“A CAN OF WORMS”: AEROSOL WASTE WITHIN THE CONTEXT OF EPR, SOME INSIGHT FROM SOUTH AFRICA

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ABSTRACT

According to Extended Producer Responsibility (EPR) regulations, the paper and packaging sector needs to prepare EPR schemes for management of their end-of-life products. The aerosol sector recognises that aerosols present somewhat different challenges at end-of-life when compared to other types of packaging waste due to the nature of aerosols in comparison to paper and packaging. The Aerosols Manufacturing Association (AMA) therefore initiated background research to determine the feasibility of developing an aerosol specific EPR scheme. The CSIR was commissioned to conduct research to determine the current practices relating to end-of-life management and the associated challenges posed by aerosol cans as part of the packaging waste stream.

This paper presents the findings from a survey focussing on aerosol waste management practices and the challenges hampering increased recycling rates. EPR is a good option for implementing recovery of aerosol wastes. It should be considered that aerosol waste can be divided into pre- and post-consumer waste. There are instances where individual manufacturers have implemented recovery of pre-consumer aerosols, but respondents indicated that there are currently no formal takeback programs at municipal level for spent post-consumer aerosols. The informal sector does recover some of these items from households (post-consumer), but in general it was reported that buy back centres are reluctant to accept poorly dismantled aerosol cans. A challenge for collection is the low post-consumer volumes of aerosol can waste from households. Poorly managed aerosols do have several negative environmental, health and safety impacts. There is a need for more training and education on the specific requirements for handling and disposing of aerosol waste for the different stakeholders involved. There is also a need for innovative recycling technology which is simple to implement, and which is cost effective. Efforts should ideally be focussed on the pre-consumer waste streams, which can be recovered in relatively large volumes. The post-consumer waste streams present a co-mingled challenge, hence a ‘can of worms’ to mitigate. The findings of this research also provided evidence to AMA to inform their approach to EPR.

KEYWORDS

Aerosol Waste, Pre-consumer, Post-Consumer, Risks, Informal Sector, South Africa.

INTRODUCTION

Aerosol waste ideally refers to empty canisters from products that were packaged as aerosols, but in reality these cans are often not fully discharged leaving hazardous residues inside (Yasuda and Tanaka, 2006). A study in Japan confirmed the presence of explosive, inflammable, and reactive substances in waste aerosol cans (Yasuda & Tanaka, 2006). A typical aerosol canister will contain the following items: the metal cans (of either steel or aluminium metal), the plastic lid, internal plastic straw, sometimes left-over propellant, and the contents of the can (the product). Aerosol cans are used to package several products like household care or cleaning products[1], spray paint and insecticides; personal care products[2]; and products for the food service industry[3]. Personal care products are typically packaged in aluminium cans, whereas household and pest control products are packaged in tinplate steel cans (Niemiec, Fitrzyk & Grabowik, 2021).

This survey was prompted by the 5 May 2021 promulgation of the Extended Producer Responsibility (EPR) regulations (RSA, 2021) which apply to the Paper and Packaging Industry. Aerosol manufacturers have generally associated with the Paper and Packaging sector, especially on matters like EPR. However, the collection of paper and plastic packaging is somewhat different to that of end-of-life (EoL) aerosols, hence this survey to understand the status quo of the sector with some key questions related to EPR and a transition to a circular economy in South Africa. This paper outlines the current collection systems, how they function, who are the key role-players, the challenges experienced in recovering these materials, and some suggestions to address these challenges towards increased aerosols recycling.

AIMS AND OBJECTIVES OF THE STUDY

The main aim of this study was to collect information on the current practices, challenges and opportunities associated with EoL aerosol collection and management. The main objectives were to answer the following research questions:

1. Who are the key stakeholders in the collection of post-consumer aerosols?
2. What does the collection of aerosols for recycling entail?
3. How is this waste stream treated and handled at waste sorting facilities?
4. What are the challenges experienced in the collection and handling of pre-consumer and post-consumer aerosols?
5. How can these challenges be addressed to increase collection and recycling of aerosols, and by whom?

Following is a synopsis of the methods followed.

METHODS

Data collection was undertaken using semi-structured interviews, and self-administered questionnaires circulated via e-mail to targeted organizations identified as being associated with aerosol waste. For respondents to provide candid information on their processes, it was important to protect their identity through anonymity. Key stakeholder groups engaged for data collection were identified as the following:

- **Waste management** and **recycling companies** in South Africa who potentially collected aerosols.
- **Municipalities** (and the metros) implementing waste separation at source initiatives.
- **Metal recycling companies**.
- **Informal waste pickers**.

Due to an initial poor response rate from self-administered questionnaires, the focus was shifted to interviews conducted by phone or virtually using MS Teams.

[1] *Air fresheners, polish, carpet cleaners, and oven cleaners.*

[2] *Like deodorant, hair-shaving products.*

[3] *Baking and cooking non-stick sprays.*

RESULTS

The response rate on the self-administered questionnaires was initially only two out of 15 disseminated questionnaires. Fortunately, one-on-one virtual interviews (using phone or MS Teams) proved to be valuable in soliciting responses. The final response rate achieved from industry organisations were 7 out of 14 (50%) and from municipalities were 6 out of 9 (66.7%) participating in the phone/virtual sessions.

To ensure anonymity of participants, the responses below are reported in general terms, without reference to specific organisations, individuals, or municipalities. Some relevant general findings worth considering are presented below:

Pre- and Post-consumer Aerosol waste

The study revealed that there are two distinct aerosol waste streams. P**re-consumer** aerosol waste contains large volumes of product which need to be disposed of responsibly. This could be expired or still viable content either a liquid or gaseous material. These materials can furthermore be classified as either ***General***[4] or ***Hazardous*** wastes[5]. Thus, controlled combustion or landfilling at sites duly authorised to accept these different wastes is the current reported practice. However, disposal of liquid waste to landfill is restricted by law and is being phased out nationally (RSA, 2013)[6]. Recycling of pre-consumer aerosols requires the aerosols to be suitably separated at source. The distribution centre or storage facility will need to sort by brand or product type as each product type may require a different handling and disposal procedure. The different product classes need to be kept separate to ensure safe and proper treatment, recycling, and disposal. This waste stream was reported to be relatively small but carefully managed by manufacturers due to the high cost of product in the cans. **Post-consumer** cans are typically collected as part of the municipal solid waste (MSW) stream and disposed at municipal landfills These aerosol cans are usually assumed to be empty, but some may also still contain varying amounts of product. Municipalities surveyed consider co-mingled aerosol cans as a low-risk waste at the landfill site.

Risks associated with aerosols

Unpunctured aerosol cans were reported to pose a fire or explosion risk during baling at sorting facilities or during compaction on the landfill site. There is a potential for aerosol cans (with contents intact) to contribute to landfill leachate if liquid content escapes, which is another concern. Additional risks may be associated with the contents of the aerosol cans, especially if the contents are of hazardous nature.

The Informal sector

The informal sector is involved in the recovery of a wide variety of packaging materials including tin, aluminium, and some plastics which are also associated with aerosol cans at kerbside or at poorly managed waste sites. (DEFF, 2020; Godfrey, Strydom & Phukubye, 2016). Although the survey has indicated some informal sector activity in the recovery of aerosols, this was indicated as limited. Therefore, further studies are required on the specific contribution of the informal sector to the recovery of aerosol cans for recycling.

Low recycling rates

Respondents indicated that recovery rates for post-consumer aerosol cans were currently low, for the following stated reasons:

- Scrap metal dealers only accept punctured aerosol cans where product, propellent, the plastic straw parts have been removed. Poorly segregated aerosols were reported to be rejected or the seller heavily penalised in the form of lower prices per Kg or Tonne.
- The puncturing of metal aerosols is tedious and sometimes risky from a health and safety perspective.
- The relatively small volumes of aerosols currently recovered from post-consumer sources does not warrant investment in puncturing equipment by recycling companies. However, this may

[4] *For instance, metals, plastics, cans containing compressed air, oils or other items used for food preparation.*

[5] *For instance, chemicals, hydrocarbons, poisons, or insecticides.*

[6] *Prohibitions and restrictions on the disposal of waste to landfill come into effect after the timeframes indicated for each waste type, six years for certain liquid wastes as stipulated in Section 5 of the legislation.*

change if the volumes of recovered aerosol cans increase because of policy or legislation changes.

- The volumes collected currently were reported to be too small given the current high transport costs.
- Time, effort and risk associated with recovery, decompression, and dismantling of the aerosol cans especially when co-mingled with other waste streams, and then to transport this, makes it not viable for waste pickers or small waste businesses at the current offered prices.
- Informal pickers collecting aerosol cans are likely to be in the minority due to the relatively low value currently associated with aerosol cans and the difficulty reported to crush the cans. It is likely that higher value products are cherry picked by the informal sector in preference to aerosols, for instance where copper, aluminium, white paper, different plastic grades, or cardboard may instead be collected. However, higher prices paid to informal sector may provide an incentive for increased collection.

The above were some general observations from stakeholders. Findings as relates to the main research questions are outlined below:

Who are the key stakeholders in the collection of post-consumer aerosols?

Several stakeholders were reported by respondents, including municipalities (and metros), private waste collection companies, informal waste collectors, buy-back centres (BBCs), middlemen, some scrap metal dealers, material recovery facilities (MRF), and large metal recyclers.

- **Municipalities** or their appointed private sector service providers like **SMMEs**, or **cooperatives** collect mixed waste or source separated recyclables from pilot projects and government programs. Post-consumer recovery of aerosols is usually restricted by municipal by-laws assigning ownership of the waste to the municipality.
- Most pre-consumer aerosols are collected by **private waste collection companies** servicing business entities and industries which may not yet have reached the public. Although relatively small in volume, this waste stream is problematic due to the relatively full aerosol containers which may also be hazardous in nature.
- **Informal waste collectors**, the ‘trolley brigade’ or ‘waste pickers’, collect mainly post-consumer, kerbside, or wase site sources.
- **Buy-Back Centres** (BBC) buy recyclables from the informal sector and trolley brigade, but these need to be properly processed beforehand for instance to decompress and separate out the different constituents. The crushing of aerosol cans before removal of the plastic (straw) components by the informal sector typically renders the aerosols rejected.
- **Middlemen** for instance the “bakkie brigade”, buy materials from the informal sector and sell to scrap metal dealers.
- **Scrap metal dealers**, buying from the bakkie brigade, small BBCs, middlemen and the public, including the informal sector. They reportedly only buy decompressed cans with the plastics removed.
- **Material Recovery Facilities** (MRFs) are large industrial scale enterprises and are either municipal or privately owned. These may accept segregated aerosol cans that are still whole for safe decompression and removal of the recyclable components, but there is a cost to this.
- **Large metal recyclers** typically only buy from scrap metal dealers, and not from individuals. They may reject or penalise sellers with mixed loads through lower prices for contaminated or mixed loads.

What does the collection of aerosols for recycling currently entail?

The collection of aerosols for recycling is dependent on **good source separation**. Expired pre-consumer aerosols typically contain significant volumes of product plus propellant and may require further separation by product type to facilitate recycling or safe disposal of the product (contents) as well as the aerosol cans. Some **separation at source** initiatives were mentioned to exclude aerosol cans. This is reported due to the risks posed by these aerosols which is mitigated through avoidance.

The **informal sector** collects aerosols if there is a market and if the price to dismantle is worth their while. Training for them should be designed to mitigate **health and safety risks** and prevent

environmental pollution resulting from inappropriate puncturing, emptying and disposal of components and content.

Post-consumer aerosols are co-mingled with household waste and disposed of in this state at landfill. There was no organised or formal sorting mentioned from post-consumer sources. Commercial business, industrial and other pre-consumer sources are collected by specialised waste management companies. These are either disposed at suitably licenced landfill sites. Contents from pre-consumer aerosols is sometimes recovered but some is either burnt as a fuel or treated as required.

Transport costs are high and increasing, which limits the recovery of co-mingled aerosol can waste. When combined with the handling costs (time and labour) for recovery and then dismantling of aerosol cans, respondents indicated that it was not worthwhile separating out aerosols from a co-mingled waste stream.

How is this waste stream treated and handled at waste sorting facilities?

Most recycling or sorting facilities do not accept aerosols unless these are punctured, and the contents removed. Where these are recovered the empty aerosol cans are reported to be sorted together with other cans (food and drink cans) and sold to scrap metal dealers. The study only found one instance where post-consumer aerosols are reportedly manually emptied, in a well-ventilated area and the plastic components removed using a simple set of pliers. This is possible due to the relatively low volumes of aerosols captured in the recycling stream from the MRF. Other instances were mentioned of a manufacturer decompressing aerosol cans (in-house) on one of its manufacturing lines for pre-consumer aerosol waste being treated (punctured and contents recovered). This would likely be a part of the manufacturers' waste minimisation policy/initiatives in place in order not to waste valuable aerosol propellant or product.

Waste sorting facilities in general do not have the time nor equipment to puncture, empty and safely store or manage the non-recyclable contents of aerosol cans. Especially if these are collected in relatively large volumes. The current approach by most waste sorting facilities is to treat aerosol cans as non-recyclable waste and dispose of these to landfill. This is unless benefit can be easily derived from the contents (propellant or product). Disposal of non-recyclable materials to landfill by private sorting facilities, attracts high disposal fees.

What challenges are experienced in collection or handling of aerosols?

The **pressurised or flammable propellants** and then the type of contents (hazardous or otherwise) may make handling waste aerosols a challenge. This requires careful transportation including TREM or either TREC cards (SANS, 2019) and decals to mitigate risks. This is especially true when large volumes are carried in one vehicle. The normal regulations for the transport of hazardous waste, under the Hazardous Substances Act, 1973 (Act 15 of 1973, as amended), apply in this case.

The respondents indicated that there are **no aerosol recovery programs in South Africa**. There may be specific initiatives at manufacturers, but no municipal wide programs. This is indicative of the relative low volumes in municipal solid waste.

The **informal sector** reportedly does not recover large volumes of waste aerosols because buy back centres are only interested in the valuable metal if the can has been suitably decompressed and separated from the plastic straw internals. This is a time-consuming process and requires training and awareness – a cost.

Deconstruction (i.e., separation into the different components) is a time-consuming process, which becomes **expensive in terms of labour costs and or disposal costs** for recovered contents. Although some of the contents could possibly be utilised due to high calorific values. Few buy back centres are willing to spend the money to invest in this technology because of the low volumes of materials.

Poor labelling of the individual components which make up the whole aerosol canister. Some of the plastics are not labelled (caps for the aerosol and the internal straw) which could otherwise be recovered if the material was known.

How can these challenges be mitigated to increase collection and recycling of aerosols, and by whom?

The following are recommended:

1. **Guidelines** for the decompression and safe handling of post-consumer aerosol cans by registered handlers and post-consumer aerosol dispensers.
2. **Awareness, Education Road Shows** or campaigns on the safe handling of aerosol cans. Also, education for the informal sector on how to handle the aerosol cans to ensure recycling.
3. New **innovative technologies** for quick simple safe decompression, puncturing and draining contents and separating individual components. Alternatively, consideration of what works in other countries.
4. **Material substitution** of the non-recyclable parts of the aerosol can. Clear labelling to assist with recyclability.
5. **Incentives** to increase the prices for recovered processed aerosol cans, especially for the informal sector.
6. **Increased awareness** about the recyclable nature of aerosol cans including the metal and plastic fractions, as well as the contents in some instances.
7. **Dedicated drop-off sites** for post-consumer aerosol collection at landfills, or garden sites. this could also increase the volumes of aerosol cans.

CONCLUSION

The Aerosols Manufacturing Association is aware of the uniqueness of aerosol packaging and therefore initiated this study to inform decisions relating to future EPR schemes for aerosols. The study has shed light on several issues that should be considered in the development of an EPR scheme for this waste stream.

Currently there are no programs for the recovery of aerosol cans in South Africa. This is likely due to the relative small volumes of aerosols waste in municipal solid waste streams. The study found that a distinction between pre-consumer and post-consumer sources of aerosols is important. There are small pockets of innovation in the private sector where individual companies are recovering expensive products and contents from aerosols (from pre-consumer sources).

This study clearly indicated that increased aerosol recycling will require:

- Source separation of aerosol cans as part of the recycling stream.
- Collection systems at scale to justify transport costs.
- Standardised labelling of plastic parts and the use of recyclable components where possible.
- Innovative technology solutions to safely decompress and dismantle aerosol cans at waste sorting facilities.
- Education and training on the safe handling of aerosol waste.

Some further research as to the role that the informal sector could play is also needed. There is also a need for funding, ideally through an EPR mechanism for guidelines, training, and awareness for stakeholders especially the informal sector and others. The recycling role players indicated that recovery rates for aerosols was relatively low compared to other mainline recyclables. Although this is a relatively small waste stream as compared to other packaging streams, the potential for avoided negative environmental impacts associated with increased mismanagement or recycling and proper end-of life treatment may be significant.

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REFERENCES

DEFF. 2020. *Waste Picker Integration Guideline for South Africa: Building the recycling economy and improving livelihoods through integration of the informal sector*. [Online], Available: http://sawic.environment.gov.za/documents/13012.pdf.

Godfrey, L.K., Strydom, W.F. & Phukubye, W. 2016. *Integrating the Informal Sector Into the South African Waste and Recycling Economy in the Context of Extended Producer Responsibility*. [Online], Available: http://www.wasteroadmap.co.za/download/informal_sector_2016.pdf.

Niemiec, K., Fitrzyk, A. & Grabowik, C. 2021. The Circular Economy Aspects and Recycling of Materials in the Aerosol Industry. *International Journal of Manufacturing Economics and Management*. I(1):31–39. [Online], Available: https://www.ijmem.ro/vol1no12021/04_Niemiec_Katarzyna.pdf.

RSA. 2013. *National Environmental Management: Waste Act 2008 (Act No 59 of 2008): National Norms and Standards for Disposal of Waste to Landfil*. Vol. 7. South Africa: Government Gazette 36784, 23 August 2013. [Online], Available: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=2ahUKEwijr7mnorrdAhWnCMAKHbpADcAQFjABegQICRAC&url=http%3A%2F%2Fsawic.environment.gov.za%2Fdocuments%2F2177.pdf&usg=AOvVaw2lfJQFxrYx8ZKexQYrRNXb.

RSA. 2021. *National Environmental Management: Waste Act: Amendment of the Regulations and notices regarding Extended Producer Responsibility, 2020*. Government Gazette No 44078, 15 January 2020. [Online], Available: https://www.environment.gov.za/sites/default/files/gazetted_notices/nemwa_regulationsamendment_extendedproducerresponsibility_g44078gon20.pdf.

SANS. 2019. *SANS 10232-4 : 2019: SOUTH AFRICAN NATIONAL STANDARD Transport of dangerous goods — Emergency information systems Part 4 : Transport emergency card*. [Online], Available: https://intraweb.csir.co.za/csiris/SABS/documents/SANS10232-4_2019_Ed1Am4.pdf.

Yasuda, K. & Tanaka, M. 2006. Report on hazardous household waste generation in Japan. *Waste Management and Research*. 24(4). [Online], Available: https://go.gale.com/ps/i.do?p=AONE&u=googlescholar&id=GALE%7CA148425128&v=2.1&it=r&sid=AONE&asid=f65a0a9e.