A CASE STUDY OF WASTE MANAGEMENT AT ROYAL DEVON AND EXETER HOSPITAL

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SUMMARY

This project was undertaken to better understand the waste management processes at Royal Devon and Exeter Hospital. Process mapping of the waste pathways was first conducted with the management level employees responsible for waste management across the hospital site. The process by which the different types of waste flowed from disposal at the ward/department level to collection by the external waste contractor and the locations in which waste was stored were mapped out. Hospital employees completed a questionnaire, developed by two medical students, about their current perceptions and use of recycling systems and their concern about wastes which are not currently recycled at the hospital.

The process for disposal and collection of clinical wastes has been well refined and simplified. Much of the clinical waste is stored at the ward/department level, collected by the hospital waste team and taken to a single storage area before collection by the external waste contractor. Domestic waste follows a similar simple process with the addition of compaction to reduce the volume of the waste. By compacting the domestic waste prior to collection by the external waste contractor, the hospital has been able to reduce the number of

times per week that domestic waste is collected, thereby reducing the cost of domestic waste disposal.

Recyclable wastes have the most variegated disposal pathways. Different hospital teams are responsible for the collection of different wastes from the wards/departments around the hospital. The different recyclable wastes are also stored in different areas due to the need for segregation and collected by different external waste contractors.

The majority of the waste around the site flows from the wards/departments to either the energy centre or the estates yard within the hospital site. This centralised method of waste storage allows the wastes to be monitored, kept secure and collected easily by the external waste contractors.

The questionnaire revealed that the majority of hospital employees are aware of the recycling facilities that are available to them. However, a large minority of hospital employees are not aware of what wastes can be recycled and where to recycle them. The employees also thought that more could be done to recycle wastes around the hospital, but not all employees were equally concerned about these issues.

The health and social care waste management behaviour improvement framework is used to highlight the main factors to consider when trying to change employee waste management behaviour. Information about appropriate waste management practices, recycling and why these waste management practices are important in the wider relationship of the hospital and the environment. It will be useful to provide all employees with this information during both training sessions and the everyday workplace environment. This will help the hospital employee's 'workplace-self' to know how to recycle all types of waste and the necessity of these practices in relation to their work role and the wider environmental context.

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1 INTRODUCTION

This project was initiated by the Royal Devon and Exeter (RD & E) hospital to help them better understand the structure, layout and use of the hospital waste management system. This information, collected and consolidated during the course of the project, could then be used to inform changes to the waste management system, future waste management contract tenders and employee training.

The project involved firstly bringing together all of the disparate pieces of information about waste management at the site. The next stage was to use this information as the basis for a process mapping session with the members of the hospital management team responsible for waste management at the hospital.

The process mapping session involved using maps to identify the location of waste storage areas across the site. The next stage of the process mapping session was to identify the types of storage bins available and the number of bins available in each location. Once this had been achieved the final stage of the process mapping process was to determine the process through which the different types of waste moved through the system from the point of disposal to removal from the hospital by the waste contractor.

To accompany the process mapping, a questionnaire about waste management practices at the hospital was conducted with hospital employees by two medical student's; Nicole Needham and Kate Penny. The questionnaire was conducted by Nicole and Kate as part of the RD & E Hospital sustainability week. The questionnaire focused on understanding what employees thought about current waste recycling practices, what they knew about recycling at the hospital and how they thought recycling in their department could be improved.

This report will discuss and assess the waste management process at RD & E in terms of the types of waste to be found at the site and the process by which they are disposed. The organisation of the waste streams and the movement of the waste around the site will then be presented using site maps to contextualise the discussion. The findings from the questionnaire will then be discussed in terms of the current waste management system presented in the preceding sections. The report will conclude by drawing together the main observations from the process mapping and questionnaire findings highlighting good practice and where improvements to the waste management system could be made in the future.

2 THE WASTE STREAMS

The Royal Devon and Exeter (RD & E) hospital is currently producing 24 main types of waste at the Wonford site. These wastes include; confidential wastes, clinical wastes, recyclable wastes, furniture, waste electrical and electronic equipment (WEEE), IT equipment, printer toner cartridges and chemicals. The

process maps for the various waste types will be discussed under the headings of; clinical wastes, domestic wastes, confidential wastes and recyclable wastes.

The format in which the process mapping of the various waste streams has been presented provides several pieces of information for each waste type. The process map moves from the waste type to how that waste is stored at the ward or department level, then to how that waste is transferred to the external waste storage area. The containers used to store a specific waste type once at the external waste storage are then described followed by the frequency with which the waste is collected by the external waste contractor. The final disposal location of the waste is then stated if known and the processing method by which the waste is disposed of is the last piece of information.

2.1 Clinical wastes

The disposal of clinical wastes at RD & E has been simplified due to the use of a single disposal process for several clinical waste types. The clinical waste disposal process described in Figure 1 applies to; cytotoxic/cyctostatic waste, pharmaceutical waste, sharps, potentially infectious clinical waste (including anatomical waste), offensive waste and implanted and contaminated WEEE.

The various types of clinical waste are disposed of in their relevant containers on the wards. Potentially infectious clinical waste is disposed of in the yellow bin bags and for anatomical waste this will involve double bagging the waste and then placing that inside a hard shell plastic container. All sharps waste is disposed of in hard shell container, cytotoxic/cytostatic and pharmaceutical wastes are also disposed of in hard shell containers with purple lids for the cytotoxic/cytostatic and blue lids for pharmaceutical waste. Offensive waste is stored in orange bags (with a black stripe?) and it is comprised of waste which is not likely to be infectious but is not suitable for disposal in landfill such as nappies, plasters, bandages and plaster casts.

These wastes are stored in the disposal room on the ward or a nearby 770 litre clinical waste bin which, as will be discussed in Section 3, are sometimes located nearby to the ward entrances. All of the clinical waste produced by a ward or department will be collected by the hospital waste team. The waste team operates 16 hours per day, they collect the waste from the disposal rooms on the wards and the 770 litre bins from the corridors using tug vehicles. The clinical wastes are taken to the external waste storage area and are collected from this location by the external waste contractor twice daily. The waste contractor takes the waste to an incinerator in Cornwall where the incineration of the waste takes place. (No information about final disposal of fly and bottom ash?).

Clinically contaminated mattresses have a slightly different disposal pathway to other clinical wastes. Due to the size of the mattresses and the practicality of storing them, they are collected by porters from the ward/department where they originate. The mattresses are then stored in the energy centre which is the main waste storage area. Once 30 mattresses have accumulated for collection, Peakes the external waste contractor for clinical wastes is con-

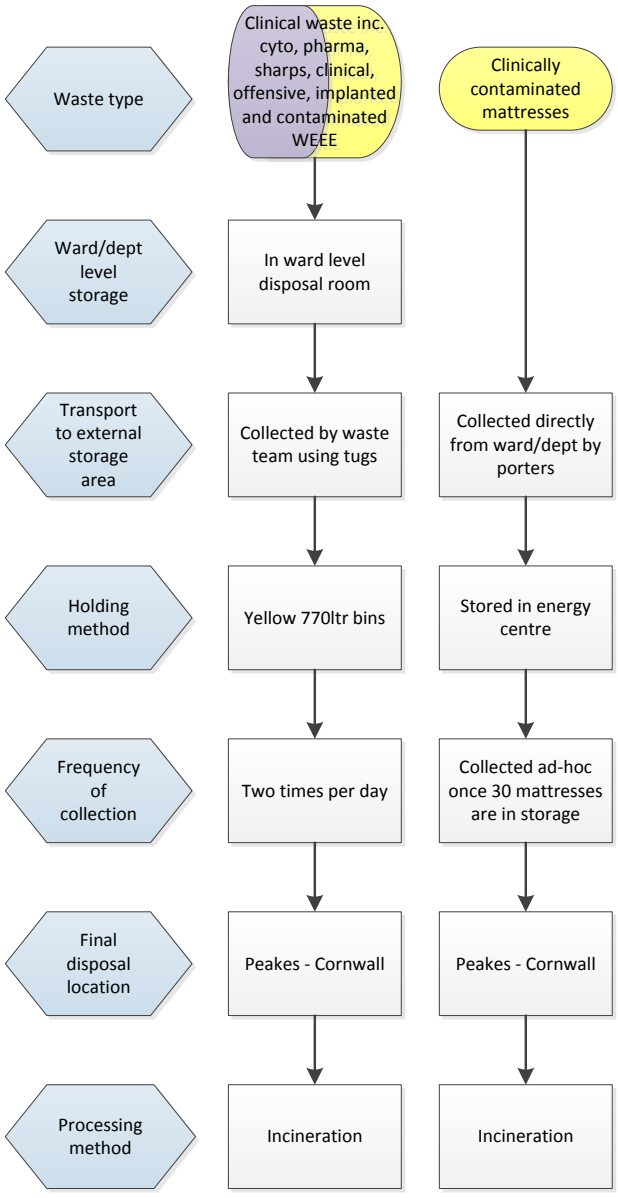

Figure 1: Process maps for the storage and disposal of clinical wastes at RD & E Hospital

tacted. The mattresses are collected and taken to Cornwall for disposal by incineration.

2.2 Domestic wastes

Domestic wastes are comprised of waste which is both non-clinical and non-recyclable, their disposal pathway is described in Figure 2. Domestic waste is disposed of in black (or clear?) bags on the wards and departments around the hospital. Some areas of the hospital have small compactors for domestic waste, whether compacted or not the waste is stored in the disposal rooms or in 770 litre waste bins in close proximity to the ward/department. As with clinical wastes, domestic waste is collected 16 hours per day by the hospital waste team. The domestic waste is taken to the external waste storage area at the energy centre. There any waste that has not been compacted at the ward/department level is compacted and stored in 1100 litre bins. The external waste contractor collects the domestic waste from the energy centre two times per week. This waste is then disposed of by landfill at either Bovey Tracey or Newton Abbot.

Furniture which is not able to be recycled is also treated as domestic waste and disposed of by landfill. Old furniture is collected by the porters from where it has previously been in use around the hospital site. Reusable furniture is separated and stored for re-use. All other furniture is broken down and anything that cannot be recycled is stored at the energy centre as domestic waste, then collected during the twice weekly collections of domestic wastes.

2.3 Confidential wastes

The process by which confidential paper waste is disposed of in the hospital is described in Figure 3. The storage of confidential paper waste at the ward/department level varies. This is because the hospital shreds its confidential waste on-site, so standardised secure bins are not provided by an external waste contractor at the ward/department level. When confidential paper waste is collected by the waste team it is taken to a secure store beside the energy centre to be shredded. By shredding the confidential paper waste on-site the hospital is able to have the shredded paper waste collected by an external waste contractor as recycling. The disposal of recyclable waste is less expensive than the secure disposal of confidential waste by an external party. The shredded confidential paper waste is collected two times per week for recycling.

Confidential data in a non-paper format such as video, film, photographs and CD's, is disposed of in the same way as clinical waste. The non-paper confidential waste is disposed of in the sharps bins at the ward/department level and once full the sharps bins are stored in the ward level disposal room. The sharps bins containing the non-paper confidential waste are collected by the waste team and taken to the energy centre where they are stored in yellow 770 litre bins. The clinical waste is then collected twice daily by the external

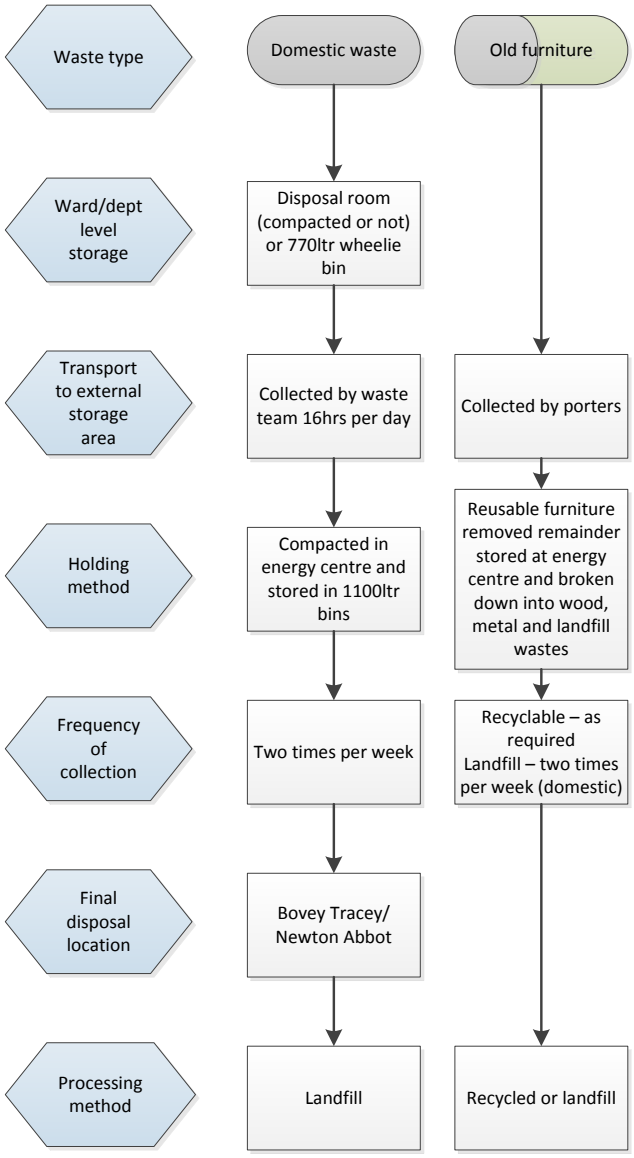

Figure 2: Process maps for the storage and disposal of domestic wastes at RD & E Hospital

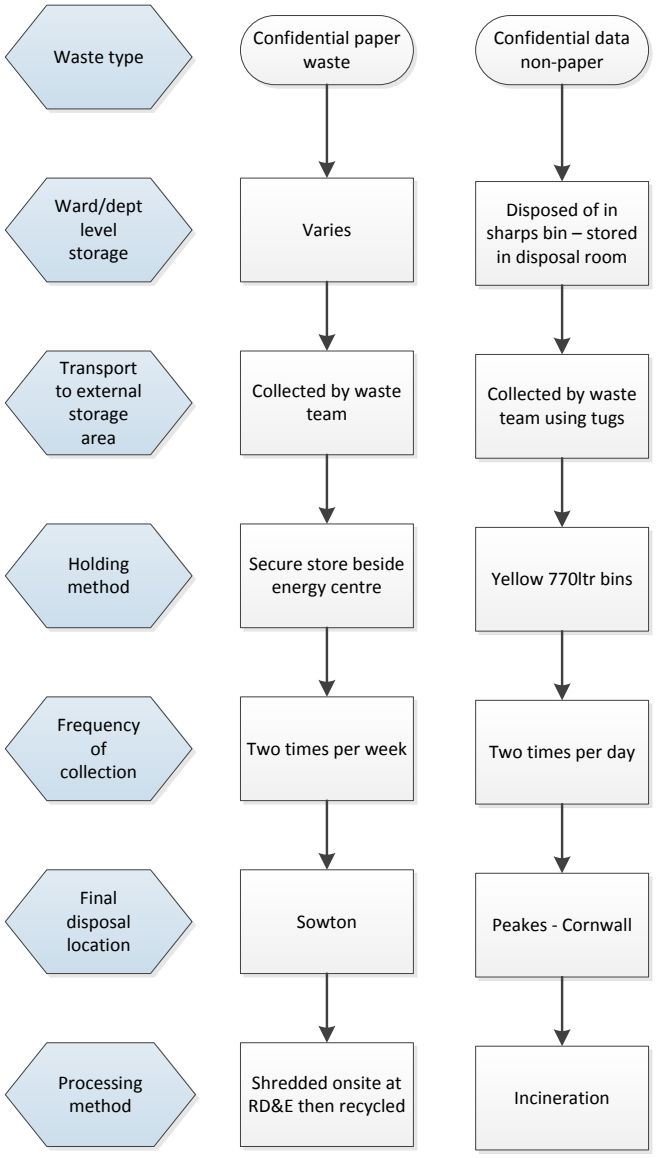

Figure 3: Process maps for the storage and disposal of confidential wastes at RD & E Hospital

waste contractor. The sharps bins containing non-paper confidential waste are disposed of by incineration by Peakes at a site in Cornwall.

2.4 Recyclable wastes

The recyclable wastes are the most varied in terms of segregation and disposal pathway. This is a common trait of recycling systems due to the segregation requirements and specific material preferences of external waste contractors. It is uncommon for a single waste contractor to collect a large number of recyclable material types due to their access to markets where the raw materials can be resold for a profit. The disposal pathways for the various recyclables wastes produces at RD & E are illustrated in Figures 4, 5, 6 and 7.

Non-confidential paper waste is disposed of by the company Paperchain, they provide storage tubes to the wards/departments who have requested non-confidential paper waste recycling facilities. The non-confidential paper waste is collected by the waste contractor directly from the ward/department where the storage tube is located. The frequency of these collections varies depending on the agreement between the ward/department and the waste contractor.

Cardboard waste is produced in different areas around the hospital site and they have different methods for storing the waste. Cardboard waste produced on the wards is stored in the ward level disposal rooms, cardboard waste from estates is stored in a cage located in the estates yard and that produced by the shops located within the hospital is stored in wheelie bins. All of the cardboard waste is collected by the waste team who transport it to the energy centre. All of the cardboard waste is bulked and baled at the energy centre, in this form it can be sold to the waste contractor for recycling. The baled cardboard waste is collected from the hospital by the external waste contractor DCW once per week for recycling at their plant on the Marsh Barton industrial estate.

Where mixed recycling is in-place around the hospital site, the waste is stored in the disposal room at the department level. There are currently no mixed recycling bins available on the wards but there are plans to introduce these in the near future. The benefits and considerations for introducing mixed recycling across the entire hospital will be discussed in Section 5. Mixed recyclable waste generated by the canteen is taken directly from the bins within the canteen to the waste storage area at the energy centre by the canteen employees. Mixed recyclable waste is stored in 1100 litre bins at the energy centre until it is collected by the external waste contractor DCW on a weekly basis.

Batteries, accumulators and uninteruptable power supplies (UPS) are either stored in battery tubs at the ward/department level or taken directly to the energy centre if they are large or of a specialist nature. The battery tubs and large or specialist wastes are collected by the waste team or medical electronics if they must be disconnected from equipment prior to transport or require special handling during transport. Once the waste batteries, accumulators or

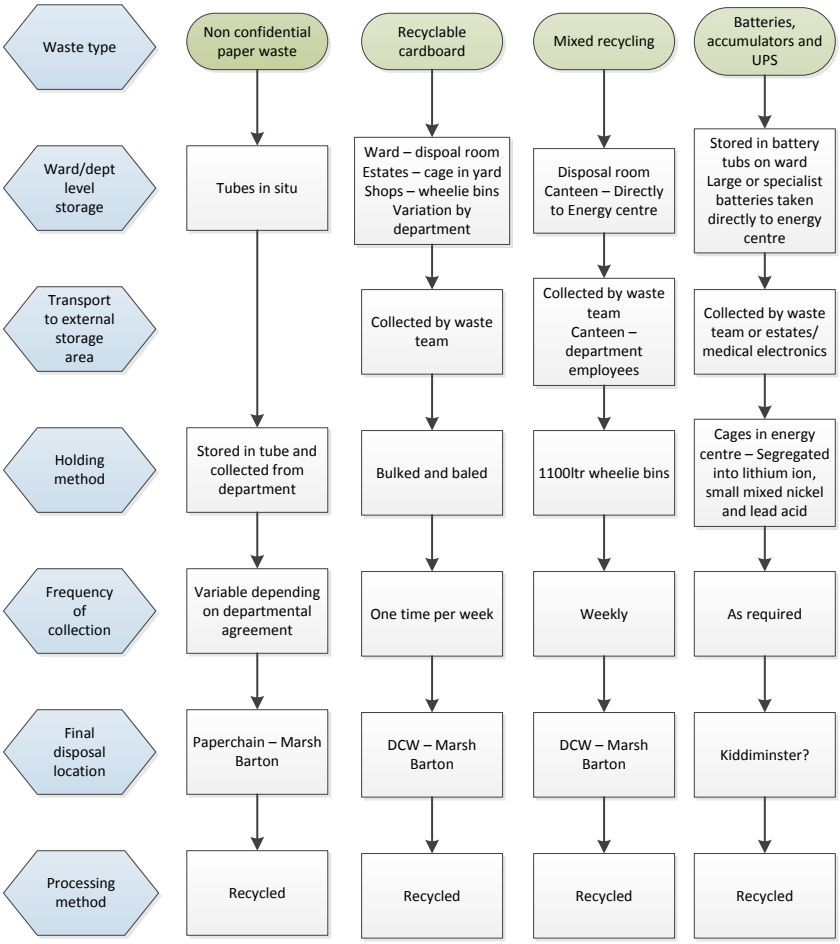

Figure 4: Process maps for the storage and disposal of recyclable wastes at RD & E Hospital part 1

UPS's reach the energy centre they are separated and stored in cages by type e.g. lithium ion batteries, small mixed nickel batteries, lead acid batteries and other related equipment. Batteries, accumulators and UPS's are collected by an external waste contractor for recycling on an ad-hoc basis once a sufficient amount have accumulated.

Florescent strip light bulbs are one waste that is found in all healthcare buildings. When these are changed by the estates team at RD & E hospital they are taken away and stored in a purpose built unit in the estates yard. Waste florescent strip light bulbs are collected by the external contractor for recycling when the storage unit is full.

The ever increasing use of technology and electronic equipment in healthcare has lead to more waste electrical and electronic equipment (WEEE) being produced. This waste is stored on the ward/department in a safe place until it can be collected. The employees on the ward complete a collection form which is sent to the waste team who come and collect the WEEE. The waste team then take the WEEE from the ward/department to the estates yard where it stored in large containers. Once these containers are full they are collected by the external contractor and the WEEE is taken away for recycling.

Medical electrical and electronic equipment refers to all equipment that comes under the remit of the medical electronics team, this is mainly comprised of electronic equipment used for medical diagnosis and treatment. When such equipment is disposed of it will be removed by the medical electronics team. The medical electronics team will make a decision on whether or not the equipment is suitable for reuse. If suitable for reuse the equipment is sent to auction. If the waste equipment is not suitable for resale then it is taken to the estates yard and follows the same pathways as WEEE. The waste medical electrical and electronic equipment is stored in the estates yard until it is collected for recycling by the external waste contractor.

IT equipment which is broken or to be replaced is stored on the ward/ department where it has originated. It is then collected by the hospital IT department who will assess the equipment to see if it can be reused internally. If the equipment cannot be reused internally then it is sent back to the IT contractor who will refurbish the equipment for reuse or recycle the components.

At the ward/department level chemical waste is stored in control of substances hazardous to health (COSHH) regulations compliant containers. These containers are collected by the waste team and taken to the energy centre where the chemical waste is either stored in a secure locker or appropriate container. Chemical waste is then collected by the external waste contractor on an ad-hoc basis once a sufficient amount has accumulated. An estimated 85% of the chemical waste produced by the hospital is recycled and the remainder is incinerated.

Scrap metal from the hospital site is collected by the estates team or the waste team as it is produced. This waste is then stored in a skip in the estates yard which once full is collected by the external waste contractor and taken away for recycling.

Old furniture which is suitable for recycling is collected from the ward/ department where it has originated by the hospital porters. Any furniture

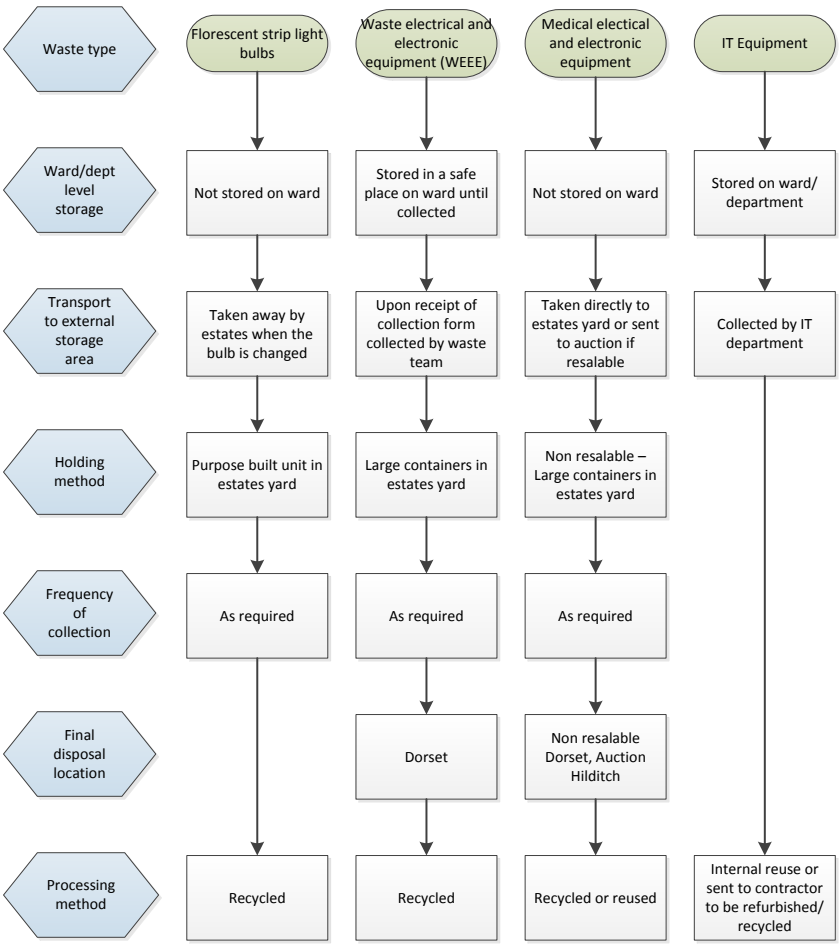

Figure 5: Process maps for the storage and disposal of recyclable wastes at RD & E Hospital part 2

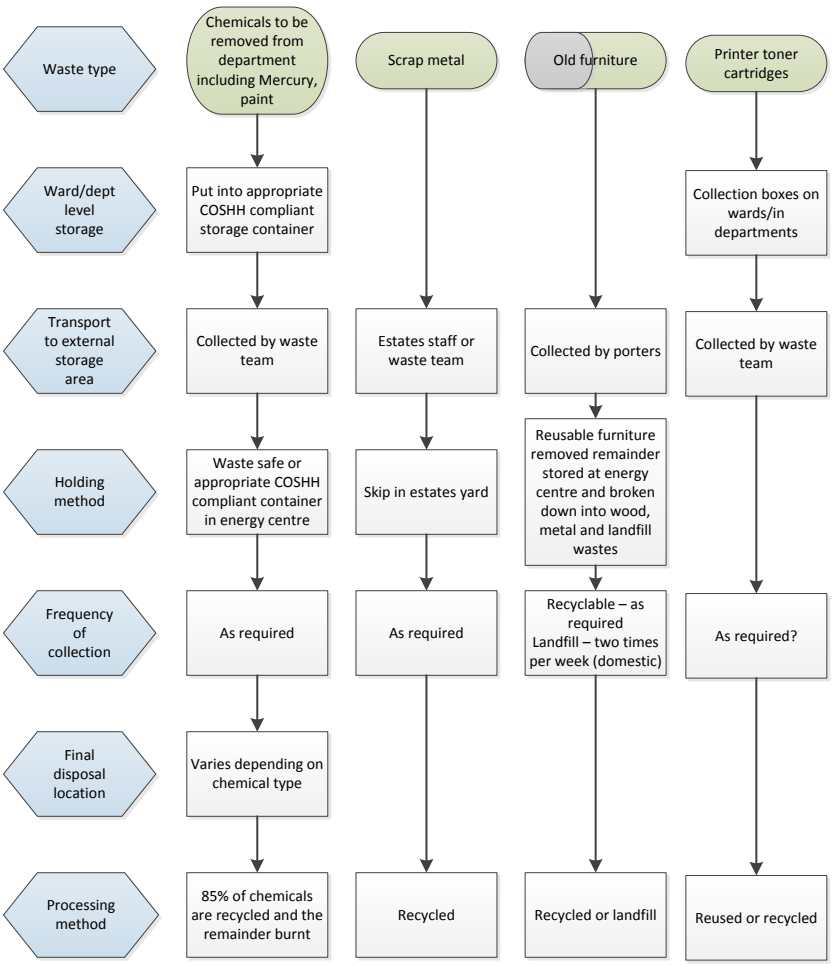

Figure 6: Process maps for the storage and disposal of recyclable wastes at RD & E Hospital part 3

which is reusable is removed and stored. That which is not suitable for reuse is broken down into constituent parts. Metal and wood are stored in the appropriate recycling area and all other waste is sent to landfill as domestic waste. The metal and wood components will then be collected for recycling.

Many documents are printed out in the course of the healthcare process producing large numbers of toner cartridges. There are collection boxes in the wards/departments around the hospital. These boxes are collected by the waste team and either reused or recycled by the external waste contractor (Ask Luke for more detail).

Uncontaminated glass and crockery is stored on the wards in clear bags. These bags are collected by the waste team and taken to the estates yard where there are 240 litre bins specifically for glass recycling. The glass bins are then collected by DCW, the external waste contractor, when the bins are full and their contents recycled.

Many deliveries arrive at the hospital loaded on wooden pallets. The pallets from a previous delivery are not collected by the company when they make their next delivery. As a result a large number of wooden pallets accumulate. Pallets which have been used to deliver equipment to the wards/departments are stored where most practical on the ward. These are then collected by the waste team and taken to the energy centre where they are stored. The empty pallets are then collected by a company who refurbishes and reuses pallets preventing them from going to waste.

3 ORGANISATION OF THE MAIN WASTE STREAMS AND WASTE MOVEMENTS

Appendix B contains a key for the buildings, wards and departments labeled on the maps contained within this section.

3.1 Recyclable wastes

The locations where recyclable wastes are stored are shown in Figure 8. Recyclable wastes are produced predominantly in the buildings surrounding the main hospital building. This is because mixed recyclable waste is only produced in the hospital cafeteria and shops not on the wards and departments within the main hospital building. The recyclable wastes produced across the site are collected by the waste team with the exception of the cafeteria recyclable waste which is transported by the cafeteria employees. All of the recyclable waste is centrally stored at the energy centre (building 7 on the map) for collection by the external waste contractor. This includes cardboard waste which is baled at the energy centre prior to its collection by the external waste contractor.

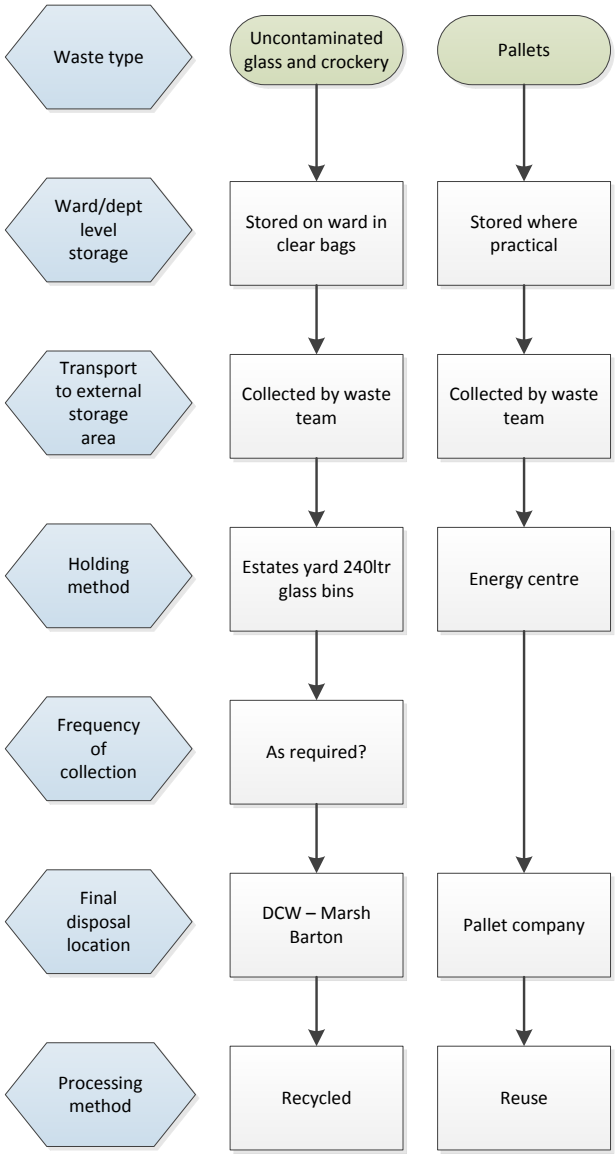

Figure 7: Process maps for the storage and disposal of recyclable wastes at RD & E Hospital part 4

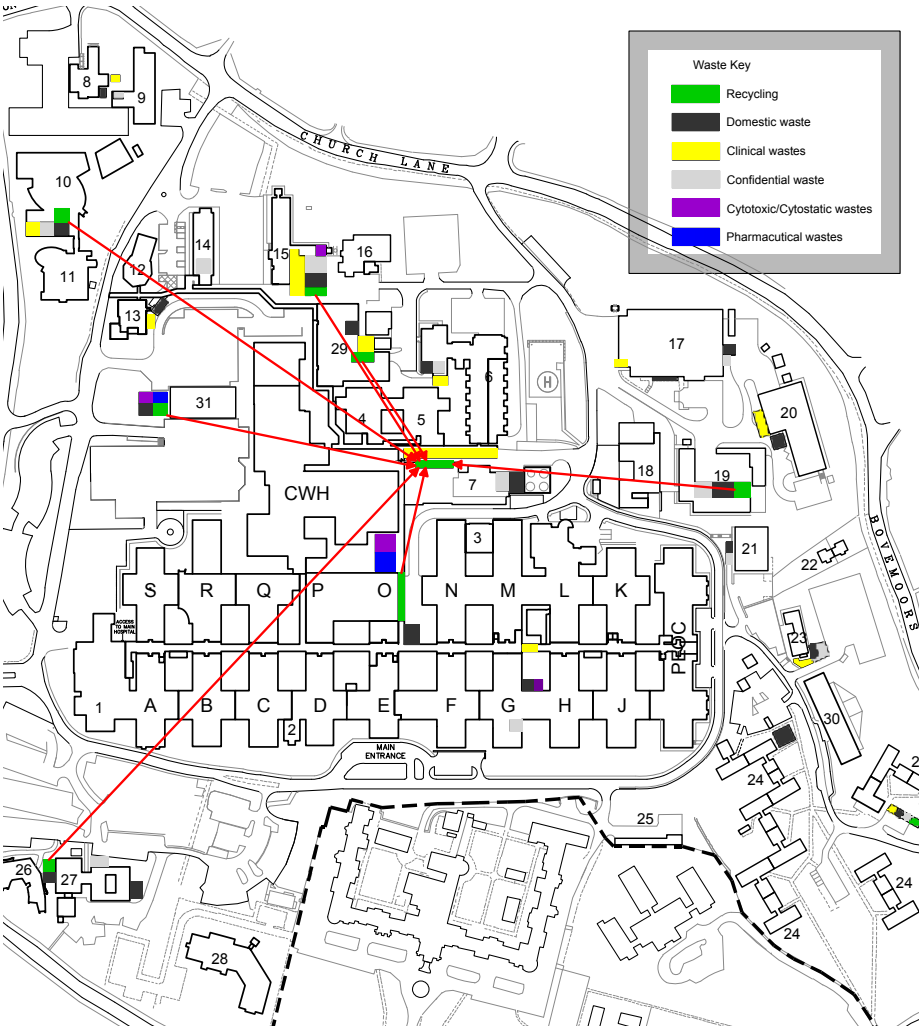

Figure 8: A map of the mixed recycling storage locations and movements at RD & E Hospital

3.2 Domestic waste

Domestic waste is produced and stored all across the hospital site as shown in Figure 9. Location G in the main hospital building is a template for wards A through to S. All of these wards are similar in layout and waste disposal facilities. Domestic waste is stored in the disposal room on the wards before it is collected by the waste team. Domestic waste from around the hospital site is collected by the waste team and transported to the energy centre (building 7). At the energy centre all of the domestic waste from across the site is compacted if this has not already been done at one of the smaller compactors around the site. The compacted domestic waste is stored at the energy centre until it is collected by the external waste contractor.

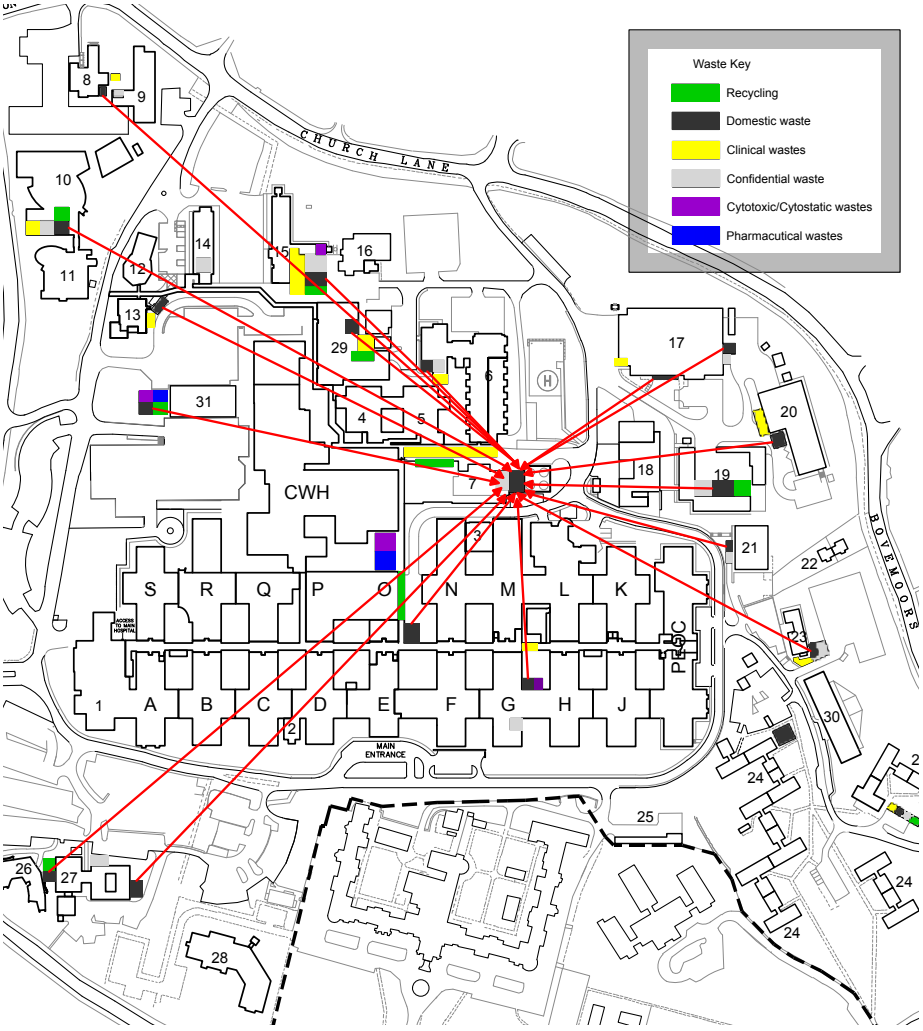

Figure 9: A map of the domestic waste storage locations and movements at RD & E Hospital

3.3 Clinical waste

Figure 10 shows the locations where clinical waste is stored around the hospital site. The clinical waste storage location in the main hospital corridor between wards G and H is a 770 litre clinical waste bin. These large 770 litre clinical waste bins are located along the main hospital corridor at regular intervals. This allows the wards to dispose of bags of clinical waste safely and securely without taking them to the main storage location outside the energy centre. The 770 litre clinical waste bins from within the main hospital corridor and around the rest of the site, are towed using small tug vehicles to the energy centre (building 7), where they await collection by the external waste contractor.

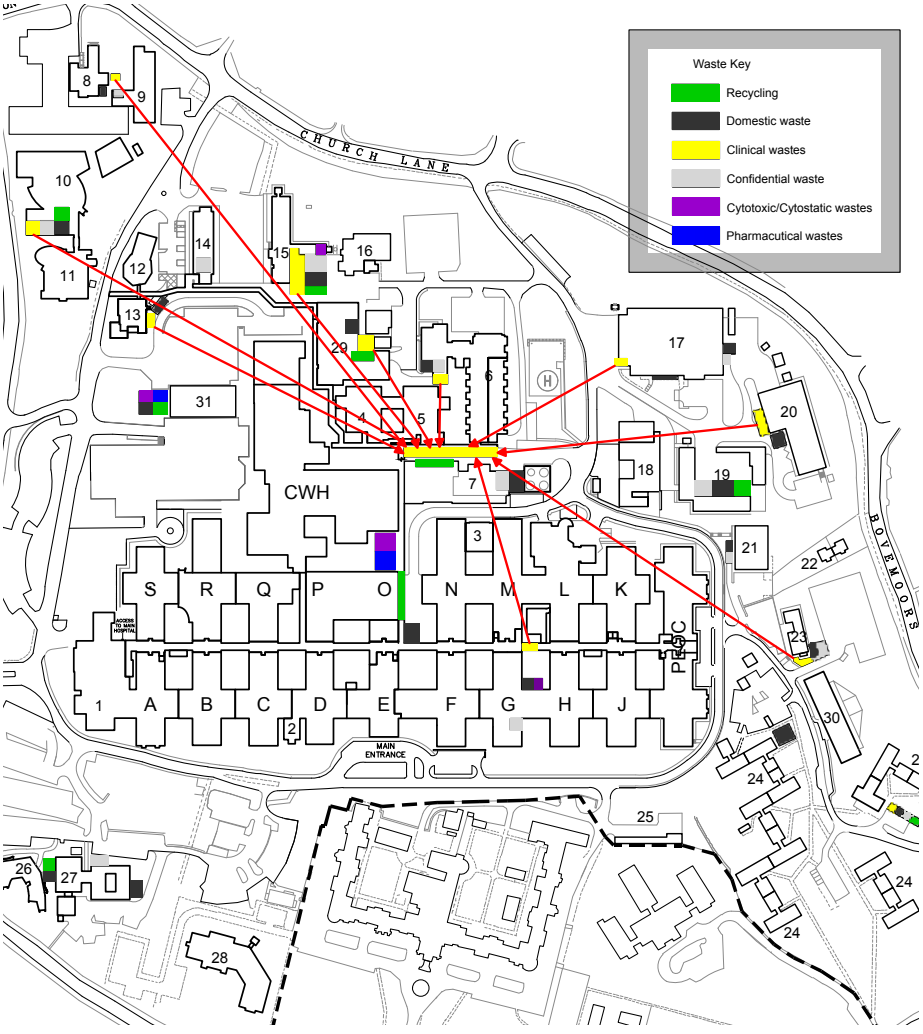

Figure 10: A map of the clinical waste storage locations and movements at RD & E Hospital

3.4 Confidential paper waste

Confidential paper waste is produced by medical and administrative departments across the hospital site. The locations in which the confidential waste is stored can be seen in Figure 11. The confidential waste is collected by the waste team from the storage locations around the site and those wards/departments within the main hospital who have a confidential paper waste bin. Confidential paper waste bins have to be requested by a ward/department, they are not found across the site as standard. All of the confidential waste is collected by the hospital waste team and taken to the energy centre (building 7). At the energy centre the confidential paper waste is shredded and then disposed of as recycling for collection by the external waste contractor.

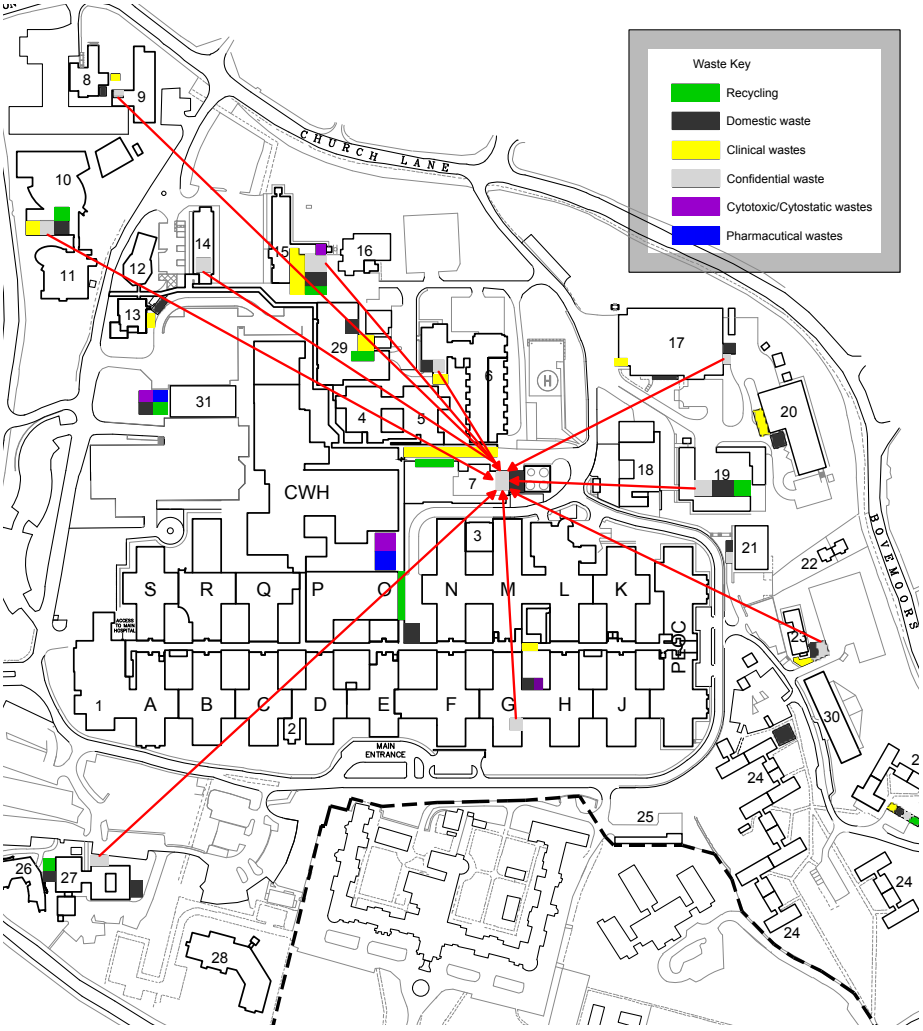

Figure 11: A map of the confidential waste storage locations and movements at RD & E Hospital

3.5 Cytotoxic/cytostatic waste

As shown in Figure 12 cytotoxic and cytostatic wastes are stored in three main locations; building 31 the aseptic unit, building 15 the pathology lab and beside department O the pharmacy. If used in other wards/ departments unused cytotoxic and cytostatic drugs or containers will be stored in solid yellow containers with a purple lid and placed in the ward disposal room for collection by the waste team. Cytotoxic and cytostatic drugs are used in the treatment of cancer because they kill cells or impair their ability to grow and replicate. These drugs have to be treated with care to ensure they do not come into contact with healthy individuals or contaminate the environment. The cytotoxic and cytostatic waste containers are collected by the waste team from around the site and stored at the energy centre alongside the other clinical wastes. Cytotoxic and cytostatic wastes are then collected by the external waste contractor at the same time as the other clinical and offensive wastes.

3.6 Pharmaceutical waste

Pharmaceutical waste is only stored in two locations; building 31 the aseptic unit and department O the pharmacy. It is common practice to ensure that all unused pharmaceuticals and waste containing pharmaceutical residues are returned to the pharmacy before disposal. At RD & E all pharmaceutical waste produced in the main hospital is returned to the pharmacy before disposal. Pharmaceutical waste is disposed of in solid yellow containers with a blue lid which are filled then sealed. The pharmaceutical waste is collected by the waste team and taken to the energy centre where it is stored alongside the other clinical wastes for collection by the external waste contractor.

4 QUESTIONNAIRE FINDINGS

A questionnaire to investigate employee perceptions and knowledge about recycling at RD & E hospital was devised by two medical students Nicole Needham and Kate Penny with input from myself and the hospital energy and sustainability manager Luke Mitchell. The questionnaire, a copy of which can be found in Appendix A, was completed by 75 hospital employees during a week of sustainability events at RD & E hospital. Forty five employees provided details about the department in which they work. The questionnaire was completed by employees from 25 different hospital wards/departments and 30 employees did not provide this information.

4.1 Employee perception of waste management at the hospital

As illustrated in Figure 14 the majority of employees thought that the recycling facilities where they worked were adequate. The high percentage of employees stating that they think recycling facilities are adequate is unexpected due

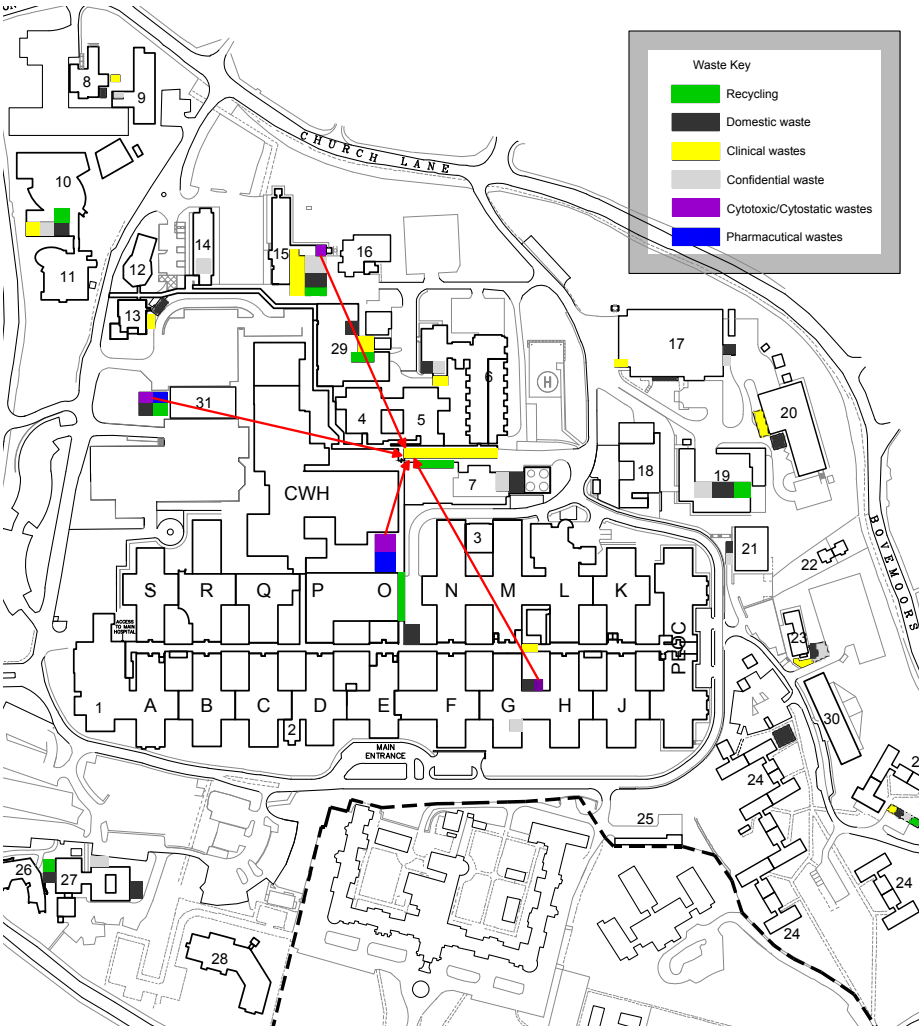

Figure 12: A map of the cytotoxic and cytostatic waste storage locations and movements at RD & E Hospital

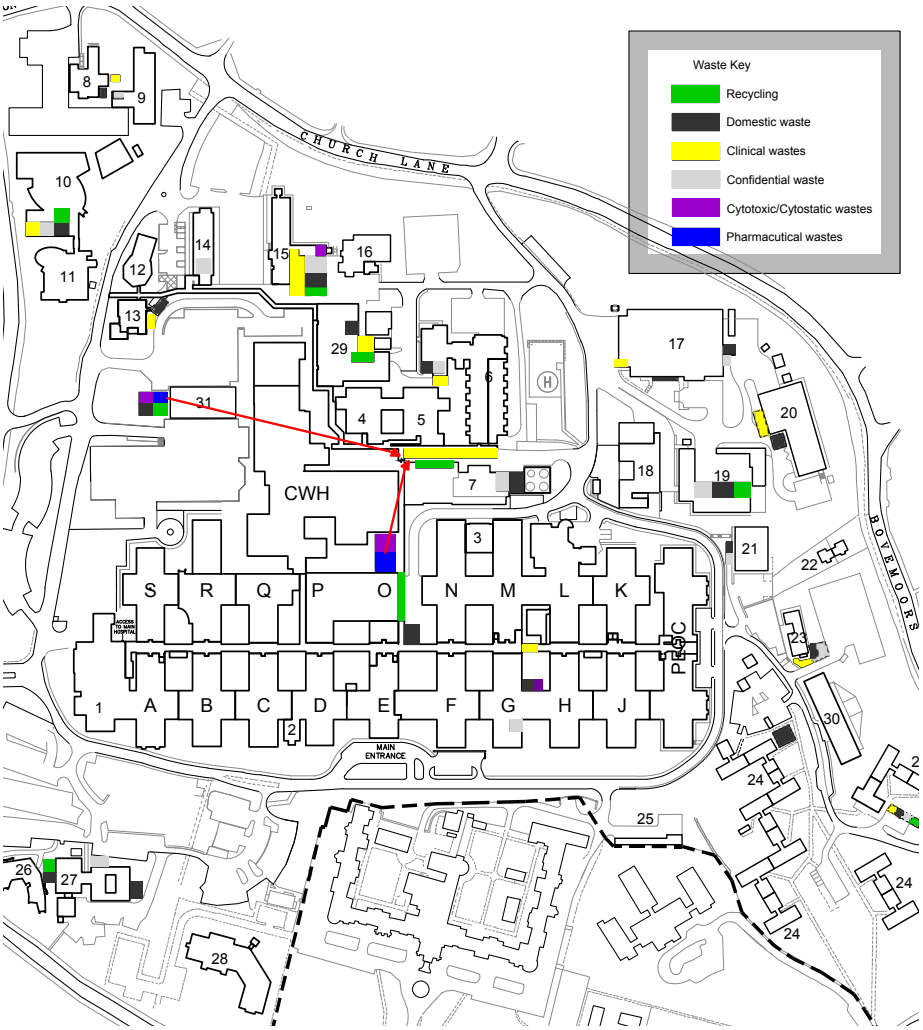

Figure 13: A map of the pharmacutical waste storage locations and movements at RD & E Hospital

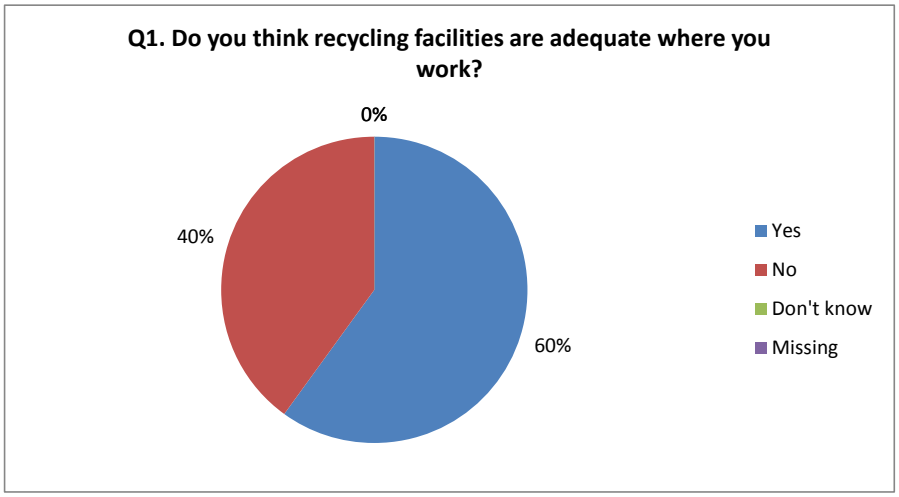

Figure 14: Perception of hospital employees about the adequacy of recycling facilities in the area where they work n = 75

to mixed recycling not being available on the wards within the main hospital. Currently the majority of employees are only responsible for recycling cardboard, paper, printer toner cartridges and batteries.

A large minority of employees thought that the recycling facilities at the hospital were not adequate. When asked why they thought that recycling at the hospital was inadequate employees responded by say that there was a lack of facilities including a lack of non confidential paper recycling facilities. This is an interesting finding due to paper recycling bins being available on request but only a limited number of employees being aware of this as can be seen in Section 4.3, Figure 19. The materials being used for equipment were also cited as an issue, for example where plastic cups are used to supply patients with a drink they can not be recycled due to plastic waste not currently being recycled.

The overwhelming majority of employees also responded to the question "Do you think it is important for hospital waste to be recycled/composted?" in the affirmative (Figure 15). It seems to be a contradiction that almost all employees think that hospital waste should be recycled or composted yet they are content with recycling facilities that do not allow them to recycle some types of waste or compost any waste at all. This contradiction might be explained by employees having different ideas about what adequate recycling is. For some employees carrying out any level or form recycling may be perceived as adequate but for other employees not being able to recycle certain types of waste may be seen as a deficiency in the waste management system.

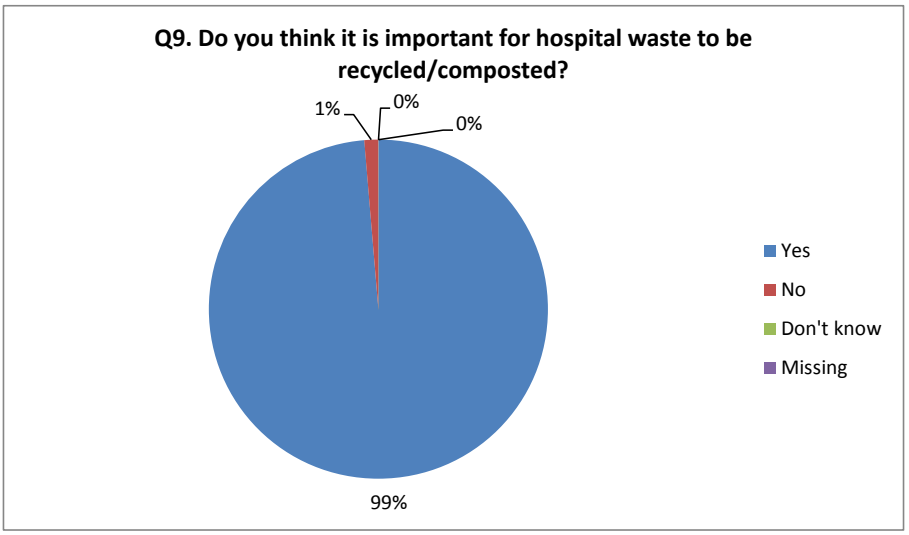

Figure 15: Perception of hospital employees about the importance of recycling and composting hospital waste n = 75

4.2 Employee concern about sustainability issues at the hospital

Concern is a more personal judgment that an employee might make than the perception of or awareness about a sustainability issue. To be concerned implies that a particular issue is judged negatively when compared to ones own personal values and/or expectations. Fifty three percent of employees at RD & E hospital were concerned about the amount of food waste being produced by the hospital which was sent to landfill (Figure 16). This left almost half of the employees surveyed either not concerned about the amount of food waste being sent to landfill (40%), not knowing how concerned they are (3%) or not answering the question (4%).

Some employees responded that they did not work in an area of the hospital where food waste was produced. Such responses resulted in the employee stating that they were unconcerned about the amount of food waste being sent to landfill. The lack of employee concern about the amount of food waste being sent to landfill may result from employees not witnessing for themselves the amount of food waste being thrown away every day. Such detachment from the issue can result in denial of the problem or it being a problem related to them.

Those employees who answered the questionnaire saying that they were concerned were asked to suggest ways in which the high disposal rate of food waste could be improved. Composting was suggested as a possible way of recycling the food waste without sending it to landfill. There are inquiries being made at RD & E about the introduction of a composting system. There are a number of considerations that need to be made such as whether composting will take place on site or not. If it takes place on site then the system

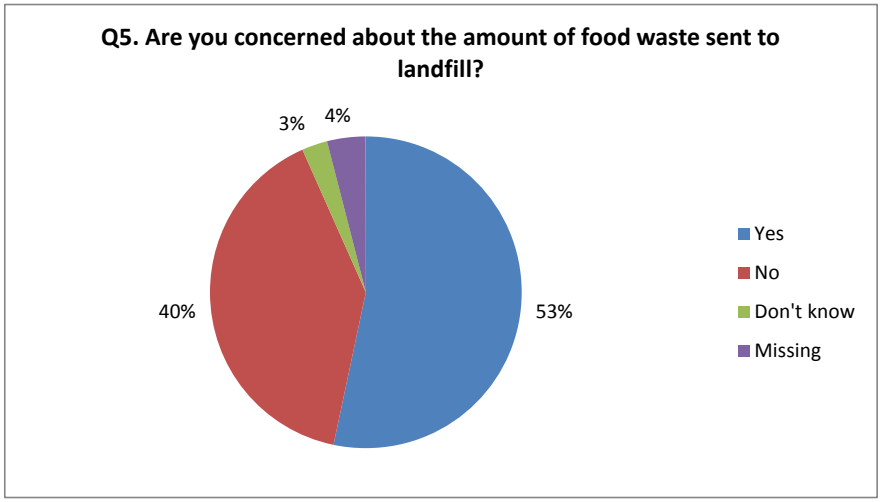

Figure 16: Employee concern about the amount of hospital food waste being sent to landfill n = 75

must be of a sufficiently large scale to accept the amount of food waste being produced and properly maintained to avoid vermin issues. If the composting takes place off site then the waste must be stored in a safe and hygienic manner prior to collection.

One of the most practical suggestions was the improvement of the food ordering and preparation system. Reductions in food waste may occur by ensuring that food preparation can meet patient requirements in terms of what food they want, how much of the food they want and that the quality of the food encourages the patient to eat it. Reducing the amount of food waste being produced in the first instance has the potential to reduce the amount of money the hospital has to spend on food and the amount they have to spend on the disposal of that food. This is the foundation of the waste hierarchy where you first aim to reduce the amount of waste being produced.

The second level in the waste hierarchy is re-use. Some employees suggested that excess food be either given to charity or sold to staff. There is only a very short window of opportunity in which to use cooked/prepared foods that have not been served up to patients. This food could be sold to staff for a reduced price on the day that it has been prepared or given to a charity organisation but this must also occur on the day that the food was prepared. Perhaps the larger issue for the hospital is patients not eating the food that is brought to them. This is where the reduce approach to food waste production and changing the preparation system would likely have the greatest impact on food waste amounts.

When employees were asked if they were concerned about the amount of packaging produced by the hospital which is not being recycled, the majority of employees responded saying yes they were concerned (Figure 17). The

percentage of hospital employees concerned about the recycling of packaging was greater than the percentage of employees concerned about the amount of food waste being sent to landfill. The increase in the percentage of employees concerned about the recycling of packaging may be due to a greater number of employees disposing of packaging compared to food waste. This would make the disposal of packaging an issue which is of more relevance to more employees and of greater salience during their daily work.

There was still a large percentage (32%) of employees who were not concerned about the amount of packaging not being recycled by the hospital. In contrast to the food waste where some employees may not participate in or witness the disposal of large amounts of food waste, it is more likely that many employees dispose of or see large amounts of packaging disposed of. It is possible that those employees who are not concerned about the amount packaging not being recycled do not know or do not consider, due to the healthcare setting in which it is produced, packaging to be recyclable. This is an issue of employee knowledge and awareness about recycling and waste management which will be discussed further in Sections 4.3 and 5.

Hospital employees suggested three associated ways in which the recycling of packaging could be improved. In the first instance the amount of material used to package equipment could be reduced and the packaging made to be reusable or recyclable. This method requires the hospital and/or employees to feedback to the equipment suppliers. This could be achieved through a representative being sent from the supplier to the hospital site or visa-versa. This feedback could also be provided by video conferencing allowing employees to directly share their views with the suppliers.

Much of the packaging disposed of by the hospital will be recyclable and if more does become recyclable, the facilities and space for those facilities needs to be allocated, this was the second suggestion made by the hospital employees. Space is always at a premium in hospitals so ensuring that waste management and recycling facilities are included in structural and strategic planning by the hospital is important. This would ensure sufficient space is allocated to waste management and recycling facilities during restructuring and redevelopment projects. Finally ensuring that employees know what to recycle and where to recycling it was the third suggestion made by the hospital employees. This also included the suggestion that employees are encouraged to recycle. Both the topics of awareness and encouragement will be discussed in Sections 4.3 and 5.

4.3 Employee awareness about sustainability practices at the hospital

Carboard is a highly recyclable material and well recycled at RD & E hospital. As Figure 18 shows the majority of employees were aware that cardboard was recycled at the hospital. However, almost a third of employees were not aware that cardboard waste could be recycled. This question was phrased as a leading question because it told employees that the recycling of cardboard took place at RD & E hospital. Even without neutral phrasing a large number

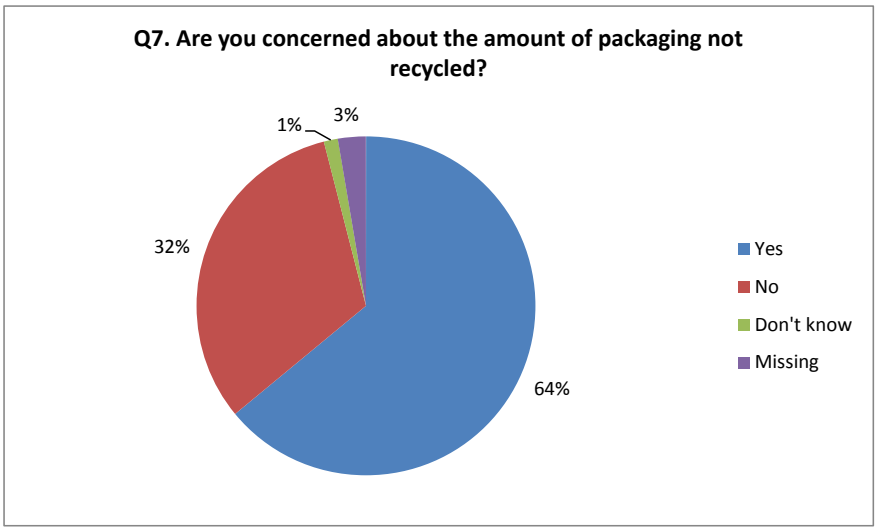

Figure 17: Employee concern about the amount of packaging not being recycled by the hospital n = 75

of employees still responded saying that they were not aware that cardboard recycling took place. This highlights the importance of ensuring employees are aware of the recycling facilities available to them. This information should be accompanied with further information about where to recycle the waste and the importance of recycling that waste type.

It is important to not assume that employees will know or be willing to dispose of all types of waste correctly. Although many people will recycle at home this behaviour does not necessarily transfer to the workplace, there are a few reasons for this. The context in which waste takes place is different in the workplace compared to the home environment. There are different rules which govern the disposal of waste in the workplace compared to the home and different bin types. Employees have to relearn all of the rules and behaviours governing waste disposal in the workplace.

There is also the issue of ownership, at home the employee is responsible for that space and the waste produced by the house. In the workplace the organisation is often perceived to be responsible instead of the individual leading to a diffusion of responsibility. This will occur even if the employee holds strong pro-environmental values due to peoples ability to create a separate 'work-self'. This 'work-self' is potentially a product of organisational culture and workplace peer influence. This 'work-self' needs to learn how to recycle waste in the same way as the 'home-self' employee did.

The majority of hospital employees were not aware that a paper recycling bin could be requested for their ward/department (Figure 19). This may have led to those employees not being aware that they could recycle non-

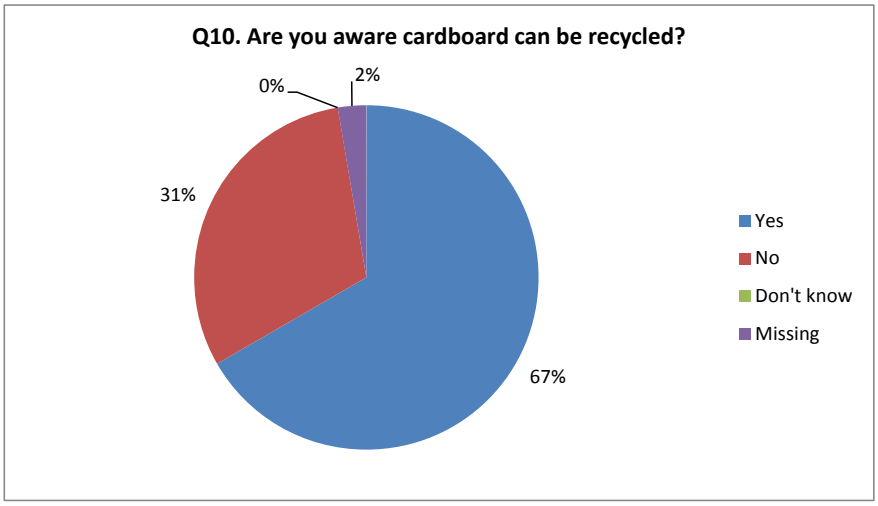

Figure 18: Employee awareness of cardboard recycling facilities availability within the hospital n = 75

confidential paper waste and them disposing of this waste in the domestic waste bins. As the employees suggested in Section 4.2, ensuring all hospital employees are aware of the recycling options available to them and how to use them will help them to make better use of the system.

It is the role of the hospital management to not only put waste management and recycling facilities in place but also to ensure that their employees know how to effectively use these systems. Employee induction training, formal training sessions and e-learning can all help to provide information to employees about the waste management options available to them, where they are located and how to use them. What employees also require are prompts to aid them in remembering to remember the information that was provided to them during those training sessions.

Visual cues such as posters, stickers and colour coding can all be used to prompt employees to remember to perform the appropriate waste management behaviour. When placed in the vicinity of the waste management equipment where employees will see them as they dispose of waste posters, stickers and colour can all act as cues to action. A reminder to not put cardboard and paper in the clinical and domestic waste bins can remind employees to use a recycling bin instead. A further factor to account for in this instance is to ensure that recycling bins are as easy to access as clinical and domestic waste bins. Hospital employees are often under time pressures and have higher priority tasks than waste disposal to perform. If recycling is too difficult and time consuming to access employees are less likely to use those facilities.

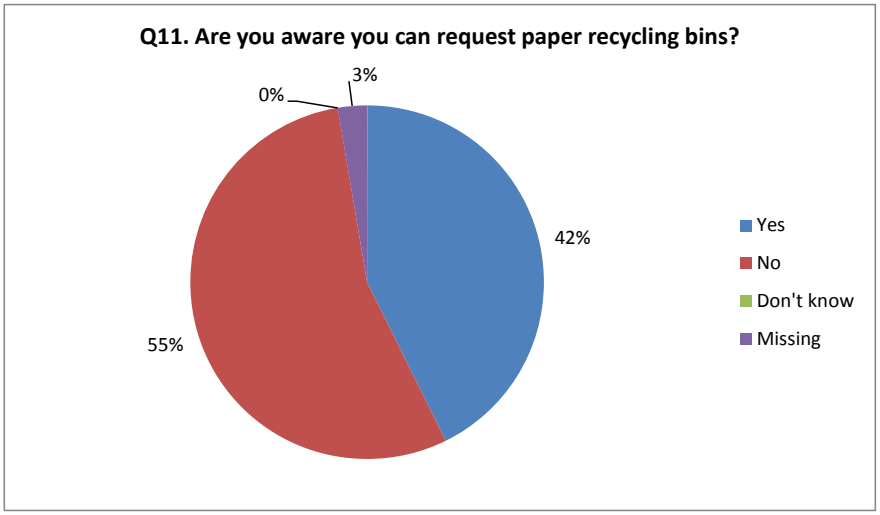

Figure 19: Employee awareness of paper recycling bin availability within the hospital n = 75

In a similar way to employee awareness of cardboard recycling, the majority of hospital employees were aware that printer toner cartridges could be recycled (Figure 20). There was also almost a third of employees who were not aware that printer toner cartridges could be recycled. In this instance some employees might not change the toner cartridges in the printer or would ask somebody else to do it for them. If however, they are changing toner cartridges without realising that the cartridges can be recycled then these are likely being disposed of in the domestic waste stream.

5 DISCUSSION

All wastes at RD & E move towards the centre of the site from the various departments and wards. The majority are stored at energy centre and the remainder in estates yard. Wastes are amalgamated in these locations by the hospital waste and estates teams.

The disposal and collection of clinical wastes at RD & E hospital has been refined into a simplified and efficient process. Most clinical wastes go through the same process of disposal, storage in the same location on the wards, collection by the waste team and then storage at the energy centre for collection by the external waste contractor. This makes the process of managing many different clinical waste streams easier and the location of clinical wastes at any given time can easily be tracked.

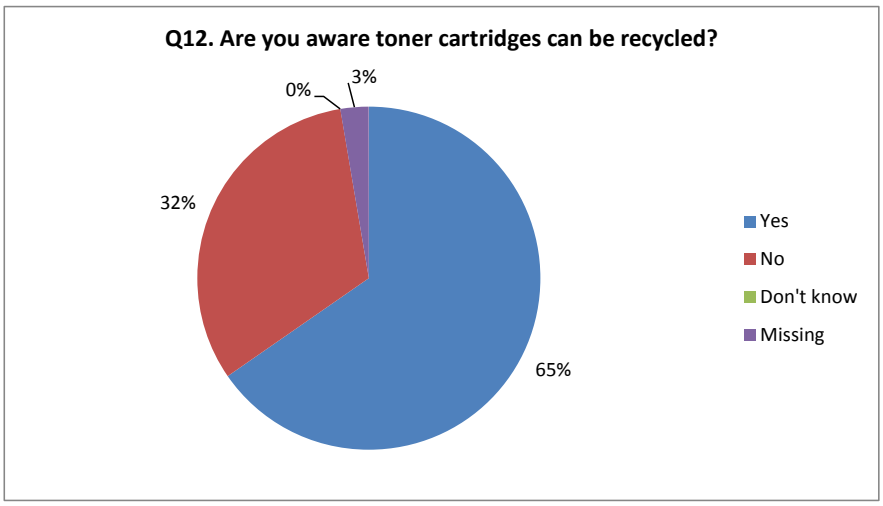

Figure 20: Employee awareness of printer toner cartridge recycling facilities availability within the hospital n = 75

Large amounts of clinical wastes are currently produced at the hospital requiring them to be collected two times per day by the external waste contractor. Auditing the clinical waste streams to assess what proportion of recyclable materials they contain, would reveal whether the amount of clinical waste produced by the hospital could be reduced. A program of change may be required to change employee behaviour to ensure domestic and recyclable wastes are not being disposed of in the clinical waste.

The disposal, storage and collection of domestic wastes is likewise a simple and efficient procedure at RD & E hospital. Domestic waste appears to be produced in relatively small amounts compared to clinical wastes due to them only being collected twice per week compared to twice daily for clinical wastes. The volume and hence number of collections is kept low due to the compaction of domestic waste on site.

The greatest level of variation in the disposal pathway is seen in the recyclable wastes. This is due to the level of segregation required and the number of different external waste contractors used to collect the wastes. Without clear and consistent support from the hospital management such high levels of segregation of recyclable wastes can lead to confusion for employees and ineffective use of the recycling system. The introduction of mixed recycling into the medical wards/departments would be advantageous as it would likely reduce both clinical and domestic waste amounts. The issue is that employees will require instruction about how to use the recycling facilities. Such instruction will be required to ensure that the recycling bins are used by employees and they are used in the appropriate way.

As discussed in Section 4.3 people create a 'work-self' which differs from the 'home-self'. For recycling to be fully effective the 'work-self' of hospital employees needs to learn several things about waste management and particularly recycling. These are: what facilities are available to them, where those facilities are located, what should be disposed of in each bin and most importantly why it is necessary for them to dispose of wastes especially recyclable wastes appropriately. Much of this has been achieved for clinical wastes through training and workplace practice. Hospital employees understand the importance of disposing of clinical wastes appropriately because it has a direct impact on them, their colleagues and their patients. The importance of recycling however has more distal impacts which are not immediately apparent to employees and there are a number of factors which will impact on a hospital employees waste management behaviour.

Figure 21 is a framework of the factors impacting on health and social care waste management behaviour (HWMBIF) from Manzi (2014). The concept of environmental cognizance represents the way hospital employees think about environmental issues related to healthcare waste management and is an amalgamation of three factors; an employees awareness about environmental issues and the contribution of hospital waste, their concern about these issues and the salience of these issues in their daily environment. The employee 'work-self' requires information about the impact of their work on the environment to create awareness about environmental issues, they then need to develop concern about these issues and these issues need to be prominent to them within the work place.

Providing information about environmental issues related to healthcare, such as the contribution of healthcare to climate change and the increased demand climate change will place on the healthcare system, can be displayed alongside practical information about recycling using visual cues such as posters and stickers. This information will not only inform the employee about the environmental issues relating to waste management, influencing their environmental cognizance, but also remind them to perform the appropriate waste management behaviour.

Time and priority are factors in the HWMBIF which inform the waste disposal choices of hospital employees. Hospital employees are often under considerable time pressures with multiple tasks to prioritise and perform. This will determine much attention an employee gives to waste management tasks. As discussed in Section 4.3 by making recycling facilities as easily accessible as clinical and domestic waste bins the hospital can help further encourage employees to use the appropriate bin.

From the questionnaire findings it seems that many employees are aware of the issues with waste management at the hospital and are using those recycling facilities that are available to them. There are however a large number of employees who are not concerned about the waste management issues at the hospital and do not know about the recycling facilities available to them. Using the suggestions from this report it would be possible to further improve waste management and recycling at the hospital. It is important that the hospital management take the lead in implementing recycling and foster-

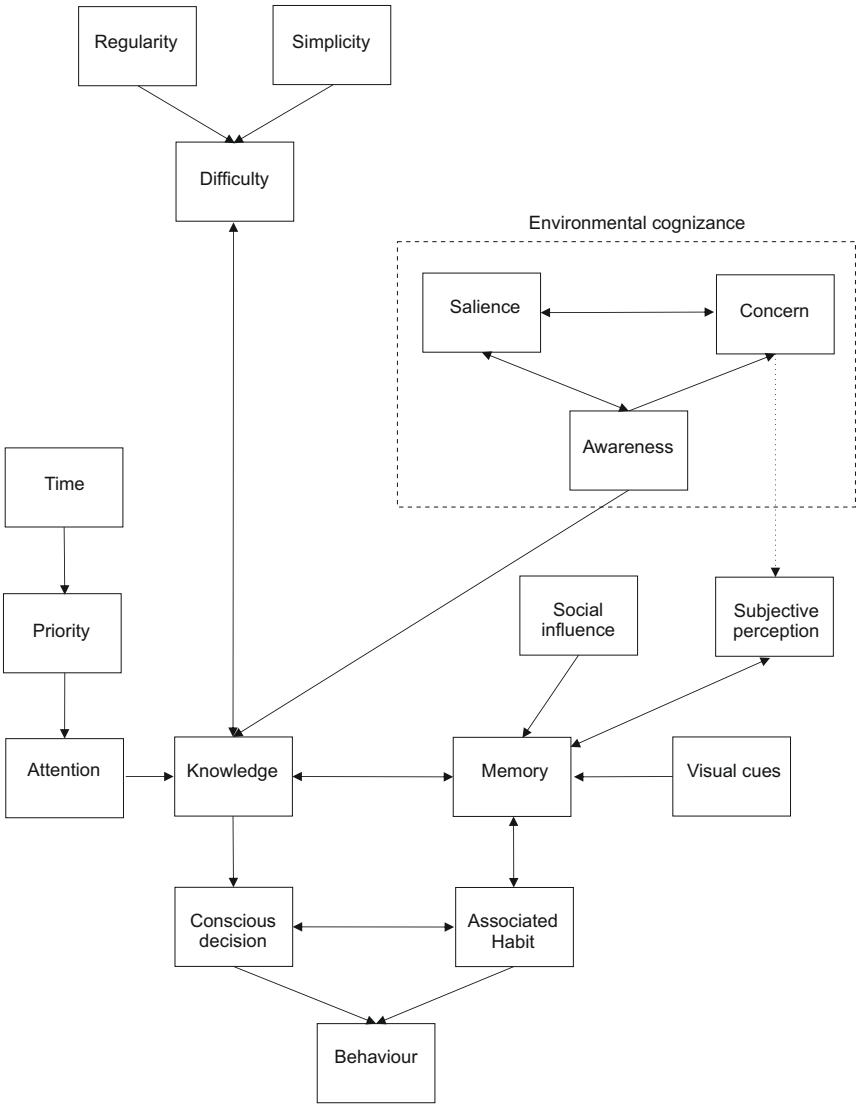

Figure 21: The Health and social care waste management behaviour improvement framework (HWMBIF) from Manzi (2014)

ing a hospital culture that is aware of its environmental impact and seeks to minimise this so that there is authority behind any changes made. By communicating with employees about waste management issues and how they might best be tackled, effective solutions can be developed through cooperation. The planned sustainability group could can act as a mediator between all hospital employees and management on issues such as the further implementation of recycling. This can help ensure that waste management at RD & E meets the needs of the patients, the employees, the hospital and the environment.

REFERENCES

Manzi, S. (2014). *Understanding waste management behaviour in care settings in South-West England: A mixed methods study*. Phd thesis, Plymouth University.

Appendices

APPENDIX A

Hospital employee sustainable waste management practices questionnaire template

Royal Devon and Exeter NHS
NHS Foundation Trust

Questionnaire for Hospital Staff regarding Waste disposal

This questionnaire seeks to understand recycling in the hospital from the employee perspective. All of your thoughts and ideas are appreciated.

In which area/department of the hospital do you work?

Do you think the recycling facilities where you work are inadequate?

☐ Yes ☐ No

If yes, why do you think the recycling is inadequate and what can't you recycle that you would like to be able to?

Are there any barriers that prevent you from recycling in your area?

Do you have concerns about the amount of food waste that is sent to landfill from the hospital?

☐ Yes ☐ No

If yes, how might this be improved: _____

_____

Do you have concerns about the amount of packaging that is thrown away and not recycled?

☐ Yes ☐ No

If yes, how might this be improved: _____

_____

Do you think it is important for hospital waste to be recycled or composted where possible?

☐ Yes ☐ No

Royal Devon and Exeter NHS
NHS Foundation Trust

Are you aware that all non-infectious/uncontaminated and non-confidential card board can currently be recycled?

☐ Yes ☐ No

Are you aware that you can request non-confidential paper recycling bins or secure confidential paper bins?

☐ Yes ☐ No

Are you aware that toner cartridges and batteries can be recycled on the E-link corridor?

☐ Yes ☐ No

Would you be interested in joining an environmental group in the hospital to help tackle some of these issues?

☐ Yes ☐ No

If yes, please provide your email address

_____

Please use this space to include any other thoughts or ideas you might have about recycling practices in the hospital:

APPENDIX B

Ward and department key for map of the Royal Devon and Exeter Hospital Wonford site

L0 = level 0/basement

L1 = level 1/ground floor

L2 = level 2/ first floor

PEOC - Princess Elizabeth Orthopaedic Centre

L0 Hydrotherapy Outpatients, Consultants / Teaching – 2x disposal rooms, 1x confidential bin

L1 Tavy, Dyball Ward & Durbin Ward – 2x disposal rooms

L2 Capener & Knapp Wards, PEOC Theatres – 1x disposal room

A L1 Exeter Oncology centre Bolham / Medical Physics Cherrybrooke – 1x disposal room, 2x clinical 770

L2 Clinical Chemistry/Haematology/Immunology/Blood Transfusion 1x disposal room, 1x domestic bin, 1x clinical

B L1 Yeo & Torridge Wards / Yarty – 2x disposal rooms, 2x cyto 770, 1x clinical 770

L2 Culm West & Culm East Wards – 1x disposal room, 2x clinical 770

C L1 Acute Medical Unit West & MTU, Acute Medical Unit East – 1x confidential 1100, 1x disposal room, 2x clinical 770

L2 Avon & Taw Wards, Coronary Care Unit – 1x disposal room, 2x clinical 770

D L1 Medical Outpatients – 1x disposal room, 1x clinical 770, 1x confidential 770

L2 Neurophysiology, Clinical Measurement, Respiratory Medicine – 1x disposal room, 2x clinical 770, 1x domestic

E L1 Main Entrance, Shops, Health Information Centre – 1 disposal room, 3x domestic 1100, loading bay cardboard cage

L2 Meeting Rooms Use of level 1 disposal

L3 Junior Medical Staff Accommodation & Overnight Stay - Use of level 1 disposal

F L1 West Of England Eye Unit – 1x disposal room, 1x clinical 770, Parkerswell Ward – 1x disposal room, 1x clinical 770

L2 Lowman & Okement Wards – 1x disposal room, 2x clinical 770

G L1 West Of England Eye Unit Theatres– 1x disposal room, 1x clinical 770

L2 Lyme & Dart Wards 1x disposal room, 2x clinical 770

H L1 Bramble Ward – 1x disposal room, 2x clinical 770

L2 Mere & Exe Wards – 1x disposal room, 2x clinical 770

J L0 Physiotherapy / Occupational Therapy – 1x disposal room, 2x clinical 770, 1x confidential

L1 Surgical & Children's Outpatients, Audiology – 1x disposal room, 2x clinical 770

L2 Otter & Abbey Wards – 1x disposal room, 2x clinical 770

K L1 Fracture Clinic / Surgical Outpatients – 1x disposal room, 2x clinical 770

L2 Intensive Therapy Unit / Dept of Anaesthetics – 1x disposal room, 2x clinical 770

L L1 Accident & Emergency – 2x disposal room, 1x clinical 770

L2 Theatres – 1x disposal room, 1x radioactive 770 (storage only 36hr)

M L1 X-Ray Department – 1x disposal room, 2x clinical 770

L2 Theatres – 1x disposal room, 1x radioactive 770 (storage only 36hr)

N L1 Nuclear Medicine – 1x clinical 770

L2 Endoscopy, Stoma Care, Breast Screening – 1x clinical 770

O L1 Pharmacy / Kitchen Store

L2 Chapel / Catering Department – Varying number of domestic 1100’s throughout the day

P L1 Pharmacy / Kitchen Store

L2 Oasis Restaurant

Q L1 Medical Records

L2 Medical Photography / Staff Changing / Training

R L1 Haematology / Yarty Ward

L2 Kenn & Bovey Wards

S L1 Bolham Ward / Cherrybrook Unit

CWH Centre for Women's Health

1 Oncology Centre

2 Cardiology

3 MRI Scanner

4 Creedy Ward

5 Clyst Ward

6 Sid & Kenn Wards (Renal Unit)

7 Energy Centre

8 Diabetes Centre

9 Child Health & Clinical Psychology

10 Research Innovation Learning & Development Centre (RILD)

11 Peninsular Medical School

12 Clinical Research Centre

13 William Wright House

14 Noyscott House

15 Pathology

16 Mortuary

17 Laundry

18 Boiler House Generator & Incinerator

19 Estates Department

20 HSDU

21 Medical Electronics

22 1 & 3 Bovemoors Lane

23 Stewart Smith House

24 Residential Accommodation

25 Gardener's Building

26 F.O.R.C.E

27 New Bowmoor House

28 Hospice

29 Yealm & Ashburn Wards

30 Nursery

31 Aseptic Unit