test Conditions:
Temperature: 18°C to 29°C
Humidity: 20% to 80%
Barometric Pressure: 890 mbar to 1050 mbar

Date Received: 12/1/2005
Date Issued: 4/28/2006
Valid Until: 4/28/2007
Model Conditions:
As Found: IN TOLERANCE
As Left: IN TOLERANCE

SubAssemblies:

Description:	Serial Number:

Calibrated per Procedure:56V981

Reference Standard(s):

I.D. Number	Device	Last Calibration	Date Calibration Due
ET0000366	B&K ENSEMBLE	10/14/2005	10/14/2006
S00335	FLUKE PM6666	7/21/2005	7/21/2007
T00230	FLUKE 45 MULTIMETER	6/8/2004	6/8/2006

Measurement Uncertainty:

+/- 2.4% ACOUSTIC (0.2DB) +/- 1.4% VAC +/- 0.001% HZ
Estimated at 95% Confidence Level (k=2)

Calibrated By: Paul M. Wegmann 4/28/2006
PAUL WEGMANN Service Technician

This report certifies that all calibration equipment used in the test is traceable to NIST, and applies only to the unit identified under equipment above. This report must not be reproduced except in its entirety without the written approval of Quest Technologies.

QUEST
TECHNOLOGIES, INC.
1060 CORPORATE CENTER DRIVE • OCONOMOWOC, WISCONSIN 53066-4828
800.245.0779 • 262.567.9157 • FAX 262.567.4047 • INTERNET ADDRESS: www.questtechnologies.com

098-393 Rev. B

Appendix H Jamaica Public Service Company Limited Letter

Jamaica Public Service Company Limited
CHANGING LIVES WITH OUR ENERGY
6 Knutsford Boulevard, Kingston Jamaica, W.I.
Telephone: (876) 926-3190-9 Fax: (876) 511-2167
Website: www.jpsco.com

June 18, 2007

Application No. 0706-A17447

Ministry of Health
2-4 King Street
Kingston

Attention: Ms. Navarine Hylton

Dear Sirs:

Re: Medical Waste Treatment Facility

Reference is made to your correspondence dated May 29, 2007 regarding the caption.

Our Technician visited the premises and we advise that supply can be made availabl from Greenwich Road for 415/240v, 3-phase.

Please bear in mind that an application must be made at the appropriate time with a detai load data.

Kindly engage the services of a licensed electrician to provide the necessary informatio for your application.

Yours truly,
JAMAICA PUBLIC SERVICE CO. LTD.

Evan Gordon (Miss)
Customer Care Manager
KSA South
7-9 East Parade

Rec'd

Appendix I *National Water Commission Letter*

☐ 28-48 Barbados Avenue
P.O. Box 65, Kingston 5
Tel: (876) 929-5430-5
Fax: (876) 926-1329

☐ 18 Oxford Road
Kingston 5
Tel: (876) 926-5825-7
Fax: (876) 926-7121

☐ 4 Marescaux Road
Kingston 5
Tel: (876) 929-4840-4
Fax: (876) 960-0582

☐ 2a Manhattan R
Kingston 5
Tel: (876) 929
Fax: (876) 968

☐ 231A Old Hope Road
Kingston 6
Tel: (876) 977-4998-9
977-5000
Fax: (876) 927-1870

☐ 28-30 Church Street
Kingston
Tel: (876) 922-8110-9
Fax: (876) 967-1499

NATIONAL WATER COMMISSION
Water is Life

June 28, 2007.

The Permanent Secretary
Ministry of Health
Oceana Complex 2-4 King Street
Kingston.

Dear Sir;

Re: Proposed Southeast Regional Medical Waste Treatment Facility.
NWC Ref # 0384/07

Reference is made to previous correspondence relating to the matter in caption.

The Development Committee is pleased to advise that the National Water Commission (NWC) **is able** to provide the services of water supply and wastewater disposal to the proposed facility.

As has been pointed out to your representative who made the presentation before the Development Committee, the relevant connections will be made once the associated payments are made by the Ministry of Health, for which purpose the Ministry is required to make a formal application for water at the NWC's commercial office.

Approval for the wastewater connection will be given once the Ministry provides a proper layout plan showing the direction of flow of sewage, manholes and details of the proposed connection points to any NWC existing sewer mains.

We trust that the foregoing will suffice and look forward to hearing from you.

Yours truly;
NATIONAL WATER COMMISSION

Paul Burgess
For Development Committee

Appendix J Questionnaire

MINISTRY OF HEALTH
SOUTHEAST REGIONAL MEDICAL WASTE TREATMENT FACILITY

COMMUNITY QUESTIONNAIRE

DATE:_____ **INTERVIEWER:_____**

LOCATION: _____

The Ministry of Health proposes to build a medical waste treatment facility that seeks to provide a more environmentally friendly option for the treatment of medical waste stream generated within the Southeast Health Region. Steam sterilization and shredding technology will be used to treat the waste. This technology combines shredding, direct heated steam & high pressure to achieve complete sterilization of infectious materials with no harmful air or liquid emissions. The final treated waste is harmless, unrecognizable, and is safe for disposal just like ordinary domestic waste in a controlled sanitary landfill.

1 Are you aware that there is an incinerator at the Kingston Public and Victoria Jubilee Hospital and/or National Public Health Laboratory and Blood Bank?
(i) Yes (ii) No

2 Does the presence or use of the incinerator affect you?
(i) Yes (ii) No

If yes, how are you affected?
_____

3 Is there a specific time of the day/week when the effect of the incinerator is most noticeable?
(i) Yes (ii) No

If yes when?
_____

4 What do you think of the car park area being used to dispose of garbage?
_____
_____

5 Are you aware that the Ministry of Health is proposing to construct a medical waste treatment facility at the existing car park area?
(i) Yes (ii) No

If yes, how were you informed?
_____

6 Do you believe that this waste treatment facility will affect you?
(i) Yes (ii) No

If yes, how?

_____

7 Is there anything in particular about your area that you would like to tell us?

_____

_____

8 What else would you like to see done in your area?

_____

_____