

# Characterising the waste profile at the North-West University, Potchefstroom Campus: Lessons learned

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## ABSTRACT

In January 2015, the North-West University, Potchefstroom Campus opened its doors to ten prospective students who registered for the BSc. Hons. Environmental Sciences with specialisation in waste management – the first degree of its kind in South Africa. The research papers of the students who enrolled for the programme focused on understanding and characterising the waste profile and waste management practices at the North-West University, Potchefstroom Campus. The limited knowledge of the profile and quantities of waste generated on Campus, was an area of concern highlighted by the Green Campus Committee of the North-West University (Institutional Office). This paper reports on the main findings of the waste characterisation studies, as well as the lessons learned and recommendations for improvement. The paper further elaborates on the limitations and challenges that students experienced while applying waste characterisation methodologies developed for municipal domestic waste surveys on the campus environment.

## 1. INTRODUCTION

### 1.1 The importance of waste management and waste information

You cannot manage what you do not measure.

For integrated waste management systems to be effective, waste characterisation is key to understand the composition and quantity of waste, as a first step towards implementing suitable waste management solutions. Academic literature on waste management in developing countries is municipality orientated and rarely addresses issues at universities. Few studies have been conducted on the composition of solid waste at universities (Smyth et al., 2010:1007).

South African legislation and the National Waste Management Strategy (NWMS, 2011) require that waste management options advocated within the waste management hierarchy be considered (South Africa, 2008:32). Implementing the waste hierarchy will give effect to Section 16 (general duties regarding waste management) of the National Environmental Management: Waste Act (59 of 2008), as amended, as well as commit to the aims of the NWMS.

Universities are well suited to take the lead in research on environmental protection and sustainability practice regarding source separation and waste characterization (Kaplowitz et al., 2009:613). University settings are also ideal arenas for putting theory in to practice, understanding local components and process complexities into collaborative quality and quantity waste related research (Smyth et al., 2010:1014).

The general perception at the North-West University (NWU), Potchefstroom Campus, is that the campus is mostly clean and that the majority of waste that is generated on campus, is disposed of responsibly and lawfully. Limited focus has, however, been given to the implementation of the waste management hierarchy to divert waste away from landfill sites. Furthermore, the profile, composition and quantities of waste generated at the NWU, Potchefstroom Campus were not well known or understood. This study, conducted in 2015, was the first step towards understanding and improving waste management practices at the NWU.

### 1.2 Waste management at the North-West University, Potchefstroom Campus

Universities are resource consumers and producers of waste, which remains a key challenge for achieving sustainability goals including goals set by a University itself (Tu et al., 2015:258). Solid waste programmes and reduction of waste are central for campus sustainability (Smyth et al., 2010:1007; Tu et al., 2015:258). Although the NWU has no formal environmental- or waste management policies or plans, current practices at the Potchefstroom Campus indicate some form of commitment to sound waste management practices.

Not much had been done, prior to 2015, to optimise waste management practices on the Campus. The behaviour of students and staff, as it relates to waste management was also not understood, and little was done to understand and change waste management practices. The Green Campus Committee of the North-West University had identified this lack of information and understanding as a shortcoming, which needed to be addressed.

In January 2015, ten students registered for the *BSc. Honours degree in Environmental Sciences with specialisation in waste management* – the first degree of its kind offered in South Africa. The research module focused on characterising and profiling the waste generated at the Potchefstroom Campus of the NWU, and proposing recommendations for improvement, where applicable.

### 1.3 Focus of the waste characterisation studies

Key study areas were identified in collaboration with the Green Campus Committee. The study areas and/or themes included:

- Two men's residences and one women's residence;
- Two restaurants (Drakenstein and De Jonge Akker) located on Campus;
- One dining hall (with the key focus being on organic waste); as well as
- The management of:
  - Garden waste;
  - Paper and printer cartridges;
  - Fluorescent tubes;
  - Laboratory waste; and
  - General waste (including recyclable waste).

## 2. METHODOLOGY

An overview of the research methodology is provided in the subsequent sections. The references provided may be consulted for a comprehensive explanation of the methodologies used.

### 2.1 Research site

The study was conducted at the Potchefstroom Campus of the NWU located in the North West Province, South Africa. The NWU also consists of an Institutional Office (located in Potchefstroom), the Vaal Triangle Campus (in Vanderbijlpark) and the Mafikeng Campus (in Mafikeng). The study was only conducted at the Potchefstroom Campus and is not indicative of the waste management practices or profiles at the other Campuses.

### 2.2 Research design

The study (ten individual, yet aligned studies) was conducted between February and September 2015. Waste management practices at the NWU, Potchefstroom Campus were investigated and internal environmental legal compliance audits carried out by the Centre for Environmental Management (CEM), NWU were considered during the study.

South African waste legislation and related documents were studied to provide the background and legislative framework on waste management.

Articles and information on other universities' waste management practices as well as relevant academic publications and waste management were reviewed to inform the research design and methodology.

### 2.3 Research methodology

Several different techniques were used to gather data, based on the scope and extent of each individual study. The research methodologies included physical sorting, separation and measurement (weighing) of waste, interviews and questionnaires, observations, etc.

The following well known methodologies were used (in the absence of specific methodologies aimed at waste characterisation at universities):

- Waste characterisation methodology for municipalities of developing countries (Desiree, 2014:2; European Commission, 2004:11; Smuts, 2014:439; Smyth et al., 2010:1007);
- The waste characterization methods proposed by the European Commission (2004:7); and
- The methodologies proposed by Dahlén et al., (2008:1110), Desiree (2014:2) and Smuts (2014:439).

A few assumptions and limitations were applicable.

## 2.4 Assumptions and limitations

The assumptions and limitations which were applicable to the study included:

- Only waste which was placed into waste receptacles (waste bins) was considered during the study.
- Due to the size of the campus and the waste collection schedules, a sampling plan was developed and the study was conducted accordingly.
- A hand scale with a standard weight deviation of 0.5 kg was used. Light weight waste, e.g. plastic wrappings of bottles, were too light to accurately determine the weight.
- The waste was classified and sorted in its current state, i.e. no separation at source took place prior to profiling the waste. This had the implication that wet and dry waste streams mixed, and wet waste contaminated and added weight to the dry waste in some instances.

## 3. RESULTS AND DISCUSSION

The results of the research study are thematically presented and summarised in the following sections:

### 3.1 Waste from residences at the NWU, Potchefstroom Campus

The average amount of waste generated per student per week was calculated as 1.1 kg. This is much less than proposed in literature, however, it must be taken into consideration that a student spends about one third of his/her day at the residence and the rest elsewhere.

It was found that approximately 60 – 85% (by weight) of the waste generated at the residences had the potential to be recycled, and the waste consisted mainly of:

- Paper (22%);
- Plastic (20%);
- Aluminium cans (14%);
- Glass (13%); and
- Other and non-recyclable wastes (31%).
- Organics?

The waste profile differed quite substantially between a normal class week and an examination week, where the amount of aluminium cans (mainly due to energy drinks) and paper (from class notes) were significantly higher during an examination week.

One of the students tested the awareness and willingness of students in the men's residence to separate waste at source for recycling purposes. Students were made aware of the study and were requested to place waste into designated receptacles. The awareness campaign showed positive results. During the "awareness week", 57% of all waste generated ended up in the dedicated receptacles. Of the 43% of waste, which ended up in the normal waste bins, only 8% had the potential to be recycled.

### 3.2 Waste from the Drakenstein and De Jonge Akker restaurants

The main waste types generated at both restaurants are glass and food waste. An average weight of approximately 1 ton of glass is produced by the Drakenstein and 100 kilograms of glass is produced by De Jonge Akker Restaurant per week. The glass is currently collected by a waste recycler, at no cost or profit to the NWU. An average of approximately 70 kg and 250 kg of food waste per week is produced by De Jonge Akker and Drakenstein Restaurants, respectively. The food waste is either disposed of at a landfill site or donated to pig farmers in the area. None of the food waste is composted.

### 3.3 Waste from the Dampad dining hall

The waste characterisation study at the Dampad dining hall indicated that food-related organic waste was by far the largest contributor to the waste stream at approximately 400 – 450 kg generated per week. The waste stream consisted of the following components:

- Organic waste (84%);
- Plastic (7%);
- Paper (4%);
- Polystyrene (4%); and
- Aluminium cans (1%).
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Dampad is only one of the five dining halls located at the Potchefstroom Campus. If the organic waste of the other four dining halls is taken into consideration (extrapolated by taking the waste generated per student per week into consideration), the amount of organic waste generated for all of the dining halls per week is estimated to be approximately 1.8 tonnes per week. The food waste is either disposed of at a landfill site or donated to pig farmers in the area. None of the food waste is composted.

### 3.4 Garden waste

Approximately 180 kg of garden waste is generated during a 7-day cycle (average for spring- and autumn sampling cycles). Garden waste is collected by the NWU's waste collection contractor and taken to the Potchefstroom landfill site. None of the garden waste is composted.

### 3.5 Paper and printer cartridges

The study indicated that the NWU, Potchefstroom Campus has several practices in place to firstly avoid/minimise the amount of paper waste generated and, secondly, to separate paper waste at source for the recycling market. Between 1 and 4 tonnes of waste paper is collected from the Potchefstroom Campus per month. The waste collection contractor removes the waste and takes it to a sorting-, shredding- and baling facility in Potchefstroom, at no cost or profit to the NWU.

It has been established that no formal practices have been implemented for the management and disposal of printer cartridges. Printer cartridges from commercial printers are collected by the supplier/contractor. Printer cartridges from desktop-type printers more often than not end up in the general waste stream.

### 3.6 Fluorescent tubes

Most of the construction and maintenance work of facilities and buildings of the NWU is outsourced to service providers. The removal and disposal of waste streams associated with construction, maintenance and demolition work forms part of the contract. Apart from stating that the waste must be disposed of lawfully, the NWU does not influence or control the waste disposal practices of its contractors.

The procurement, replacement and disposal of fluorescent tubes are however, not outsourced. The precautionary measures used during the transportation and storage of fluorescent tubes are insufficient. Containers for the storage of fluorescent tubes are not weather or shock resistant. Fluorescent tubes are collected by a waste removal contractor and disposed of at a hazardous waste disposal facility.

### 3.7 Laboratory waste

Laboratory waste is stored at the NWU and collected by a hazardous waste collection contractor as the need arises. Storage measures on campus are insufficient as far as containment, restricting unauthorised access and records of safe disposal are concerned. No standardised methodologies or operating procedures exist for the management of waste.

### 3.8 Disposal of general waste (on campus)

The disposal of general waste on campus was determined, which also considered the disposal of wastes with recycling potential in normal waste bins and receptacles for the separation of waste at source. It was determined that 74% of waste disposed of in the normal waste bins has the potential to be recycled. The profile of general waste disposed of on campus consisted of:

- 40% aluminium cans;
- 16% food-related organic waste;
- 14% glass;
- 10% plastics;
- 10% paper; and
- 10% other wastes.

During an observation study at the student centre, it was noted that only between 20 and 40% of students make use of the facility for the separation of waste at source, when throwing away wastes with the potential to be recycled. The other 60 to 80% of students preferred to dispose of waste in the normal waste bin. When questioned about their waste disposal practices, students indicated that they were either not aware of the facilities on campus for the separation of waste at source, or did not have the time to separate waste before disposal. Some indicated that the placement of the facilities for separation of waste at source is less favourable than the normal waste disposal bins.

## 4. CONCLUSIONS AND RECOMMENDATIONS

Many waste streams with the potential to be scaled up in the waste management hierarchy are being generated at the North-West University, Potchefstroom Campus. In 2015, the most common method of dealing with these waste streams was disposal, with limited practices, facilities and/or infrastructure for the re-use, recycling, recovery, treatment and/or composting of waste.

There is potential financial gain for the NWU if it decides to move away from landfilling towards a more efficient way of dealing with waste. However, its responsibility towards environmental protection and sustainability should be the driver for more efficient waste management practices.

This study proposes various options to reconsider waste management practices at the NWU:

- More attention needs to be given to solid waste characterisation studies and the management of solid waste at the NWU. Universities can accommodate innovative solid waste solutions, which can spread the surrounding community.
- The results of this study can be used as a basis to provide accurate information when the NWU considers recycling projects and investment in waste management infrastructure and practices.
- A few practical considerations have been advised:
  - Substitute non-recyclable and hazardous items with reusable or recyclable products at the student centre and other campus retailers.
  - Participate in deposit or refund programs where plastic containers, glass and tin can be sold to companies to recycle their reusable products.
  - Establish an organic recovery facility to use all the organic waste generated to be composted and reused for gardens or products to sell.
  - Conduct various awareness programs to sensitise and motivate the students toward the need for sustainable waste management by sharing information and recommendations, as well as explaining source separation and reduction.

## 5. ACKNOWLEDGEMENTS

The work of the 10 students who completed their BSc. Hons in Environmental Sciences with specialisation in waste management is acknowledged: Christiaan Baron, Abri Bothma, Petrus Coetzee, Rino Diedericks, Marnus du Plessis, Sune du Plessis, J.P. Green, Mandre Joubert, Nico Keyser, Jaunmari Schoonraad.

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