



RECYCLING 101

TRAINING MANUAL



TABLE OF CONTENTS

INTRODUCTION	3
WASTE 101	4 - 5
THE RELEVANCE OF RECYCLING TO SOUTH AFRICA	6-7
WHAT THE LAW SAYS ABOUT RECYCLING	7-8
RECYCLING VALUE CHAIN	
Recycling Hierarchy	9
Waste Pickers	9
Co-operatives	10-14
Buy-Back-Centres	14-15
Waste Management Companies	16
Reprocessing Facilities	
- PLASTICS	17-23
- PAPER	24-25
- METALS	26-27
- GLASS	28-30
WHAT YOU NEED TO KNOW ABOUT PAPER AND PACKAGING RECYCLING?	
Plastic	31
Paper	32-34
Metals	35-36
Glass	37-38
RECYCLABLE – BASIC BUSINESS TOOLS	
What affects the pricing of recyclables	39
Business tips	39
Three keys to success	39
PAPER & PACKAGING INDUSTRY SUPPORTERS	40
PAPER & PACKAGING CONTACT DETAILS	41

INTRODUCTION

The Manual

The RECYCLING 101 training manual has been developed by **Packaging SA** to assist waste pickers and recyclers in the South African recycling sector. The manual will define terms used within the industry and give an overview of the entire recycling industry. The manual contains guidelines to help assist all collectors within the recycling space to understand the different waste streams, as well as how the materials should be collected, sorted and processed for recycling.

About Packaging SA

The Packaging Council of South Africa (PACSA) was founded in 1984 and has been replaced by a new industry body called Packaging SA. Packaging SA is closely associated with The Institute of Packaging South Africa (IPSA). Packaging SA is a voluntary industry body. Its members are in two broad categories, Converters and Associates. The Converters represent some 70% of the revenue generated by the industry. Associates are in effect the major raw material suppliers, material organizations, brand owners, retailers and other organizations and associations with interests in the packaging industry. Collectively this body directly employs some 60 000 people in South Africa.

Packaging SA represents views of its members on National issues with particular focus on environmental matters.

Copyright

This manual may be shared with other individuals or companies with the intention of improving recycling.

Acknowledgements

Packaging SA would like to thank Jacques Lightfoot (Plastics|SA: Sustainability Manager) for writing the training manual.

Packaging SA would also like to thank all the following partners; Plastics|SA, PETCO, POLYCO, SAVA, PSPC, Recycling Paper ZA, TETRAPAK, TGRC, METPAC-SA, AMA and the National Recycling Forum for their support of this programme.

WASTE 101



What is Waste?

Waste can be defined as anything that is no longer useful and needs to be disposed of. In the waste management process, waste is considered to be any material that has been discarded and, as such, needs to be disposed of in an environmentally acceptable manner.

Definition of Waste

According to the National Environmental Management: Waste Amendment Act, 2014 (Act No 26 of 2014)

"Waste" means

- (a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, by the holder of the substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or
- (b) any substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraph (a) and (b) ceases to be a waste -
 - (i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;
 - (ii) where approval is not required, once a waste is or has been re-used, recycled or recovered;
 - (iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or
 - (iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

Waste Classifications - defined in the NEM: Waste Amendment Act, 2014

Waste is divided into two classes based on the risk it poses - general waste and hazardous waste.

"General waste" means waste that does not pose an immediate hazard or threat to health or to the environment, and includes; domestic waste, building and demolition waste, business waste, inert waste; or any waste classified as non-hazardous waste (in terms of the regulations made under section 69, and includes non-hazardous substances, materials or objects within the business, domestic, inert or building and demolition waste.)

"Hazardous waste" means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within the business waste, residue deposits and residue stockpiles.

Waste Minimisation and Recycling

Recovery refers to the controlled extraction (of material) or retrieval of (energy) any substance, (or) material or object from waste (to produce a project).

Re-use refers to utilise the whole, a portion of or a specific part of any (articles) substance, material or object from the waste stream (again) for similar or different purpose without changing the form or properties of such (articles) substance, material or object.

Recycling means a process where waste is reclaimed for further use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.

Waste Hierarchy

The waste hierarchy forms the basis of waste management and in its simplest form is referred to as the 3 R's – Reduce, Reuse and Recycle. The top of the inverted pyramid is the most preferred way to deal with waste, with the bottom of the pyramid the least favourable.



The trend is to manage the waste cycle from cradle-to-grave, beginning with separation at source. Separation at source is an action whereby waste is separated into different waste types at the source of generation. The aim is to separate recyclables from non-recyclables, hazardous from non-hazardous into different waste fractions, which can then be taken directly to a suitable facility keeping in mind the waste hierarchy as mentioned above

THE RELEVANCE OF RECYCLING TO SOUTH AFRICA

There is a viable recycling industry in South Africa even though there are currently no laws to enforce it. Recycling should be promoted and supported in order for it to reach its full potential and to maximise formal and informal employment opportunities.

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WHY SHOULD WE RECYCLE?

Recycling has the following benefits:

- It reduces the waste stream going to landfill sites, thus saving landfill airspace
- It can create jobs
- It helps reduce pollution and conserve natural resources
- It conserves energy and reduces manufacturing costs
- It reduces litter
- It can reduce informal salvaging from landfill sites

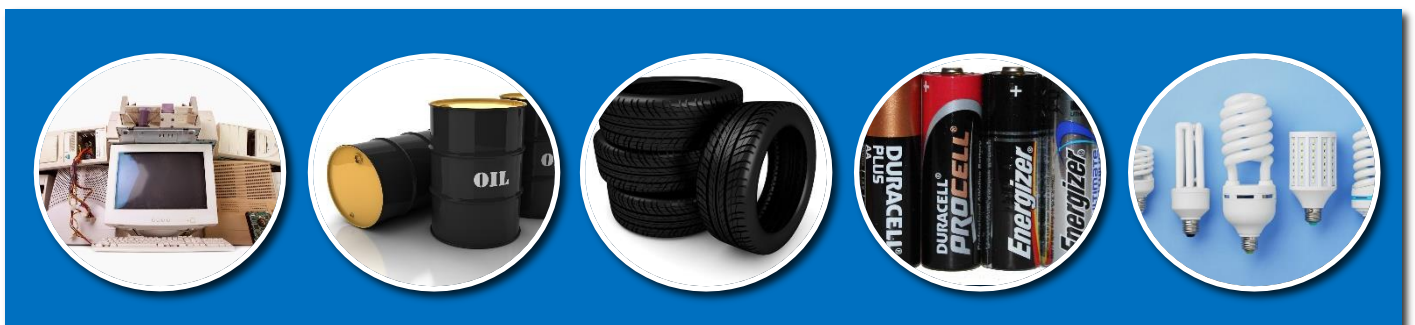
WHAT CAN BE RECYCLED?

Paper and Packaging

- Plastic
- Paper
- Metals
- Glass

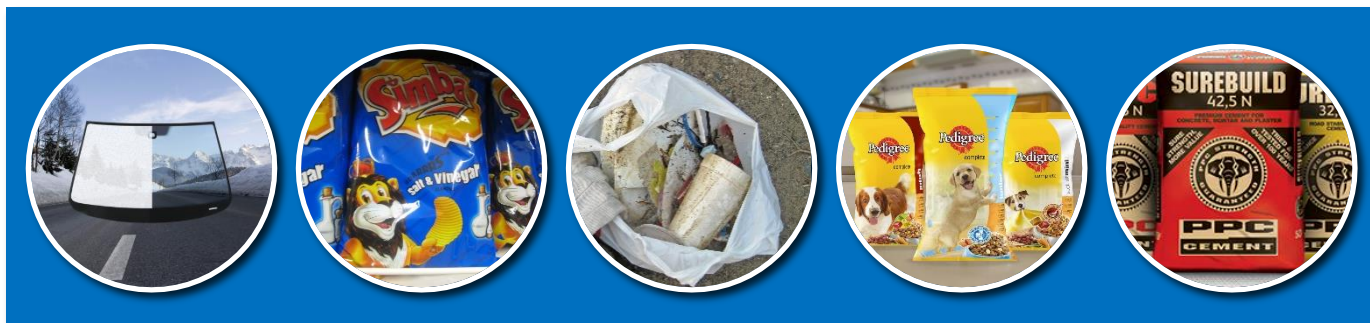
Other Recyclable products

- E-Waste
- Oil
- Tyres
- Batteries
- Lights and Bulbs



WHAT CANNOT BE RECYCLED?

- Dirty recyclable materials
- Laminates made of mixed material e.g. plastic-paper, paper-metal foil laminates
- Laminated glass such as car windscreens
- Materials that are uneconomical to recycle because of insufficient volumes, or transport distances to markets are too great.



WHAT THE LAW SAYS ABOUT RECYCLING

WASTE MANAGEMENT POLICY

While central and provincial government departments and agencies have the responsibility of setting policy and specific targets for waste reduction and recycling, municipalities are responsible for general waste management planning, and the development of by-laws which include economic incentives to support waste minimisation and recycling in their areas. There is currently no legislation making recycling a legal requirement. Recycling is at this stage entirely voluntary and not associated with any incentives or rewards from the Government.

The White Paper (Policy) on Integrated Pollution and Waste Management sets out the principles that underpin the National Waste Management Strategy (NWMS). This NWMS translates the policy principles into strategic plans and actions. By law, municipalities have the responsibility of waste collection and disposal. In terms of the NWMS and the White Paper it is envisaged that new laws will be passed dealing with recycling and environmental economics (e.g. incentives, taxes). The National Environmental Management Act also emphasises the need for development to be sustainable and requires that 'waste is avoided, or where it cannot be altogether avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner'.



LEGAL FRAMEWORK

Waste management is mostly controlled through municipal by-laws and, since each municipality makes its own by-laws, there are often discrepancies in enforcement, regulation and administration of waste management functions between the different municipalities.

The Department of Environmental Affairs and Tourism is drafting minimum standards for the recycling of waste in South Africa in order to promote the culture and implementation of recycling and a reduction in the amount of waste going to landfill. Every municipality is now required in terms of the Municipal Systems Act to prepare an Integrated Development Plan (IDP). One of the elements within the IDP should be an Integrated Waste Management Plan which, in terms of the National Waste Management Strategy, must implement the hierarchical management of waste with emphasis on waste avoidance and minimization, through to responsible disposal.

The Municipal Systems Act also includes recycling as one of the activities to be promoted by municipalities when setting tariffs for waste management services. The White Paper and NWMS propose a comprehensive Waste Management Act regulating the management of solid waste based on the “Hierarchy of waste management”. The Department of Environmental Affairs & Tourism is currently drafting a new waste management law that will address issues of extended producer responsibility, recycling and promotion of waste related businesses with job creation.

At the National Waste Summit held in Polokwane in September 2001, the Polokwane Declaration was adopted which commits South Africa to achieve zero waste to landfill by 2022. Future waste legislation will promote reuse and recycling, and require manufacturers to develop products that do not create waste and that can easily be recycled.

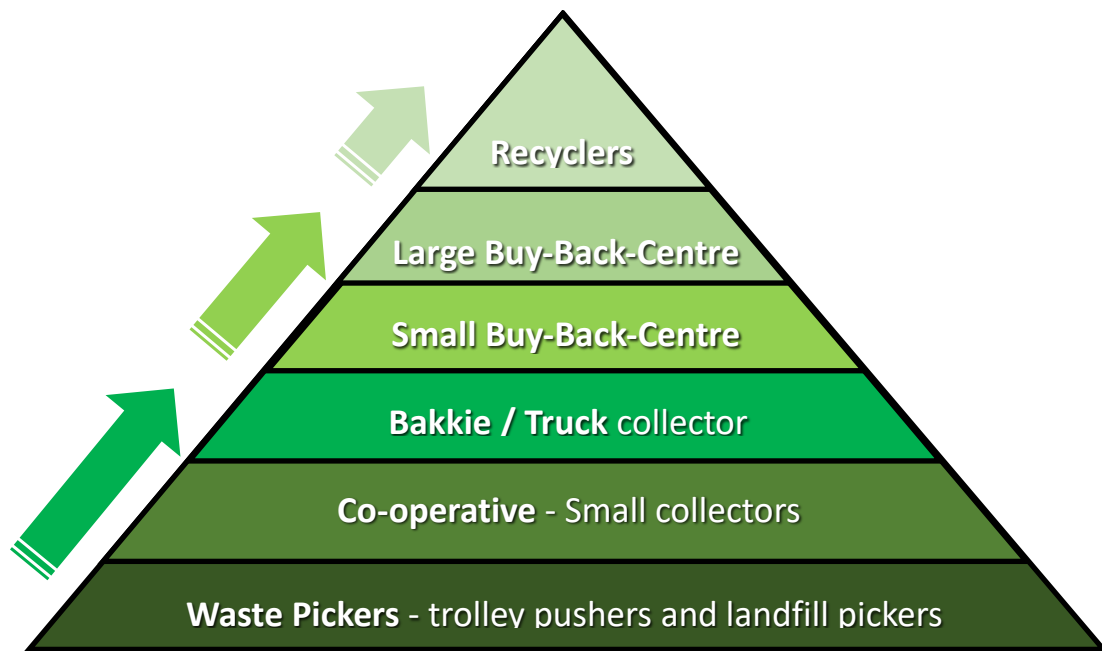
IMPROVING THE QUALITY OF RECYCLABLES – Separation at Source

Recyclable wastes should be separated as near to source (the place they are made) as possible. This limits the costs of labour and machinery associated with sorting after collection and will prevent recyclables like paper being soiled (dirtied) by wastes such as food if mixed in with the waste stream. Once paper or cardboard is soiled, it cannot be recycled. Other items, if soiled, will have to be cleaned before being recycled. Separating recyclables into types will also increase their value when sold to the processors of the materials.

The recycling industry needs to be supported to improve the quality of the recycled products.

RECYCLING VALUE CHAIN

RECYCLING HIERARCHY



1. WASTE PICKERS

■ Introduction to Waste Pickers

Historically waste pickers have played an important role in the recycling sector in South Africa. Although it is difficult to quantify the contribution made by the waste pickers, it is estimated to be a significant contribution.

The majority of waste pickers in SA operate on landfill sites and this has its advantages and disadvantages. The advantages include the reduction in the amount of waste that has to be landfilled as well as the monitoring role waste pickers play in spotting illegal behaviour. The waste pickers are normally very well versed with the waste stream they deal with and the landfill they operate on, as such know what is legal and what is not. However, the dangers to the health of the waste pickers outweighs these advantages. Waste pickers operate without any personal protective equipment (PPE) and hence handle waste directly, thereby getting exposed to health risks. In addition, waste pickers are often in danger of being run down by the trucks and/or the heavy machinery operating on the site. While the contribution of waste pickers to the recycling sector is widely acknowledged, waste picking on landfill sites is not encouraged.



Who are Waste Pickers

Waste pickers have been defined as people who “collect, sort and sell reusable and recyclable materials. The recyclables predominantly include; plastic, paper, cardboard, metal and glass. Waste pickers have other names, depending on the social and geographical context.

The term ‘reclaimer’ is generally used to refer to persons reclaiming materials from landfills. Waste pickers also describe themselves as “bagariesi”, a Setswana term which is thought to mean someone who is looking for valuable or good things that are useful. Other names reflect perceptions about waste pickers’ social status and their economically precarious position in society. For example, they are also referred to as “skarrelaars” (scuttlers), “grab-grab and “minza” (meaning struggling to survive). In Johannesburg the term - “bayahlupeka” (struggling to make ends meet) - is also used. Waste pickers also include ‘trolley pushers’ collecting recyclable materials from residential, commercial and industrial areas, but mainly in large urban centres.

Waste pickers play a vital role in the collection process and without their efforts, larger amounts of waste would be sent to the landfill sites.

2. CO-OPERATIVES

Background of Co-operatives in South Africa

For as long as South Africa continues to generate waste, that waste has value, and while there are businesses prepared to buy the waste, we will continue to find formal and informal collectors of recyclables. There will always be work, the market exists, and rubbish will not go away.

The types and quantities of waste generated in the larger towns and cities of South Africa has created opportunities for people to earn a living through the collection of recyclables, salvaging paper, plastic, glass or cans from waste bins at kerbside or from landfill sites. As a means of stimulating job creation in the formal waste economy, these collectors of recyclables are often advised by government or other stakeholders, to group together and register as a co-operative.

Grouping of people into a co-operative is intended to provide several benefits which individuals would not be able to achieve on their own. The co-operative model provides invaluable benefits to members and employees as more recyclables are collected collectively and therefore making the business more successful.



Co-ops Challenges

Finding suitable premises without lengthy delays or getting long-term occupation agreements on such premises seems to be challenging for co-operatives. Vacant government buildings are an option, but buildings standing empty for a while are often in a run-down or vandalised state and obtaining lease agreements has its own problems.

Co-operative members are often forced to work from their homes and private yards due to the lack of a central shared or communal space that is large enough for sorting of the collected waste. The quantity of recyclables a co-operative can handle at any given time is restricted by the space they have available, and they are forced to stop working if the sale of recyclables is, for some or other reason, delayed. Space is also needed to accommodate co-operatives' growth possibilities, for example to house a future processing plant.

Maintenance and operational costs of big expensive structures:

In some instances co-operatives are provided with premises and structures that do not fulfil their needs. Co-operatives are challenged to maintain donated structures, especially if the maintenance cost is more than they can afford.



Equipment

Co-operatives refer to two types of equipment, namely, technical operations equipment and office equipment. Office equipment can help to streamline administrative tasks such as bookkeeping and record keeping. The need for equipment for technical operations increases as the co-operative seeks to recover, sort, store and transport greater volumes of recyclables.

Not all co-operatives work in the same part of the recycling value chain and not all co-operatives thus need exactly the same equipment. Operations along the waste value chain include activities such as collection, sorting, buying back, recycling and manufacturing or recovering. Some co-operatives cover, or want to cover, a larger part of the value chain and need more equipment. Other co-operatives are familiar with the picking operations and are content to do just collection of recyclables and to sell it loose to mobile buy-back centres (middle-men) for somewhat lower prices. One of the advantages of selling to mobile buy-back centres is to have faster movement of recyclables through the co-operative without having to store for long periods, or having to maintain expensive equipment. Thus, less space is needed and running expenses are also less.

PPE for health and safety such as bags and overalls and bulk bags for storage of recyclables are the first essential equipment that any co-operative in the recycling business needs. Many co-operatives reported receiving PPE from various stakeholders and recyclers and other stakeholders sometimes donate bulk bags. By providing bulk bags or cages/bins to businesses such as taverns, a co-operative builds relationships with the owners and reaps the benefit of collecting the recyclables for free.

The need for PPE and bulk bags is followed by scales and baling machines, but it should be kept in mind that if co-operatives do not have electricity at their premises, they should select baling machines and scales that do not need electricity to operate. The type of scale needed will depend on where and how it will be used. A scale is useful for co-operatives to verify the information they receive when they sell their material, or if they are buying recyclables from other collectors. If co-operatives only collect and then sell to buy-back centres, they can get by without scales for weighing their recyclables, because buy-back centres provide receipts or slips that indicate the weight of the recyclables which the co-operatives can use for their record keeping purposes.



The type of baling machine needs to match the type of recyclables that are collected. Cans need a specific type of crusher and using a baling machine intended for plastics to bale cans will impact the life of the baler and increase maintenance costs. If co-operatives are baling the recyclables, a forklift may be needed to load the heavy baled recyclables onto a truck for transport to the recyclers who buy the recyclables. In instances where the recyclers collect the recyclables at the co-operatives' premises, they still need a forklift to load the bales or bulk bags. Currently the recyclers' trucks are not equipped with hoisting gear – something that could be considered in future – and not many recyclers are prepared to travel too far to collect recyclables from the co-operatives.

With ownership of equipment comes the responsibility of maintaining the equipment and paying insurance on the equipment. Ownership of equipment is also accompanied by the need for lockable space where the machinery can be safely stored.



Transport

The need for transport can be grouped into two categories:

- Transport for collecting recyclables, and
- Transport for delivering recyclables to the markets

Transport needs are dependent on the local area in which each co-operative operates. Transport for collecting recyclables is often less of a problem in the smaller towns, where the biggest transport challenge is to move the recyclables over long distances to get to the markets in the bigger cities. The opposite is true in cities where the collection areas are much bigger and the buy-back centres relatively closer.

Depending on the activities of the co-operative – collecting from households, or transporting bales and filled bags to recyclers – different types of transport are needed. While collection vehicles can save time collecting recyclables over long distances, trolleys and tricycles combined with trucks can be a neat and lower cost solution.



Co-operatives with access to (reliable) transport have opportunities to service larger areas, collect larger volumes of recyclables, including collection from other businesses or co-operatives that do not have transport. Co-operatives with access to transport can thus get hold of higher volumes of recyclables and they can also sell to those offering the best prices, because they are not restricted to buyers in close proximity to their operations. But access to vehicles also increases the operational costs of co-operatives, e.g. fuel, insurance, licensing.

In cases where municipalities have special arrangements with co-operatives to provide trucks, these arrangements do not necessarily allow for optimal and satisfactory working conditions. Sponsored vehicles are not always suitable to get the job done. Either the size or type of vehicle is inappropriate, or it is not available at the time or day needed by the co-operative. Co-operatives can also become dependent on the sponsored transport, and although they do not have control and it is not an optimal arrangement, it makes it difficult for them to move back to simpler ways of transport which they will be able to afford in the long run.

Because profit margins are low in the recycling business, a transport hiccup can cost a co-operative dearly if sufficient volumes cannot be collected and moved on time.

Transport or the lack thereof, especially between remote towns/rural areas (the source) and cities (the market) is a significant problem. Not all recyclers are willing or interested in travelling long distances to collect recyclables.

The recyclers often place the burden of transport of the recyclables on the co-operatives, which in turn has a direct impact on the types of recyclables the co-operatives can collect. The lack of interest to collect is usually because the value of the recyclables is less than the cost to collect. For the same reason one could argue that it will also not be profitable for co-operatives to take recyclables to the recyclers in the larger cities, even when they have their own trucks.

Operations

In the true spirit of a co-operative, members come together and form a co-operative naturally, when the members realise there is greater benefit in working together than there is apart. Members often have experience of working together, before they register as a co-operative. Unfortunately, according to co-operatives this is not always the case, with government seen to be driving (or “forcing”) a top-down approach in registering new co-operatives. People with no or very little experience of working together now need to function together as co-operative members.

With government’s drive to register new co-operatives, co-operative members do not always have experience of working together. A co-operative thus needs to plan and discuss how the members are going to go about executing their operations, including their daily tasks, because it is a huge transition from working for oneself to working together, especially if the members have not been working together as a group before.

3. BUY-BACK-CENTRE

A buy-back-centre or buy-in-centre is a facility where individuals or groups bring recyclables in return for payment.

These centres promote job creation as they attract unemployed collectors of recyclables in the informal sector who usually sell their items to the centres for a better price than is offered by the mobile agents that collect recyclables from vehicles on behalf of some formal recycling companies on an ad hoc basis on street corners.

The benefit of the buy-back centre is that collectors can return when they like, selling their collected recyclables and ensuring that the items are weighed correctly on an accurate scale. The collectors are also then free to find more items and return later to sell them at the centre. It is extremely important that these centres are conveniently placed in the areas where collectors find the recyclables. Each centre should be strategically located to service collectors within a maximum of a 2 to 5km radius around the centre. This is because recyclables like cardboard are heavy to haul by hand or in barrows for long distances. If the centre is not close enough to the collectors, they will not support it and will rather sell their recyclables to mobile agents.



Opportunities

Jobs are created at each centre as an entrepreneur is required to operate and manage each centre, sorters and balers are needed to accept and process the material for collection by the recycling companies, and informal collectors can be licensed to supply each centre in return for preferential (special) rates and value-added benefits such as storage lockers for their belongings. If the material is well sorted and baled in bulk, higher prices can be obtained - especially where paper, plastic and metal are concerned.

The recycling industry or entrepreneur usually funds the rental for the centre and the transport of the recyclables to the processing factory, using profits from the sale of the recyclable items to the recycling industry. If municipal property is used for the centre, reduced rental and rates for the site are recommended for a minimum of the first three years in support of the business, until a stable clientele is established by the entrepreneur

To ensure the viability of the centre, the entrepreneur should also be advised to go out and secure recyclables themselves from known sources like businesses in the area.

The buy-back centre entrepreneur also needs to build up a good relationship with informal collectors in the area, and consult them about prices they want for the sale of their recyclables.



CO-OPERATIVE LAUNCH - VALLPARK

4. WASTE MANAGEMENT COMPANIES

Waste Management companies are private owned businesses that buy and sell recyclables, which may include; plastic, paper, metals, glass, electronic waste, oil and organic waste. They are normally large organisations that use industrial equipment to sort, bale and transport waste. Majority of the waste companies use manual labour to sort waste, as automated machinery are very expensive.

Waste companies do buy from waste pickers, but mainly buy recyclables from buy-back-centres, Material recovery facilities (MRF) or offer waste management service to businesses, shopping centres, sports grounds, residential complexes etc.



5. REPROCESSING FACILITIES OR MECHANICAL RECYCLERS

South Africa, like the rest of the world, discard most of its waste to landfill where it is covered with soil and forgotten about. As consumers “consume” more and more and the higher pressure on our current landfill space for our waste, it has become a huge concern. Diversion from landfill is therefore our only solution!

Reprocessing facilities are playing a vital role in reducing the amount of waste sent to landfill sites, and in turn creating wonderful new products. In this section, we will explain all the different reprocessing facilities.

PLASTICS

Plastic recyclers procure sorted, baled end-of-life plastics and re-process it into raw material. The recycled material can be used to manufacture new plastics products. Recyclate can be used as a percentage of the final material mix and in some cases can even solely be used to produce new products.

South Africa is amongst the top recycling countries in the world!

Mechanical recycling is keeping plastics for as long as possible. Domestic recyclate is typically used in 100 % recycled products and the potential life of the product is extended but the perceived value is reduced in the process. Where recyclate is used as virgin replacement in small dosages, products are perceived as maintaining its value, although the applications would be into other short-lived packaging items. Mechanical recycling is only economically viable in large volumes.

BALED PLASTIC PACKAGING



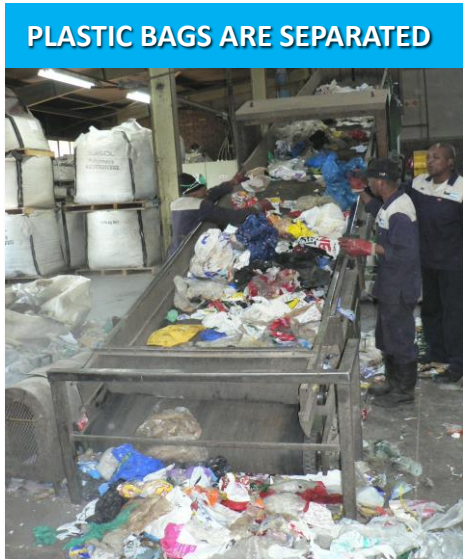
Plastics recycling process

The Plastics Recycling process can be classified in the following stages:

- Sorting and size reduction
- Washing and drying
- Extrusion / Pelletising
- Cooling / Drying
- Bagging

Sorting

Sorting and grouping of plastic materials according to resin type is an important first step in the recycling process because contamination can render a batch of material un-reusable. The most frequently recycled resins, including Polyethylene Terephthalate (PET), High-density Polyethylene (HDPE), Low-density Polyethylene (LD-PE), and Polypropylene (PP), must be carefully separated from one another in order to enable further processing. Contaminants within each type of plastic must also be removed from the base resin to ensure quality, this will include; labels, stickers and closures on certain products.



Size Reduction

Plastic materials usually need to be cut into smaller sizes in order to allow further processing and to provide easier packaging, transportation, and distribution of recycled stock. This cutting presents certain challenges, as many plastics are abrasive to metal blades and can have wide variation in their hardness, weight, and thickness. Most standard size reduction is performed by single or multi-shaft shredders, and granulators. Multi-shaft shredders perform scissor-like cutting with a series of rotating blades that can handle moderately dirty or contaminated material, but are somewhat imprecise in the size of the cuts. Single shaft shredders perform more of a tearing motion, and have slower motors that lengthen blade lifespan. They can also handle dirty or abrasive material and usually have adjustable or replaceable blades.

Granulators are composed of a rotor attached to blades that rotate within a chamber containing a grid floor. Their capacity for processing plastic material depends on the speed of the rotor, angle of the cutting blades, spacing of the grid, and the shape of the rotor. Granulators are usually sturdy machines, capable of relatively rapid cutting rates, and the presence of the grid allows for more precise control over the size of cuts. Granulator blades typically need to be replaced regularly over the course of operations



Washing and Drying

After the plastic has been cut into smaller pieces, or “flakes,” the stock usually needs to be washed in order to remove lingering dirt or attachments. Paper, glue, sand, and grit are some of the common elements targeted in the washing process, which can be accomplished using water baths, friction washers, or a washing line. The washing line applies a continuous hot spray over a stream of plastic material, removing some or all of the labels and dirt attached to the plastic surface. Detergents and disinfecting agents are often included in this process to improve the level of cleaning. Washing methods are solely based on the type of product that will be recycled within that facility.



To reduce the potential for stock contamination most recycled plastic undergoes separation treatments, which work to remove any attachments or non-reusable materials that may be present in a batch of flakes. Most separation processes can be categorized as “wet” or “dry” methods. Float tanks are the most common wet method, separating material based on density and whether it sinks or floats, while hydro-cyclones use centrifugal force to divide material according to weight.

Among dry methods, air classification differentiates between types of plastic based on the ratio of flake surface area to mass, meaning thicker materials are sifted away from thin ones. Mechanical separators usually divide flakes according to size, and sometimes shape. These machines can be designed with flat, circular, or inclined configurations. Laser spectral analysers are most advanced machines that use spectroscopic detection to determine precise levels of contamination in a given batch. Alternative devices can employ ultraviolet or fluorescent light to separate plastic according to colour or light absorption levels. Melt separation machines move plastic flakes along a conveyor or hot roller while heat is applied to separate material according to melting point.

In South Africa, the plastics recyclers use the ‘wet’ method to wash their plastics. To conserve resources, the water in the water-baths are also filtered and recirculated back into the system. Settling tanks are cleaned weekly and monthly, depending on the quality of the source of materials that are processed. Due to the fact that the majority of the plastic packaging are sourced from landfill sites, that materials are therefore heavily contaminated and hence washing is needed to increase the quality of the end product.

Once flakes are washed, the material will be dried and moved to the next stage of processing. Precautions need to be taken before the extrusion process, as the granulate must be dried properly to prevent the formation of blown pellets that will cause voids in the final product and reduce the aesthetic appearance on the product.

Extrusion / Pelletising

Pelletising is the final step in most recycling processes. Converting post-consumer plastic into pellets allows for easier distribution and remanufacturing, and ultimately benefits the speed and effectiveness of reintroducing recycled plastic into industrial manufacturing. After sorting, drawing, separating, and drying the reclaimed material, the flake stock is ready to be extruded into pellets.

Typically, single or double screw extruders are used at this stage. The ratio between the length of the extruder screw and its diameter, as well as overall screw design, can vary depending on the type of resin being processed. Single screw extruders rely on pumping action and shear to shape plastic, while double screw extruders perform more of a mixing function with lower shearing force to create a compound material. Ventilation and vacuum pumps may be required to regulate the degassing effects. Once the reclaimed plastic has been pelletized, it is ready for distribution and remanufacturing.



Cooling and Drying

Pellets are cooled by ambient air or air blowers and are either stored in bulk bags or large containers.

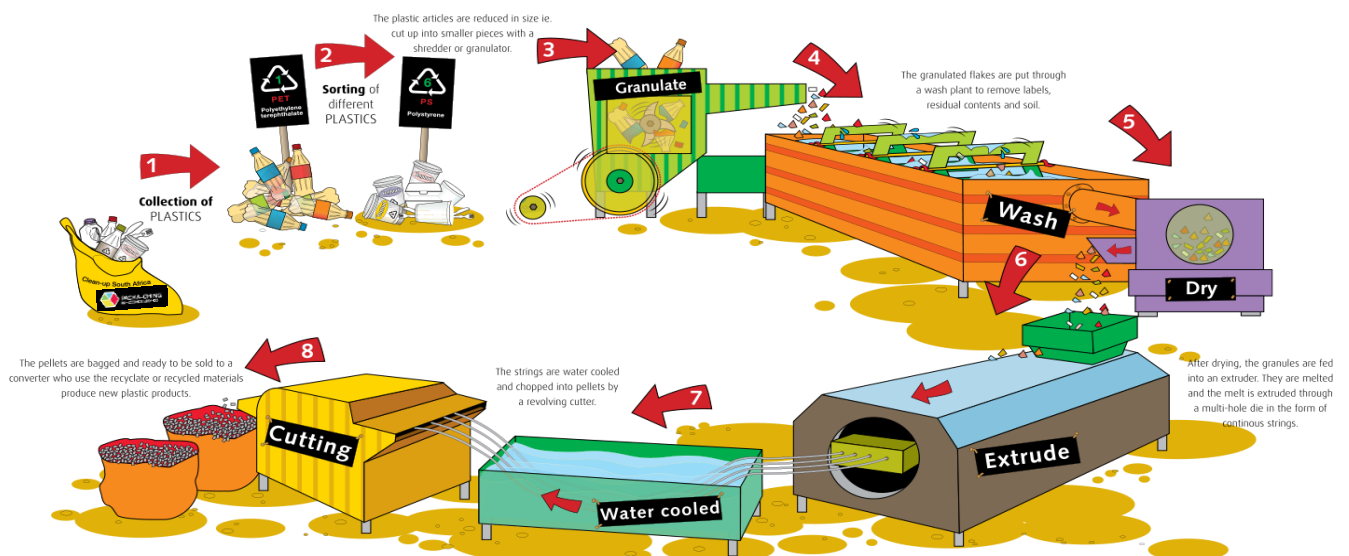


Bagging

Recycled plastic pellets are bagged in 25kg and 1000kg sizes.



Recycling Process Flow - Overview

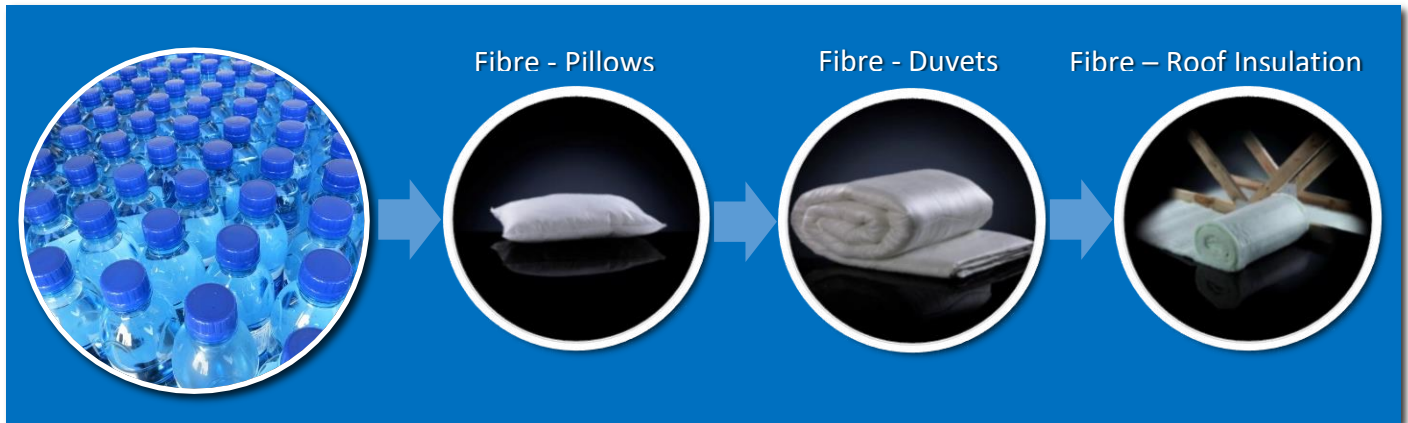


Plastic Recycled Products

The South African Plastics Recycling Industry produce many different products, for many different applications. Below are a few examples of products made from common plastics.

PET RECYCLING

PET (Polyethylene Terephthalate) is a plastic most commonly used to manufacture bottled-water and cool-drink packaging. Once used, PET can be recycled into many new and useful products, including being turned back into bottles.



PE-HD & PE-LD RECYCLING

High Density Polyethylene (PE-HD or HDPE) and Low Density Polyethylene (PE-LD or LDPE) are two common plastics used for packaging in South Africa. These materials get used for a wide range of products; from milk bottles, carrier bags, bottle closures, containers and toys.



PVC RECYCLING

Polyvinyl Chloride (PVC) use to be used for many packaging products, but has been phased out over the last decade, as PET has become the material of choice. PVC is mainly used for non-packaging products like; low-pressure pipes in the building industry and gumboots for the mining industry. PVC is widely recycled in South Africa.

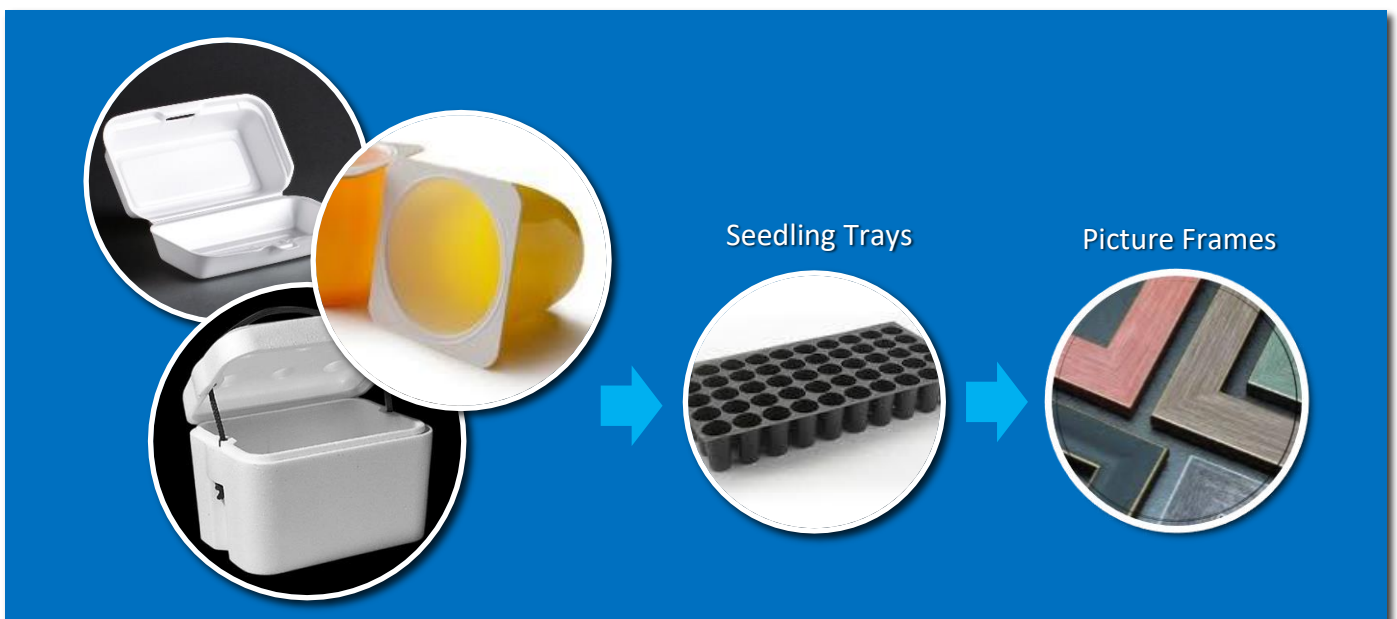
PP RECYCLING

Polypropylene (PP) is another common plastic used for a wide range of packaging and non-packaging products. Polypropylene is used in; yoghurt containers, automotive components, reusable containers of different types, plastic parts, packaging and labelling, loudspeakers, polymer banknotes, stationery, and textiles; including carpets, ropes, and thermal underwear.



PS RECYCLING

Polystyrene is one of the most common forms of plastic. It is used as take-out coffee cups, egg cartons, yoghurt containers and packing material for cushioning electronic goods. Many call it Styrofoam, though that term is actually the brand name. Polystyrene is a very versatile material, but recycling it isn't always easy, due to its light weight. Polystyrene has two forms, expanded Polystyrene (EPS) and High Impact Polystyrene (HIPS).



PAPER

Paper for recycling has to be collected separately from other materials. It is important that it is kept separate from other waste as contaminated papers are not acceptable for recycling. If, in some cases, paper is collected together with other recyclable materials, such recovered paper must be specifically marked.

The process of waste paper recycling most often involves mixing used/old paper with water and chemicals to break it down. It is then chopped up and heated, which breaks it down further into strands of cellulose, a type of organic plant material; this resulting mixture is called pulp, or slurry. It is strained through screens, which remove any glue or plastic (especially from plastic-coated paper) that may still be in the mixture then cleaned, de-inked, bleached, and mixed with water. Then it can be made into new recycled paper.



Pulping

Broadly speaking, the final production process for recycling paper is the same as the process used for paper made from virgin fibres but, as the recovered paper fibres have already been used, they also have to be sorted and cleaned. For certain paper (e.g. graphic paper and hygienic products) ink has to be removed from the recovered paper, i.e. the fibres have to be de-inked.

As a first step, recovered paper is sorted and graded then delivered to a paper mill. Having reached the paper mill, it is 'slushed' into pulp and large non-fibrous contaminants are removed (for example staples, plastic, glass etc.). The fibres are progressively cleaned and the resulting pulp is filtered and screened a number of times to make it suitable for papermaking



De-inking

Before the recovered paper can be used to manufacture certain grades of paper the printing inks have to be removed to increase the whiteness and purity. The recovered paper is first dissolved in water and separated from the non-fibre impurities.

The fibres are then progressively cleaned in order to obtain the pulp and during this stage the ink is removed in a flotation process where air is blown into the solution. The ink adheres to bubbles of air and rises to the surface from where it is separated. After the ink is removed, the fibre may be bleached, usually with hydrogen peroxide.



The pulp is then ready to be made into paper. Depending on the grade of paper being produced, quantities of virgin pulp from sustainable sources may be added. Some papers, such as newsprint and corrugated materials, can be made from 100% recycled paper.

Once the paper is used, it can be recycled and the process starts again.



METALS

Metals can be reused in the production of a multitude of different products, ranging from cars to window frames, and from aeroplanes to foil trays. Many of the food and drink products that we buy are packaged in cans made from either aluminium or steel and both. This endless reuse cycle is also known as 'closed loop' recycling. For drinks cans collected, the closed loop can mean used cans are reprocessed and remade into more drink cans.

The Recycling Journey

Stage 1: Collection

You put your cans into the appropriate recycling container, or in bring banks, and these are then collected from your kerbside or local recycling centres/points.



Stage 2: Sorting and Baled

The cans are taken to a sorting facility where large magnets are used to separate the steel cans from aluminium cans and any other materials collected.



Stage 3: Melted into Ingots

Steel cans are baled and sent to a steel making plant centre where they are then put in a furnace heated to around 1600°C. Molten iron and oxygen is added and after about 30 minutes the impurities are driven out and the mixture becomes molten steel. Aluminium cans are shredded into small pieces the size of a two Rand coin and they then have hot air blown through them to remove decoration. The shreds are melted in a furnace heated to 70°C and this molten metal flows into moulds which are then cooled by water to form a hardened ingot. These ingots are then heated and rolled into aluminium sheets to the exact specification required by the can maker.



Stage 4: New product is made

The molten steel formed from the steel cans is formed into big slabs, which are then rolled into coils. The steel coils are recycled into a variety of steel products, such as cars, train tracks and steel cans. The steel cans are used again by food and drinks manufacturers and sold to supermarkets where you buy them and start the process again.

The aluminium sheets are lubricated and made into cans which are then trimmed, washed and decorated. The cans are then ready for reuse by food and drink manufacturers who sell them to supermarkets, where you buy them and start the process again



GLASS

Sorting

The unwanted glass needs to be sorted by their colours. This is because different chemicals need to be added to different coloured waste glass to produce recycled glass of the desired colour.

Processing: Producing glass cullet

After the sorting stage, the next stage in the glass recycle process involves crushing and grinding the waste glass into tiny pieces. This finely crushed glass pieces are referred to as cullet.



Processing: Removing contaminants

The next stage in the glass recycle process involves the removal of contaminants from the glass cullet.

The glass cullet is passed through a magnetic field, where metal contaminants like metal bottle caps are removed from the glass. Other contaminants like paper and plastic are picked up manually or through an automated process.

Ceramic contaminants are removed from the glass cullet via a process known as fine sizing. The finely ground glass cullet is passed through various screens, leaving behind ceramic residues.

If, however, ceramic contaminants do pass through the various screens together with the glass cullet, the quality of the recycled glass will be affected. Ceramic contaminants in glass can lead to structural defects.



Processing: Melting of cullet

The cullet is then melted.

This glass cullet can then be used in manufacturing recycled glass products like new glass containers, bottles etc.



Processing: Decolorizing and dyeing

To produce recycled glass of the desired glass, the recycled glass has to undergo glass decolorizing in the glass recycle process, followed by dyeing.

The first step in the decolorizing process includes oxidizing the melted glass cullet.

For green glass, the oxidation process turns the deep dark green colour to yellow-green colour. A chemical known as manganese oxide is then mixed with the glass cullet to it grey. The grey base is usually used as the primary colour to which various other colouring dyes or agents are added to develop glass of various colours.

For brown or amber-coloured glass, zinc oxide is added instead to oxidize the brown glass cullet to blue or green cullet, depending on the quantity of zinc oxide added and the richness of the brown or amber-coloured glass being recycled.

If the clear recycled glass is required, erbium oxide and manganese oxide are added to the glass cullet to help clear all the colours from the glass cullet.

Some of the most commonly used colouring agents for dyeing of recycled glass include borax, potassium permanganate, zinc oxide, erbium oxide, cobalt carbonate, neodymium oxide, and titanium dioxide.



Processing: Making recycled glass products

In the last stage of the glass recycling process, the recycled glass, coloured or clear, is then moulded into the various products and sold in the markets.

MAKING OF NEW BOTTLES



WHAT YOU NEED TO KNOW ABOUT PAPER AND PACKAGING RECYCLING IN SA



In many respects, the paper and packaging sector is more advanced than most in terms of its waste management. To some extent, this is because the materials involved are, often, less hazardous than those of other industries. Also, the sector has been under close scrutiny by the public for several decades, simply because packaging waste streams pass through the hands of the general public at some stage.

Mostly, the industry's good track record is a result of its having accepted the waste management challenges confronting it and being innovative in finding solutions.

There are, nonetheless, some major obstacles still to be addressed within the industry. These are related to legislation required to enforce waste management standards across the sector and also to involve the public to a much greater extent in recycling and recovery processes.

For instance, better sorting methods at collection points, particularly households, would reduce waste management costs by providing a higher level of uncontaminated waste for the recycling industry.

It would also create jobs for people needed to collect recyclables from households and take the material to a different location for further separation.

However, most municipalities simply don't have the regulations in place to compel households to separate their waste into recyclable and other waste streams.

The paper and packaging industries has made great strides in implementing the first three elements of the waste management hierarchy as delineated in the National Environmental Management: Waste Act, No 59 of 2008. Avoiding the creation of waste, reducing the amount of waste generated, and reusing, recycling, and recovering waste that is created before sending it to a landfill site have all been improved.

Some 30% of paper and packaging waste is being diverted from landfills. Of the millions of tons of new paper and packaging released on to the South African market annually.



Well done to the **PAPER AND PACKAGING** industry in **SOUTH AFRICA**

Please note, not all packaging is recycled in SOUTH AFRICA!

PLASTIC

PLASTIC THAT WILL BE RECYCLED

- ✓ Plastic Bottles
- ✓ Plastic Trays/Tubes (**Not** PET )
- ✓ Expanded Polystyrene Packaging (Foam)
- ✓ High Impact Polystyrene Packaging (Hard)
- ✓ Plastic Bags
- ✓ Plastic Buckets

PLASTICS THAT ARE **NOT** CURRENTLY RECYCLED

- ✗ Chip Packets
- ✗ Sweet Wrappers
- ✗ Washing Powder Bags
- ✗ Sauce Sachets
- ✗ Dirty Clamshell Packaging



- ✗ Very few packaging products are made from PVC and therefore do not make it financially viable to recycle. Example; Hard, rigid, clear bottles like cordial bottles.



- ✗ Unfortunately Multi-layer plastic packaging are also **NOT** currently recycled in SA. Example; soup packets and crisp packets.



Soft drink, juice and water bottles

- ✓ Only clear, blue, green and brown bottles will be accepted



- ✓ Common white and coloured plastic, like milk bottles and shampoo/detergent containers.



- ✓ Soft, flexible plastic bottles, like squeezable sauce bottles and plastic film products such as bread bags.



- ✓ Hard plastics, like ice-cream tubs and lunch boxes.



- ✓ Rigid, brittle plastic, like yoghurt tubs and foam Polystyrene containers.

HOW TO IDENTIFY PLASTICS

Types of plastic are identified by different symbols. Despite the popular misconception, the identification code does not indicate the safety of the products – it is an international code used to identify the various plastics for effective recycling.

THE POLYMER CODE

The plastic identification code (number) is either at the base of the product or printed on the label.



PAPER



PAPER THAT CAN BE RECYCLED

- ✓ **Cardboard** - Includes cardboard boxes, cereal boxes, cardboard dividers, egg boxes, toilet roll inners, fruit boxes, wine boxes, corrugated board, phone books any other cardboard packaging.
- ✓ **Office paper** - Includes printer paper, writing paper, school books, and envelopes.
- ✓ **Magazine and brochures (including glossy kinds)**
- ✓ **Newspapers**
- ✓ **Books:** reading books, phone books, old school books, etc.
- ✓ **Envelopes**
- ✓ **Liquid packaging (TETRAPAK)** - milk and juice cartons



PAPER THAT CANNOT BE RECYCLED

- ✗ **Plasticized paper, laminated paper**
- ✗ **Photographs and overheads**
- ✗ **Dirty paper plates**
- ✗ **Waxed and grease proof paper**
- ✗ **Wet or dirty paper or cardboard**
- ✗ **Tissues, serviettes, toilet papers and paper towels for hygienic reasons**
- ✗ **Dog food bags**
- ✗ **Wax-coated or foiled lined boxes**
- ✗ **Used cement bags**
- ✗ **Carbon paper**
- ✗ **Disposable nappies**



UNSUITABLE PAPER

Cement bags, dog food bags, Reason:

- Contamination from the residue of the contents, makes them unsuitable for recycling. The raw materials and liners required to waterproof these and similar products are not recyclable.
- Plastic lined paper, foil lined paper – They don't break down in the paper cooking process.



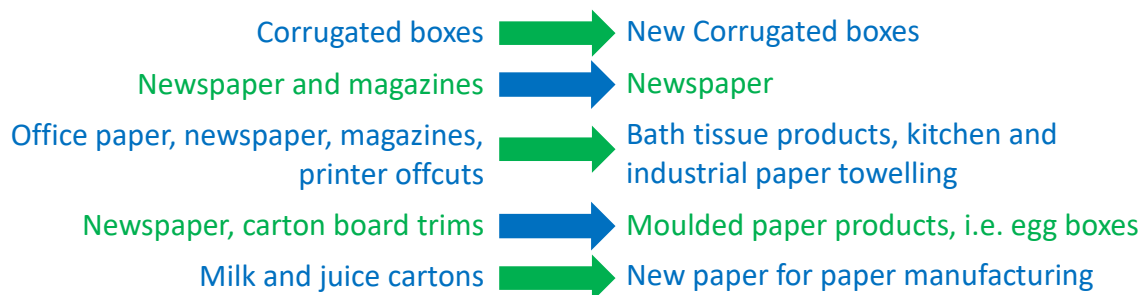
WHAT YOU NEED TO KNOW

- The quality of newspaper diminishes after 3 months, so don't hold on to them too long.
- Find a clean covered area to store your paper products. Paper that is wet will receive a lower price than dry paper.
- To minimise handling, separate your paper during the collection process. This will help you save time and allow you to collect more material in the day.
- KEEP your paper clean and dry... to ensure that you receive the highest value.

USEFUL INFORMATION

Every one of us, every day, uses paper for a variety of reasons and a number of purposes – there is plenty available to be collected.

WHAT IS MADE WITH RECYCLED PAPER



METALS



METALS THAT CAN BE RECYCLED

- ✓ Aluminium and steel cans
 - Beverage cans
 - Food cans
- ✓ Aerosol cans



Steel and aluminium cans must be separated

PLEASE USE A MAGNET TO DETERMINE WHICH CANS ARE ALUMINIUM AND WHICH ARE STEEL.



Steel can will stick!



**Aluminium can
does **not** stick**

What do you mean by contamination?

- All loose UBCs contain contamination.
- Contamination can take many forms, including: water, sand, mud, dust, plastics, foreign objects, aerosols, stones and other metals.



HOW TO DIFFERENTIATE BETWEEN STEEL AND ALUMINIUM CANS

The following tips will help identify aluminium cans over steel cans:

- The bottom of an aluminium can is much more shiny than a steel can bottom
- The best way to tell the difference is to use a magnet on the side of the can. If it is magnetic, then it is a steel can. Do not test the top of the can as all cans have an aluminium top and tab.
- Another way to identify an aluminium can is to look out for the aluminium recycling logo (not found on all cans).
- Aluminium cans are also lighter and easier to crush.

Did you know?

- The aluminium drink can is the world's most recycled packaging container.
- Steel and aluminium cans are able to be recycled multiple times with no loss in quality.
- Recycling aluminium drink cans saves up to 95% of the energy needed to make aluminium from raw materials.
- Recycling steel means only 25% of the energy needed to make steel from virgin raw materials is used.
- The price for aluminium cans are much higher than steel cans.
- UBC - stands for 'Used Beverage Cans'
- All loose UBC's contain contamination, which include: water, sand, mud, dust, plastics, foreign objects, aerosols, stones and other metals.
- Some recyclers only buy baled cans, but most buy loose cans in bags.

Some Numbers

- There are approximately 71 aluminium beverage (330ml) cans in one kilogram, and
- Approximately 37 beverage cans in one kilogram of steel cans

1000 Steel cans = 27kg
1000 Aluminum cans = 14kg

What affects the pricing of UBC?

- Pricing is largely a function of the globally traded price for aluminium. Aluminium is a globally traded commodity and is listed on the London Metal Exchange.
- Other pricing factors include the Rand/Dollar exchange rate, the level of contamination in the UBC (like sand, stones, plastic, moisture, etc.), and the quantity of cans being supplied.
- The distance from the recycler, as this affects the cost of transportation, which can be very high for loose cans.



GLASS



THE RECYCLING OF GLASS

- Benefits the environment by minimizing the consumption of raw materials and thereby alleviate pressure on natural resources
- Energy saving
- Helps create a better, safer and cleaner South Africa for everyone
- Provides a source of income to thousands of unemployed people
- Prevents waste glass from entering landfills.

GLASS THAT WILL BE ACCEPT

- ✓ Cool drink, water and juice bottles
- ✓ Food and sauce bottles and jars
- ✓ Wine and alcohol bottles
- ✓ Clear drinking glasses
- ✓ Beer bottles

GLASS THAT WE DO NOT ACCEPT

- ✗ Window pane glass
- ✗ Mirrors and windscreen glass
- ✗ Laminated glass
- ✗ Fluorescent tubes and light bulbs
- ✗ TV screens
- ✗ Car headlights
- ✗ Heat-resistant ovenware
- ✗ Crystal drinking glasses and tumblers
- ✗ Ceramic cups and plates
- ✗ Crystals
- ✗ Clay and flower pots
- ✗ Burnt glass



WHAT YOU NEED TO KNOW ABOUT COLLETING GLASS

- Your glass must be clean
- 1 ton bags must not be exposed to rainy & sunny condition for more than three weeks, otherwise they start to tear.
- Bag filled with broken glass is not equal to 1ton, it must be weighed to determine the correct weight.
- A bag full of broken glass normally weighs between 750 kg and 900 kg.
- Glass reprocesses, expected supply volumes of 25tons. Therefore collectors need to sell to BBC or smaller recycling companies.
- Always make sure that the bottom discharge chute is securely fastened on the outside of the bag. This must be done before crushing the bottles in the bag, do not use wire to fasten the bag.
- Do not under load (weight less than 22,5 tons). Re-processors will make not accept the load and you will have wasted a trip to them for nothing.
- Any load less than 22, 5 tons will incur some penalty.
- The total weight of 30 - 34 tons per load of full bags.
- Glass must be free from any contaminants (stones, soil, sand, etc)
- It is the responsibility of the collector to organise a forklift, TLB or any machine to uplift bags onto the truck. Trucks must be loaded ASAP to avoid any penalty.
- To supplement your income please sell your returnable bottle (unbroken bottles/clean) for a deposit.
- You can also recycle cans, paper, plastic etc.

KEY POINTS IN GLASS COLLECTION

- Break your glass (20-40mm) or R5 coin size
- Avoid / remove contaminants, ceramics, stones
- Do not sort your glass (MIX)
- Package your glass in bags, drums etc.
- Call The Glass Recycling Company & will refer you to a nearest buy back centre

SAFETY

- Always wear safety gloves when handling broken glass
- Always wear your safety glass/goggles when breaking glass
- Always wear shoes with thick sole when working with broken glass



RECYCLING – BASIC BUSINESS TOOLS

WHAT AFFECTS THE PRICING OF RECYCLABLES

- **Quality of materials**
 - Clean, Dirty
- **Have the products been sorted correctly**
 - Plastic (PET, PE-HD, PVC, PE-LD, PP and PS)
 - Paper (White paper, cardboard, tissue, etc)
 - Metals (Aluminium and Steel cans)
 - Glass (Colour)
- **Baled or Loose**
 - Check buyers requirements
- **Delivered or Collected**
 - Use the best option for you, either you can deliver or the recycler could collect.
 - Delivered price is always better
- **Colour**
 - Only certain plastic products need to be separated by colour, like PET (Clear, Blue, Green, Yellow, Brown)
 - Glass – Clear, Brown and Green
- **Location**
 - There are more recycling companies in JHB, Durban, Cape Town. The closer you are to the recycler, the higher the price will be.

BUSSINESS TIPS

- Do as many recyclable streams as you can manage. Plastic, Paper Cans and Glass. This will help you to have a steady income and offer a one-stop-shop to your customers.
- Grab every opportunity
- Keep on trying... and try to collect a little more every day!
- Team up with people who are prepared to work as hard as you.
- Network – remember the power of networking to grow your own business.
- Remember that your business comes first!
- Focus on growing your income
- Enjoy watching your savings grow and also reward yourself for your hard work.
- Recycling business = competitive
- To make profit – offer a service that is in demand! AND make sure that your service is reliable & professional!

THREE KEYS TO SUCCESS

- PERSISTENCE – Keep on trying
- PERSERVERANCE – Never, never give up
- DELIVERY – If you say you are going to do something, Do it!

PAPER AND PACKAGING INDUSTRY SUPPORTERS



PLASTIC

Plastics | SA



PAPER



GLASS



METALS



PAPER AND PACKAGING CONTACT DETAILS

PACKAGING

Packaging SA

www.packagingsa.co.za

PLASTIC

Plastics|SA – Plastics Industry Body

www.plasticsinfo.co.za

PETCO – PET Recycling Company

www.petco.co.za

POLYCO – Polyolefin Recycling Company

www.polyco.co.za

SAVA – South African Vinyl Association

www.savinyls.co.za

Polystyrene SA – Polystyrene Association of SA

www.polystyrenesa.com

SAPRO – South African Plastics Recycling Organisation

www.plasticrecyclingsa.co.za

PAPER

Recycle Paper ZA – Paper Recycling Association of South Africa

www.recyclepaper.co.za

Tetrapak

www.tetrapak.com/za

METALS

Metpac-SA – Metal Packaging Association of South Africa

www.metpacsa.org.za

AMA – Aerosol Manufacturing Association

www.aerosol.co.za

GLASS

TGRC – The Glass Recycling Company

www.theglassrecyclingcompany.co.za

OTHER WEBSITES

NRF – National Recycling forum

www.recycling.co.za

MyWaste – Find your nearest Buy-Back-Centre or Drop-off site

www.mywasate.co.za