



Waitakere Eco-City



**WAITAKERE CITY COUNCIL
CLEANER PRODUCTION PARTNERSHIP
PROGRAMME**

**REPORT
ON
CLEANER PRODUCTION INVESTIGATION
AT
WAITAKERE HOSPITAL
HENDERSON**

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**INDUSTRY AND
ENVIRONMENT
LIMITED**

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ACKNOWLEDGMENTS

1.0 INTRODUCTION

Waitakere Hospital, administered by Waitemata Health, has been the subject of study as part of Waitakere City's Cleaner Production Partnership Programme (CP3). Objectives of this programme are to:

- Obtain waste audit information on businesses in Waitakere City;
- Providing information on how to establish an ongoing Cleaner Production programme through the CP3 workshop and folder;
- Providing the services of a consultant to offer site specific advice.

Case studies are to be developed from the programme to assist in the development of Cleaner Production in other Waitakere industries, and throughout New Zealand in general.

2.0 BACKGROUND

Waitemata Health operates two public hospitals, one on Auckland's North Shore in Shakespeare Road Milford, and the Waitakere Hospital in Lincoln Road Henderson. Primary functions of Waitakere Hospital facility are maternity care, health services for older people, and emergency care from the independently operated Westcare facility on site. In addition, there are a range of outpatient services provided through the Community Health Services department.

Home Health Services operate under the community health umbrella. District nurses make home visits to provide:

- wound care;
- injections and treatments;
- bladder and bowel care and continence education;
- pain and symptom management;
- support and advice for caregivers;
- education in living with health problems;
- nursing support to people who are dying.

3.0 PURPOSE OF REPORT

The purpose of this report is to provide waste audit information to assist with Waitakere City's strategic waste management planning. This information in conjunction with site walk-through audit observations and staff interviews is used to identify opportunities for investigation as Cleaner Production options. It is intended that this be given attention by a Cleaner Production programme and team to be established on site.

4.0 METHODOLOGY

A representative of Waitemata Health attended the CP3 workshop, and was approached about initiating Cleaner Production at Waitakere Hospital. It was decided that the best approach would be to concentrate on one department, Community Health Services, as a pilot programme for the rest of the Hospital.

A seminar was held with approximately nine of the thirteen district nurses from Home Health Services. An introduction was given to background environmental issues, Waitakere as an Eco-City, and Cleaner Production. It was initially intended to begin a Cleaner Production programme within the department, but this is now to be through the Health and Safety Committee.

Interviews with key staff were conducted. This included the commercial support manager, contracts officer, and district nurse. In addition, a number of less formal talks were held with other staff.

A walk-through audit was conducted with the commercial support manager and contracts officer, with waste audit records being provided by Waitemata Health.

5.0 RESULTS

Waste audit results are presented for the entire Waitakere Hospital site. Where possible, this is narrowed down to the Home Health Services department.

5.1 ELECTRICITY USE

Electricity is supplied from the national grid, with emergency backup provided by a diesel emergency generator.

Table 1: Electricity consumption between July 1995 and June 1996.

MONTH	CONSUMPTION (kWh)	COST (EX GST)
July 1995	125 328	10 246.55
August	118 717	9 354.65
September	109 901	9 227.84
October	108 016	8 701.76
November	99 949	8 278.13
December	95 218	7 846.63
January 1996	94 119	7 870.24
February	95 828	8 427.06
March	103 034	9 179.03
April	102 415	8 657.07
May	116 643	9 733.05
June	117 132	10 270.59
TOTAL	1 286 210	\$107 810.60

The average price is around \$0.084 per kWh.

5.2 NATURAL GAS

Natural gas is used for the boiler, providing heating for the whole site. Average cost is \$0.029 per kWh.

Table 2: Natural gas consumption between July 1995 and June 1996.

MONTH	CONSUMPTION (kWh)	COST (EX GST)
July 1995	365 061	10 362.13
August	373 664	10 599.73
September	286 461	8 177.60
October	272 368	7 818.14
November	145 039	4 517.11
December	70 812	2 157.64
January 1996	112 375	3 560.62
February	76 671	2 483.51
March	91 554	2 907.69
April	196 566	5 931.42
May	312 193	9 216.49
June	275 190	8 131.07
TOTAL	2 577 954	\$75 863.85

5.3 TRANSPORT

District Nurses use 1.3 litre Toyota Corolla cars for making visits. These cars cover between 2000 and 40 000 km per year, with the average being around 10 000 km per year.

Vehicles are leased, with a regular maintenance programme included. Operational costs for cars are budgeted at \$6 950.67 per year including administration, tyres, fuel, insurance, and the leasing cost. Of this \$1350 is allocated for fuel, based on 15 000 km per year. Operational costs work out to about \$0.36 per km, with \$0.09 per kilometre for fuel. Fuel is obtained at a reduced price of \$0.11 below retail.

5.4 WATER USE

Water consumption for the Home Health Services department is not known due to no separate metering on site. The results for the whole site are given below in Table 3.

Water conservation measures observed include use of dual flush toilets, and industrial dishwashers.

Table 3: Water consumption between July 1995 and June 1996.

MONTH	CONSUMPTION (m³)	COST (EX GST)
July 1995	1985	1976.18
August	1071	1066.24
September	1519	1512.25
October	1610	1602.24
November	1408	1401.74
December	1636	1628.73
January 1996	1382	1375.86
February	1306	1325.07
March	1409	1460.92
April	1308	1360.27
May	1563	1625.52
June	1228	1277.12
TOTAL	17425	\$17612.74

5.5 MEDICAL SUPPLIES

Medical supplies for Home Health Services cost \$174 000 for one year from May 1995 to April 1996.

Each District Nurse has a fairly standard kit that is made up at a store of the Central Sterile Supply Department (CSSD) located in Community Health Services. Between twenty five and thirty packs are made up each day. The packs consist of

- yellow bag (explained under medical waste disposal);
- water for irrigation;
- syringes and needles;
- swabs;
- bandage packs;
- non-sterile gloves;
- plastic and glass containers of solutions.

Other special supplies are provided separately depending on the patient's needs.

All supplies in the CSSD store have their respective prices displayed on the shelves. This is so the nurses can make judgements as to which is the most cost effective way of providing the required treatment.

5.6 OTHER SUPPLIES

Other main materials are paper for the support activities of the office and record keeping. This includes photocopy, facsimile machine, and other stationery supplies.

5.7 MEDICAL WASTE

Overall medical waste disposal costs for July to December 1995 are close to \$12 000, which would imply an annual cost of around \$24 000 for medical waste disposal. This is only the cost of disposal, and does not include the cost of the sharps containers or yellow bags.

Table 4: Medical waste disposal costs between July 1995 and December 1995.

MONTH	COST (\$)
July 1995	1 692.72
August	2 561.18
September	2 249.78
October	2 210.00
November	1 852.59
December	1 199.49
TOTAL	\$11 765.76

The figures above show winter as busiest period.

5.7.1 SHARPS

Dedicated puncture-proof yellow plastic containers are used for disposal of all needles and syringes. These are returned from use on site and stored in a secure compound away from general public access. They are then collected by a medical waste contractor, and the container and entire contents incinerated.

There are about nine sizes of sharps containers in use throughout the hospital, of which the district nurses from Home Health Services use two. Almost without exception this is a 1.4 litre capacity bin. These are a convenient size for transport during visits, and would be filled every two days at a maximum, although in many cases it will take much longer than this. It was not possible to get an accurate estimate of the quantity generated per year. No problems are reported in filling these to capacity.

The other size in use is the 4 litre bin, which is used for patients with acute infections. These bins are left in the patients home over the course of several weeks during which treatment takes place, during which many injections may be administered.

CONTAINER SIZE	PURCHASE COST	DISPOSAL COST
1.4 l	\$4.10	\$2.70
4.0 l	\$5.65	\$4.77
7.6 l	\$6.55	\$5.76

5.7.2 YELLOW BAGS

All other medical waste generated by the district nurses is disposed of in 710 mm yellow plastic bags.

Purchase cost is \$0.57 per bag, with a disposal cost of \$2.43 per bag. Contract removal charges are based on the number of full or half bags for disposal.

One estimate of the quantities generated is about 2 yellow bags per district nurse per day, which would come to about 6500 bags per year. This would represent a cost of \$16 000 per year for disposal, and \$3 700 for purchase. This seems overly high, considering that medical disposal costs for the whole site are less than twice this.

Bandages are reused on the same patient until soiled, and patients are encouraged to wash bandages at home themselves. Otherwise bandages are disposed of in yellow bags.

5.8 GENERAL SOLID WASTE

General solid or 'white bag' waste disposal cost is typically \$1 100 per month, or approximately \$13 000 per year.

Solid waste is collected from all over the hospital site and mainly disposed of in a 4.5m³ front load bin. This costs \$5.25 per week to hire, in addition to six services per week at \$34.00, giving an annual cost of \$10 881. Five services per week have been trialed, but this did not cope with the volume being generated.

A smaller 1.5m³ bin costs \$3.50 per week in hire, and \$15.00 per empty. This is emptied about three or four times per week. Annual cost for this bin is around \$2 500 per year.

The waste bins are undercover to prevent dumping of unauthorised waste by the public.

Composition includes glass, food wastes from staff-supplied lunches, food wrapping, medical supply wrapping, paper, and plastics.

Glass bottle recycling at North Shore Hospital did not work due to diminishing returns. As a consequence this has not been trialed at this site. Glass bottles are disposed of with other solid waste.

No plastics are recycled. This was trialed but the volume was not sufficient to be financially viable, as well as time required for sorting being a limitation.

District nurses of Home Health Services are not thought to be contributing a significant amount to general solid waste directly, as most waste from clinics and site

visits is disposed of through yellow bags and sharps containers. Most solid waste is from support activities, administration and left-overs from peoples lunches.

5.9 RECYCLED SOLID WASTE

5.9.1 KRAFT

Kraft cardboard is collected in an open-topped cage, which costs \$20 per month to hire. A service fee of \$7.50 per empty is charged, which is usually once per week. The quantities generated are not sufficient to qualify for free pickup. Total cost for one year is in the order of \$630.

During a site visit, polystyrene and other plastics were observed inside boxes to be recycled. This results from staff failing to remove all the packaging from the boxes. Additionally, most boxes were not compacted, which inflates the cost of disposal due to the extra volume these take up.

It is understood that a change in operating practices has helped improve these problems.

5.9.2 PAPER

Paper is collected in 240 litre mobile garbage bins by Paper Reclaim. This service costs on average around \$137.50 per month. This is made up of hire of 8 bins at \$2.50 per week.

5.9.3 FOOD WASTE

Food scraps from cafeterias are collected for recycling as feed at pig farms. This is at no cost other than for management on site.

5.9.4 FLUORESCENT TUBES

Fluorescent tubes are recycled (2 and 4 ft length) at a cost of \$0.99 cents each, and \$5 000.00 per year. This would not cost so much if there was a greater volume. Look at storing.

5.10 OTHER SOLID WASTE

5.10.1 CONFIDENTIAL DOCUMENT DESTRUCTION

Paper requiring confidential disposal is incinerated. This is collected in MGBs, which cost \$4.00 per month for rental, and \$12.60 per empty. There are 4 bins at Waitakere

Hospital, with an average of 4 empties in total charged per month. The bins come back washed. The cost over the last year has dropped by 32%.

5.10.2 COLOSTOMY BAGS

Enquiries did not establish whether an official system exists for disposal of used colostomy bags. The opinion of the district nurses spoken to was that they are probably disposed of through municipal solid waste collection, which is destined for landfill. This is a significant public health issue which requires further clarification.

5.11 CLEANER PRODUCTION PROGRAMME

The initial seminar introducing staff to Cleaner Production generated interest from the district nurses, but they felt that time would be a severe limitation on their involvement. Sufficient time was not allocated, and the programme did not become established in the Community Health Services department because of this.

It is now thought that a Cleaner Production programme will be facilitated through the Health and Safety Committee on site. This committee consists of about 20 members, whose purpose is to monitor occupational health and safety on site. The structure includes people from different organisational levels and departments, and meets weekly.

6.0 DISCUSSION

6.1 ENERGY USE

Electrical usage is greatest between May and August, the most busy time at the hospital. Average consumption per month is 107 184 kWh, with a standard distribution of 9 960 kWh, or 9.3% of the average. Peak usage of 125 238 kWh in July 1995 is 33% greater than the lowest reading of 94 119 kWh in January 1996.

Gas average consumption is 214 829 kWh per month. The distribution is even more exaggerated than that of electricity, due to the minimal use in summer and intense use in the colder months of May through August. The standard distribution is 108 046 kWh, or 50% of the average.

6.1.1 ENERGY ANALYSIS AND CONSERVATION MEASURES

The annual cost of \$121 000 may merit a detailed energy audit of the hospital to ensure that the most appropriate sources of energy are employed, and they used as efficiently as possible.

In order to do this, it is necessary to have sufficiently detailed records available which will allow determination of the distribution of energy consumption by end-use. This

would allow for identification of areas with the greatest energy savings potential. From here the need for more detailed investigation may be indicated.

The nature of the hospital operations may not allow for a direct comparison of energy use to output, i.e. kWh versus patients. A more suitable approach would be to compare energy consumption per m² of floor area per year with known industry standards, and try and reduce this ratio.

Particular options which may be of relevance to the hospital are:

1. Process options
 - Identification of new and more efficient processes, particularly in older plant
2. Review of purchasing arrangements
 - Off- peak water heating
 - Use of night-rate storage heaters
 - Interruptable tariffs for non-essential equipment
3. Energy options
 - Consideration of alternative fuel sources such as LPG, CNG, coal, renewable energy
 - Co-generation
 - On-site generation
 - Renewable energy sources
4. Operation and Maintenance
 - Temperature and timing control of how water heating
 - Seasonal settings for air-conditioning
 - Maintenance of boiler and steam distribution pipelines
 - Insulation of pipes
5. Retrofit options
 - Lighting timers, movement sensors, improved reflectors, alternative types
 - How water insulation, heat pump, solar heating, thermostat control, low-flow control, instant heating
 - HVAC controls and placement, economy cycles, cold storage, night rate electric storage heaters
 - Building double glazing, insulation, shading, infiltration control, Passive solar energy design

6.1.2 CO-GENERATION

The coincidence of highest demand for gas and electricity would suggest some potential for co-generation. Extraction of both electrical and heating energy from the gas has the potential for significant savings should this be found to be a practical option. There are however some obvious limitations on this option.

With current heating requirements, at no time does the potential co-generation capacity exceed electricity demand on site. This is significant as revenue from exporting excess electricity during winter is favourable to the economics of a co-generation set.

During the winter months of June, July and August, a co-generation set has the potential to provide 65% of the sites electricity requirements, based on a typical 23% efficiency of conversion. During December, January and February, this electricity potential drops to 21%.

The use of gas in summer to provide electricity would result in excess heat being generated, and the cost of the electricity generated being pushed up close to \$0.15 per kWh. The economic generation potential is therefore limited to winter only.

A decreased reliance on national grid electricity would be a factor in favour of co-generation. Current emergency electricity generation is from the diesel generator, and this could provide a double back-up system.

6.2 TRANSPORT

The geographic area served from the Waitakere base is large, extending from New Lynn in the south to Helensville in the North, and from the West Coast to Greenhithe in the east.

Visits are made to peoples homes, based on the condition of their health and their personal circumstances, and therefore supply an essential service which cannot be cut back on.

The maintenance programme included in the vehicle lease should ensure that the cars are operating as efficiently as possible.

6.2.1 ALTERNATIVE FUELS

Consideration has been given to operating the cars on CNG instead of petrol. This has been decided against, mainly because of the lack of availability in certain areas of refuelling stations. Even though some cars could operate within areas where CNG is available, the ability to swap cars around within the fleet is necessary.

Other perceived disadvantages are the decrease in power that would result, and the room the cylinder would take up inside each car. This would also be a drawback of LPG.

A switch to CNG or LPG would have the advantage of reducing emissions of aromatic hydrocarbons to the atmosphere. This would minimise adverse health effects of automobile use. Even if the practicalities of its use could be sorted out, the economics would be have to be carefully determined to ensure that the payback from fuel savings

would offset the installation and maintenance costs of the equipment over the life of the vehicle lease.

Consideration could be given to diesel powered vehicles when replacing fleet vehicles. Diesel has less damaging emissions and is cheaper for a given mileage. The cost or availability of leasing small diesel powered cars may not be viable. Also the use of diesel in small cars may produce unacceptable vehicle performance, given the comments amount the lack of power from the current 1.3 litre petrol engines.

6.2.2 BASING CARS AT STAFF RESIDENCES

Productive time is lost coming in to collect and drop-off cars at the hospital at the start and end of each day. If nurses were to take the vehicles home after work, this would enable them to minimise this lost time, but fringe benefit tax may then have to be paid. This cost must be balanced against the advantages of saving time, and money on the need to provide parking. Sufficient supplies would also have to be carried by the district nurses to last several days.

6.3 WATER USE

At 17 000 m³ for the last year, Waitakere Hospital is one of the largest users of water in Waitakere City. The pattern of consumption shows no clear seasonality, but shows significant variation each month, with a range of 63% of the average, and a standard deviation of 15.5% of the average. It is not known whether this variation results from greatly unequal intervals between the meter readings, or for other reasons, such as variation in patient numbers.

Monitoring of individual areas through increased metering would allow the highest use areas to be identified, prioritised and investigated. It would also identify anomalies in consumption that might indicate leakage.

Simple options which are easy to implement are use of dual flush toilets, low-flow shower heads, sensors on urinals, and water-efficient industrial dishwashers. It should be clarified as to how widely these are used throughout the whole site, and further possibilities for their use sought. These and other measures identified should be backed-up with a preventative maintenance programme, and staff and patient awareness of best practices.

6.4 MEDICAL WASTE PRODUCTION

It has been suggested by waste managers that in the hospital situation in general, greater than half of the material contained in sharps containers and yellow bags may not require disposal through this method. This proportion may not be an accurate indication for all departments, and is not likely to be the case for Home Health Services. This is of concern because of the high cost of infectious waste disposal through incineration.

One reason quoted by some staff for excess medical waste generation is the time limitation of seeing to patients quickly, where staff do not have time to deliberate on the correct separation of wastes. Staff will tend to err on the side of safety and put more material in the medical waste stream. However, an appropriate amount of care must be taken under all circumstances to ensure that health and safety considerations are not compromised. Part of fulfilling this is to ensure that all infectious wastes are disposed of appropriately. The corollary of this is that all non-infectious wastes should be identified and disposed of to their appropriate receptacles. In any case, the limited range of supplies being dealt with by some departments should make the process of separation relatively automatic after a time.

It was demonstrated during a site visit to North Shore Hospital that yellow bags often contain wastes that under no circumstances should be introduced to this waste stream. Polystyrene cups were visible through the walls of yellow bags, indicating inadequate staff awareness of and/or commitment to correct disposal. Promoting a greater awareness and hopefully motivation in staff in this may be of use in reducing excess infectious waste.

To make waste separation practical, the appropriate receptacles must be provided within easy access. Where a sharps container or yellow bag is, a white bag for general waste, and where appropriate, containers for collection of recyclable materials, should also be provided. This extends to the District Nurses taking white bags with them to home visits.

There may be a grey area of understanding as to why some wastes thought to be non-infectious by the waste managers end up in infectious disposal. Tackling this problem would be better facilitated through a Cleaner Production programme, getting input from all infectious waste generators.

6.4.1 HOME HEALTH SERVICES

These produce a small and predictable range of wastes, being the used products themselves and usually all the packaging, perhaps up to one third of a container by volume. The packaging is often contaminated through contact with the instruments used to apply, for example, a pack of wound dressings. This contains

- gauze swabs (x6)
- sterile field (x1)
- plastic forceps (x3)
- dressing towel (x1)
- dressing tray (x1) with galliputs

Of the swabs, three of four may be used typically, with the others going to waste.

All waste generated from packaging is disposed of in yellow bags for infectious disposal. Most of this will be contaminated from handling while administering the treatment. Changes in handling practices when suggested to a district nurse were felt to be a trade off in hygiene. Even so, this area should be investigated further. There is

a need to involve the district nurses and staff in general to see what can be done to help minimise waste production.

6.5 NON-INFECTIOUS WASTE

Unsorted solid waste disposal for the whole hospital is costing around \$13 000 dollars per year. Other costs not factored into this are the cost of collection and management on site, and the replacement cost of the lost resources going to waste.

Minimising solid waste production requires an understanding of the entire background for waste production, including:

- what the waste is;
- how much it costs to replace, manage and dispose of;
- where it comes from;
- why it is being generated;
- what alternatives there are.

The key to improved waste management then is accurate monitoring of waste volume and composition by area or activity. This information is not currently compiled. A detailed sort of general solid waste may help to identify what potential for prevention or reduction at source, reuse and recycling there is. Options could then be identified and evaluated in detail before implementation and further monitoring to measure effectiveness.

Ongoing staff training and involvement in any measures is important as to what wastes require infectious disposal, what can be separated for recycling.

Wastes diverted for recycling such as kraft, paper and cafeteria food scraps may have further potential for reducing the amount or management cost of solid waste generated.

- Recycling of paper may be extended to confidential documents through shredding and disposal with regular paper
- Diversion of cafeteria food scraps waste to pig farms may be expanded to include food wastes from throughout offices.

Additionally, the potential for recycling of glass and aluminium should be reviewed periodically to see if quantities generated and costs incurred would make this viable.

At the moment, there is little financial incentive for disposing of confidential documents through recycling, as the price available for incineration is very competitive. This is undertaken by the same contractor that incinerates medical waste.

The possible disposal of colostomy bags in municipal solid waste is an important public health issue that needs to be addressed. It should be investigated to see whether this is occurring, and a system devised for alternative disposal if required.

Reducing waste disposal costs is a high priority for Waitemata Health, but this is not the only priority given to awarding contracts. The current three year contract has

nearly expired, and the tender documents will call for proposals for other disposal methods. The process for considering alternative methods is not understood to be linked to a formal policy for environmental management of waste, but is economically driven. Provision of a formal policy, as part of an overall environmental policy, would allow for standardised economic and environmental evaluation of waste disposal. Cost will still be an overriding factor in any option.

6.8 ESTABLISHING A CLEANER PRODUCTION PROGRAMME

The existing Health and Safety Committee would seem to be the ideal forum for Cleaner Production. This has representation from different levels of staff and management, which is desirable to make use of experience gained 'at the coal face'. Obvious practical solutions may in this way be accessed by management and implemented.

The basis of the programme should be an environmental policy, which state management commitment, and sets the scope and direction of the organisation's environmental management. It is understood that Waitemata Health does not currently have an environmental policy statement.

Minimising resource use and waste generation, and therefore environmental impact, is an ongoing process. A lot of input is required over a long time to come to solutions that suit the majority of staff and patients. Many solutions will not be technically or equipment based, but be dependent on staff attitudes and work practices. This will require allocation of responsibility and coordination through several departments.

Reducing waste generation is a continuous process of refinement, depending a great deal on the attitudes and practices of the people who generate the wastes. A Cleaner Production programme is the ideal forum for dealing with this issue.

7.0 CONCLUSIONS

7.1 ENERGY USE

The annual energy cost of \$207 000 merits detailed investigation into energy efficiency measures. Potentially large paybacks on older equipment and plant may well justify capital outlay for upgrading of plant, as well as other measures.

The possibility exists for co-generation of electricity from natural gas burnt in the boiler. This may supply up to 65% of electricity requirements during winter months, but the greatly reduced heating requirement during summer makes this an uneconomic year-round proposition. The possibility of co-generation is still worth investigating, and Enerco Gas should be approached for more detailed information.

Evaluation of co-generation should be made as part of a complete package of energy efficiency measures, not in isolation. These include the process, purchasing, fuel type, operation and maintenance, and retrofit options detailed in section 6.1.1.

7.1 TRANSPORT

The nature of the service provided by Home Health Services dictates that much of transport use will be in less urbanised areas where alternative fuels are not as readily available. Retaining the ability of vehicles to operate on petrol as well as an alternative fuel would get around this problem. This would however compromise the payback period on an alternative fuel conversion, and staff might be prone to operating the vehicles solely on petrol. The amount of room available in the car might also be unacceptable.

The constraint of swapping vehicles around within the fleet limits the ability to have dedicated alternative fuelled cars operating only in areas where that fuel is available.

Basing vehicles at staff homes may incur fringe benefit tax, but would reduce transport use and increase productive time. Exemptions from fringe benefit tax should be investigated.

7.3 WATER USE

Detailed information on water end uses is not gathered currently. Baseline monitoring to ascertain the largest uses of water would enable these to be prioritised for minimisation. It would also determine whether variations in meter readings are due to unequal meter reading intervals, a result of fluctuating patient numbers, or for other reasons. This should be determined through detailed monitoring, to allow for identification of water use reduction measures.

Some smaller measures which have a significant cumulative effect on reducing water consumption are preventative maintenance, use of dual flush toilets, urinal sensors, and low-flow shower heads. These are in part implemented on site but further opportunities for their employment should be sought.

7.4 MEDICAL WASTE PRODUCTION

A large proportion of the waste managed through infectious disposal and subsequent incineration does not necessarily have to be managed by this method.

This excess results in higher waste management costs, and arises from:

- Contamination of medical supply packaging materials during patient treatment,
- Unused sterile dressings from multiple packs being disposed of in yellow bags;
- Non-availability of alternative receptacles for general disposal or recycling;
- A lack of awareness and/or commitment to reducing infectious waste disposal quantities on the part of waste generators.

Appropriate care must be exercised at all times to ensure the safe disposal of infectious waste. As part of this process, the correct operational practices of staff should make it possible to eliminate non-infectious waste from the infectious waste stream.

Not all the contributing factors to medical waste generation are well understood, and this will need to be addressed by the waste managers to effectively tackle the problem. This would be best facilitated through the forum of a Cleaner Production programme team.

7.5 NON-INFECTIOUS SOLID WASTE

Accurate monitoring of waste volume and composition is necessary to determine reasons for generation and options for reduction.

A detailed waste analysis would be useful to determine the further potential for recycling of other materials, and indicate how effectively recycling measures are functioning.

Solid waste management methods at present incorporate recycling of paper, kraft and cafeteria food scraps, but not aluminium, glass, or plastics. Current recycling of materials should be extended to include all suitable materials as identified by a solid waste analysis.

The economic viability of alternative disposal methods should be periodically reviewed, to allow for adoption of more environmentally desirable disposal practices as they become viable.

Single-use items such as disposable cups should be targeted for replacement where suitable alternatives can be found. This is one example of what a waste management policy should clarify as part of an overall environmental policy statement.

7.6 CLEANER PRODUCTION

A Cleaner Production programme is needed to achieve staff input and coordinate long-term solutions to environmental problems. The Health and Safety committee would be a suitable forum for this, having multi-level staff representation from most departments on site.

An environmental policy statement is required to set the focus and scope of the Cleaner Production programmes, as well as assure management commitment to the initiative.

The attitudes and operational practices of staff are important to the success of any environmental options. Publicity of changes and staff training should be provided to

promote the effective implementation and functioning of an environmental management programme.

8.0 RECOMMENDATIONS

8.1 ENERGY USE

A detailed investigation of energy use is recommended to:

- Identify main consumers of electricity and reasons for use;
- Prioritise areas for improvement based on known industry standards;
- Evaluate the viability of energy options.

Co-generation of electricity from natural gas burnt for heating purposes should be investigated as part of a total package of:

- Process;
- Purchasing;
- Fuel type;
- Operation and maintenance; and
- Retrofit options.

8.2 TRANSPORT

The use of petrol-powered vehicles should be re-evaluated periodically, to determine it is still the current best option.

Consideration should be given to basing district nurses at home to increase productive time, and also reduce transport use required to collect and return vehicles each day. The criteria under which fringe benefit tax applies should be defined.

8.3 WATER USE

Detailed monitoring of water use is recommended to:

- Identify main end uses;
- Identify consumption patterns;
- Prioritise areas for improvement;
- Identify any leakages;
- Evaluate options for reduction.

Water reduction measures should be implemented over the whole hospital site where not already in place, and include:

- Dual-flush toilets;
- Urinal sensors; and
- Low-flow shower heads.

8.4 MEDICAL WASTE

Receptacles for separation of other waste streams should be provided wherever there is an infectious waste container. Staff awareness of best practices and costs should be promoted.

The appropriate disposal of colostomy bags should be investigated, and a system put in place if required.

Changes to handling and usage practices within Home Health Services and throughout Waitakere Hospital in general should be investigated to minimise contamination of packaging.

A greater understanding of medical and other waste generation in general should be developed through the forum of a Cleaner Production programme.

8.4 NON-INFECTIOUS SOLID WASTE

It is recommended that a waste audit, using Waste Analysis Protocol (MfE 1993) or similar, is conducted to determine waste source, composition and production accurately.

Based on viability suggested by waste audit results, options should then be identified and evaluated, with preference given to:

- Prevention/reduction;
- Reuse;
- Recycling; ahead of
- Treatment;
- Disposal;

The non-recycling of other parts of solid waste stream should be periodically reviewed, namely glass, plastics, and organics not already collected. Existing recycling of paper, kraft and cafeteria food wastes should be extended wherever possible.

Alternative disposal methods should be periodically reviewed to ensure viability of best practices.

Receptacles should be provide for separation at source of waste components.

District Nurses should carry white bags for collection non-infectious waste.

Consultation between waste generators and waste managers is recommended to identify and mitigate reasons for waste generation.

An overall waste management strategy should be moderated by a Cleaner Production programme.

Ensure compaction of kraft boxes and separation of other packaging

Consideration should be given to a purchasing policy which favours reusable/recyclable materials.

The effectiveness of waste disposal methods should be reviewed periodically.

8.5 CLEANER PRODUCTION PROGRAMME

It is recommended that an ongoing Cleaner Production programme be established using the existing Health and Safety Committee as a forum.

An environmental policy statement should be adopted by Waitemata Health, to secure management commitment and set the focus of the programme. This should be developed with the input of staff and other interested parties.

The Cleaner Production programme team should promote staff awareness of environmental issues, including resource use and waste production, and publicise Cleaner Production projects.

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EXECUTIVE SUMMARY

Waitakere Hospital, operated by Waitemata Health, is located on Lincoln Road in Henderson, Waitakere City.

The hospital has been the subject of a waste audit and Cleaner Production investigation as part of Waitakere City Council's Cleaner Production Partnership Programme (CP3).

It was decided to focus on the Home Health Services department of Community Health Services as an initial place to establish Cleaner Production. This department is responsible for home visits to patients for a variety of treatments and home care, provided through its thirteen district nurses.

A staff seminar, a walk-through audit and staff interviews were performed to carry out this study. Resource use and waste production information was also provided by Waitemata Health.

The hospital in general is a significant consumer of electricity, gas and water. Home Health Services is particularly dependent on use of cars for fulfilling its functions.

Main wastes produced comprise infectious medical waste, and non-infectious solid waste. Some recycling of solid wastes is operational.

It was concluded that there were several areas in which immediate improvements could be made, and others which should be periodically evaluated.

Key recommendations of this report involve:

- Detailed energy investigation, and consideration of electricity co-generation from gas heating as part of an overall programme of energy efficiency measures;
- Consideration of basing district nurses of home health services at home to minimise time and resource demands of transport;
- Detailed monitoring of water use and implementation of water reduction measures;
- Provision of receptacles for separation of waste at source, changes to medical waste handling practices, and investigation of appropriate disposal methods;
- Detailed analysis of solid waste composition, extension of recycling to other waste streams, development of an overall waste management strategy, and review of waste disposal methods periodically;
- Adoption of an environment policy by Waitemata Health to secure management commitment and set the scope of environmental management,

- Establishment of a Cleaner Production Programme utilising the existing Health and Safety Committee as a forum, and promotion of awareness of environmental issues and projects.

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