Wests Road RDF & Waste Management
Community Reference Group
33rd Meeting
Accepted Notes

13 December 2018

Conference Rooms C & D

Present:

Bruce Turner	- Independent Chair
Julian Menegazzo	- Adjacent Landowner representative
Karen Hucker	- Community representative
Karthik Viswanathan	- Community representative
Lisa Field	- Resident group representative
Mason Asadi	- Environmental group representative
Paul Von Harder	- Community representative
Stephen Thorpe	- Director City Operations, Wyndham City Council (left after items 3)
Simon Clay	- Manager Refuse Disposal Facility, Wyndham City Council
Liza McColl	- Business Analyst Refuse Disposal Facility, Wyndham City Council

Apologies/ absent:

Cr Peter Maynard	- Councillor (Iramoo Ward), Wyndham City Council
Cr Walter Villagonzalo	- Councillor (Chaffey Ward), Wyndham City Council
Cr Tony Hooper	- Councillor (Harrison Ward), Wyndham City Council
Caroline Lavoie	- Community representative
Kimi Pellosis	- Community representative
Michelle Lee	- Planner, Metropolitan Waste and Resource Recovery Group (MWRRG)
Lindsay Swinden	- Community representative

Guests:

Hayley Jarvis	- Team Leader Waste Strategy
Ritika Jindal	- Team Leader Waste Collection Services

1. Welcome and Introductions

Bruce welcomed everyone to the meeting. A particular welcome was extended to Karthik Viswanathan who was recently appointed to the CRG as part of the 2018 membership refresh process. Today was Karthik's first meeting. Karthik gave a brief overview of his interest in being part of the CRG. Karthik moved to Manor Lakes about two years ago. He is keen to be involved in community matters that help to increase the quality of life and the environment for his family and fellow community members. He believes that waste is an exciting and important portfolio. He works as a business analyst and hopes to contribute and share his skills, knowledge and enthusiasm with the CRG.

There were no Councillors at the meetings so a declaration of conflicts was not required.

2. Notes and actions from the previous meeting

The notes from the 32nd meeting, circulated prior to the meeting, were accepted and will be published on the Council's website.

An 'action tracker' document with the status of outstanding actions from previous meetings was handed out. Bruce ran through outstanding actions:

ONGOING ACTIONS – FROM MEETINGS PRIOR TO 25 OCTOBER		
M24-5.2and M26-9.1	*Council to invite Lend Lease to a future meeting of the CRG to discuss how best to represent the interests of future residents of the Harpley Estate in the CRG process (and wider community engagement).*	Lend Lease to attend meeting in February 2019. Lend Lease have asked if there is anything specifically that the group would like to know about the development or concerns/questions about their interest in joining the CRG so that they can come prepared. This has been made a discussion item for today's meeting at agenda item 5.
M24-5.3	*Council to pursue opportunities for screen planting along the Princes Freeway (in the road reserve in collaboration with VicRoads and/or on private land) to improve the view from the freeway.*	On hold. Site investigations commenced. Underground services (high pressure oil pipeline) present may influence/constrain type of trees that can be used. Not a current priority due to other projects.
M27-7.2	*Simon to circulate the auditor's report on the phytocap when this is available, before it is submitted to EPA for approval.*	Pending. The report is still with the Auditor. Council has submitted all the additional information requested by the auditor in relation to soil management. The Auditor has requested further technical information about the phytopcap design from the design consultant, Tonkin Consulting.
M27-8.1	*Simon to discuss with Council's waste strategy team the potential to initiate a dialogue around the opportunity for waste management services for businesses in Wyndham.*	Pending. Harry indicated WREC would be able to assist. Simon advised that council officers would be ready to discuss this matter with the CRG at the February meeting, because Ritika and Simon are currently working on the development of a specification for the new kerbside collection contract which needs to be advertised in April 2019.
M28-3.1-1	*Liza to circulate a copy of the Wyndham Vale Buffer Study and odour modelling information to all CRG members.*	Progressing. Odour modelling data is currently being updated.
M29-3.2	*Topic of the future of the tip shop to remain open for further discussion.*	To be made into a standing Agenda Item (and removed from this list. For discussion at Agenda item 9c – RDF Update.
M29-3.3	*Simon to circulate report on waste baling technology after it has been fully reviewed.*	Pending. To be discussed today at Agenda item 6.
M31-7.1	*Council to request information from LMS on the efficiency of electricity generation through gas combustion at the RDF.*	Not completed. Clarification was sought from the group about exactly what information they wanted.
NEW ACTIONS FROM LAST MEETING – 25 OCTOBER 2018		
M32-3.1	*Hayley to consider including*	Discussed at item 4 today

	information about the freecycle groups/service in the Wyndham Waste Guide.	
M32-4.1	*Hayley/Simon to report back to the CRG on whether the old bins and bins lids are recycled.*	Hayley confirmed that bins and lids are recycled. Action closed
M32-7.1	*Liza to send Mason a copy of the presentation on phytocaps given to the CRG in 2017 by Dr Melissa Salt from Tonkin Consultants.*	Pending
M32-8.1	*Liza and Simon to propose amendments to the CRG's Terms of Reference to make its statutory roles explicit (at such time as the ToR has to be amended for other reasons).*	Pending. Proposed to be undertaken as part of a complete independent review of the operation of the CRG which is to be discussed at the February meeting. ToR will be amended as part of this review.
M32-8.2	*Liza and Simon to reconfigure the complaints register back to 1 July 2017 and circulate to the CRG for comment (re format, information captured etc).*	Completed. To be discussed at Agenda item 9.

3. Members' Report

Lisa Field suggested that the community members of the CRG may like to get together outside of the formal CRG meetings. CRG members agreed that Lisa could contact them directly to suggest a date/time. Likely date for meeting was after 21 January 2019.

Lisa also raised the idea of a review of the CRG process and undertook to follow-up with Liza with a suggestion of someone who might be able to help with this task.

Mason Asadi informed the group that he done some work with SKM Recycling Facility, which is where Wyndham's recyclables are taken for processing. He had been informed that SKM do not accept Tetrapak and liquid paperboard, however Council currently states that these items can be placed in the recycling bin.

Hayley advised that SKM does accept liquid paperboard (but not Tetrapaks, which are aluminium lined).

Lisa shared her view that an alternative solution to this problem was needed, whether it be to direct Tetrapaks elsewhere or advocate to have them phased out and replaced with a more recyclable material.

Paul asked if Council produces a list of what wastes go in which bin. Hayley said there is such a list (Waste Guide) and it was currently being revised. She said she was open to providing this in draft to anyone interested.

Action M33-3.1: Hayley to provide the draft Waste Guide for circulation to the CRG.

Julian Menegazzo noticed that there had been a recent increase in illegal dumping on Browns Road. He asked whether Council keeps records on illegal dumping to examine spikes and potential causes and targeted prevention strategies. Stephen advised that Council has eight people working full time on this. Council keeps records of location and volumes of illegally dumped rubbish. He noted that there are regular offenders and illegal dumping locations (hotspots). Council has and will continue to prosecute offenders, wherever adequate evidence is available.

Lisa asked for more information about the Council's recent consideration of a proposed policy to ban single use plastic in council owned/operated facilities. Lisa had heard that Council had not supported the ban. Hayley clarified that Council was not opposed to the idea but asked for more information about the process and cost to be presented to them before they made a final decision.

Kathik shared his view that new community members are not clear on the rules around the use of tip vouchers and that additional information on the Council's website would be beneficial. Eg – how many tyres can people bring using a tip voucher.

Karen reported that she had formed a new neighbourhood clean-up group and that she had had some interesting conversations with neighbours and friends about the practice of using other people's bins to dispose of excess volumes of waste and how this practice would work if there was a change to pay by lift or pay by weight.

4. Strategic waste management and resource recovery

Inclusion of freecycle information in Waste Guide
Hayley indicated that the revised Waste Guide which was to be circulated in draft to the CRG (see action 3.1 above) did include references to freecycle opportunities, as per Action M32-3.1 from last meeting. She said she would welcome members' comments on the draft.

E-waste Ban Education campaign
Hayley advised that Council will be submitting an application to Sustainability Victoria for a grant of $10K to inform the local Wyndham community of the e-waste ban commencing from 1 July 2019. Hayley gave an overview of the proposed education activities (refer attached presentation) and invited feedback from the CRG members at the meeting. Council is proposing five pop-up e-waste drop offs, and e-waste community information sessions and delivery of Sustainability Victoria e-waste written co-lateral materials to the community via facebook, e-newsletters, postcards, community centres and Council events. Signage, banners and VMS boards may also be used.

Lisa noted that there seems to be an opportunity for re-use and recycling of some of these items before they are disposed and that ideas about how to facilitate this should be explored. Eg – fixers, tinkers, scavengers, welcome wagons, tradespersons for power tools.

Kerbside Bin Audit
Ritika and Hayley gave a presentation of the key results from the kerbside bin audit completed in October 2018 (refer attached presentation). The audit is conducted annually to assess the level of contamination in the recycling bin. The bins from the same addresses are audited. There is currently 20% contamination in the recycling bin.

There was discussion about how behaviour change might be effected. It was noted that education had been shown to make a difference to the level of contamination when a selection of bins were reinspected following educational materials being distributed on contaminated bins. There was discussion of incentives and consequences, as well as tapping community pride as in 'tidy town' type campaigns. Karen said Tarneit had had such a campaign in the past.

5. Proposal for RDF's newest neighbours - Harpley Estate / Lend Lease to join CRG

Lend Lease were unable to attend today's meeting. Liza reported that Lend Lease had confirmed they would attend the February CRG meeting to discuss the merits of Lend Lease joining the CRG. Lend Lease would like to know if there is anything specific that the CRG would like to know.

For the benefit of the new member of the CRG, Liza provided the background to this topic. She explained that Lend Lease is the developer of the Harpley Estate, located across the railway line to the north east corner of the RDF site. Lend Lease submitted comments to EPA on Council's Works Approval. Council met with Lend Lease to discuss how their concerns might be addressed. They were concerned that the long-term approval sought by Council would cut out the opportunity for ongoing community consultation. Council informed them about the CRG and advised Lend Lease that any resident of the Harpley Estate could apply to join the CRG. Lend Lease suggested that it may be more appropriate for Lend Lease to join the CRG, as they are often the point of contact and communication for members of the emerging community. Council officers were open to this idea but explained that this would require a change to the CRG's Terms of Reference and would need to be discussed with the existing CRG members and be subject to Council endorsement. Officers put forward the idea to the CRG last year and there were mixed views about having a developer on the CRG. The CRG members said that they would like Lend Lease to be invited to discuss the idea with them directly.

The current CRG confirmed their interest in talking with Lend Lease. The CRG want to know how Lend Lease plan to communicate with the residents of the estate, and what they need to inform potential and new residents. Karthik gave an example of friends of his who were looking to buy in Wyndham, possibly the Harpley Estate, and had mentioned their perception that waste was burnt at the RDF. Stephen clarified that burning was not used for disposal of waste the RDF. But all appreciated the need for accurate information for potential and new residents to address any misapprehensions.

Karen noted that she would also like to know whether the Harpley Estate could use waste heat from the RDF, if there was any available.

6. Strategic planning context(Standing Agenda Item)

Nothing to report.

7. RDF rehabilitation (Standing Agenda Item)

Update provided at Item 2 in Action Tracker for M27-7.2.

8. Advanced Resource Recovery and Waste to Energy

Simon noted that he will be stepping out of the day to day manager role for six months to focus on the strategic business planning and development of the RDF. Council has recently confirmed that it is fully supportive of taking the next steps in relation to the development of an advanced waste and resource recovery precinct, with mechanical pre-sorting, aerobic or anaerobic digestion and a baled landfill at the RDF. An acting manager by the name of Tom Wetherill has been appointed. Tom has an extensive landfill management background and will attend the CRG meetings in the future.

Simon circulated a paper on baling (refer attached) and reported that he recently visited a baled landfill site in South Australia (North Adelaide Waste Management Authority) – photos attached. The visit reinforced the many benefits of baling. Further work will be done on this concept to look at the financial viability.

9. RDF Update

Complaints – No complaints have been received since the last meeting in October. A new format for complaints has been prepared (as per Action M32-8.2); deferred for discussion at the February meeting.

Non-compliances – There have been no new non-compliances since the last meeting in October. The existing non-compliance relating to the exceedance of leachate levels remains and is subject to an EPA approved management plan.

Other
Simon distributed the landfill gas and tonnage reports – refer attached. He noted that the electricity output has doubled during the installation of the new engines. A fifth engine is planned to be installed in mid -2019. Karen again highlighted her interest in the opportunities presented by cogeneration and the potential uses of waste heat (she cited the example of the Fitzroy pool).

Simon noted the Council has introduced a new rate for separated green waste. It is 50% the cost of full waste.

Simon provided an update on the construction of Cell 5. The works have been broken into 2 stages, to ensure that a part of the new cell will be ready to received waste once the existing cell is full. Works on this part of the cell are progressing well. The installation of the lining has been completed – refer photo attached. Works remaining include the installation of the leachate collection system, final filtration fabric, auditor approval, EPA review of auditor report, and amendment to licence. Works on this part of the cell should be completed in late Jan/early February, with the cell commissioned and able to received waste by March 2019. The second stage of the cell should be completed by July 2019.

Simon advised that Cell 4c is on its last lift and this is the most challenging for the operational staff and has the greatest potential for impacts (noise and litter) on Julian.

10. 2019 Meeting Schedule

It was agreed that CRG meetings will be scheduled on the following dates in 2019:

- Thursday 28 February
- Thursday 2 May
- Thursday 20 June
- Thursday 29 August
- Thursday 31 October
- Thursday 5 December

Next meeting
Thursday 28 February 2019 at 4:30pm-7:00pm

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Environmental performance review and cost analysis of MSW landfilling by baling-wrapping technology versus conventional system

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Abstract

This paper first reviews the chemical, physical and biological processes, and the environmental performance of MSW compacted and plastic-wrapped into air-tight bales with low-density polyethylene (LDPE). The baling-wrapping process halts the short and half-term biological activity and consequently the emission of gases and leachates. It also facilitates the handling of the refuse, and considerably reduces the main environmental impacts of a landfill. The main technologies available for baling-wrapping MSW are also presented. Furthermore, a cost analysis comparing a conventional landfill (CL) without baling system versus two landfills using different baling-wrapping technologies (rectangular and cylindrical bales) is carried out. The results are presented comparatively under the conditions of construction, operation and maintenance and postclosure, as required by European Directive 1999/31. A landfill using rectangular plastic-wrapped bales (LRPB) represents an economically competitive option compared to a CL. The increased capacity of the waste disposal zone when using rectangular bales due to the high density of the bales compensates for the increased operating and maintenance (O&M) costs of the method. Landfills using cylindrical plastic-wrapped bales (LCPB's) do not fare so well, mainly because the density within the bales is lower, the cylindrical geometry of the bales does not allow such an efficient use of the space within the landfill, and the processing capacity of the machinery is lower. From the cost model, the resulting unit costs per tonne in a LRPB, a LCPB and a CL for 100,000 t/year of waste, an operation time of 15 years and a landfill depth (H) of 20 m, are 31.52, 43.36 and 31.83 €/t, respectively.

1. Introduction

From prehistory up to the present day, dumping has been the most widespread system for waste disposal: throwing it into open spaces near the points of production, generally without taking special precautions. Although in the definition of strategies for the management of waste, the landfill option appears to be the least desirable, the reality is that it is still the most common system for waste disposal worldwide, both in fully-industrialised countries and in developing countries. During the twentieth century, the methods and procedures used for waste disposal moved towards the design and operation of environmentally safe landfill sites (Christensen et al., 1989).

The main emphasis has been placed on introducing greater safeguards against emissions, particularly from biogas and leachates. Attention has also been paid to the characteristics of the waste. This can be seen in the recent European Union Directive (Council Directive 1999/31/EC of 26/4/1999 on the landfill of waste).

In the area of conceptual design of MSW landfills, three considerations must first be taken into account:

- The classic or conventional process of MSW landfill essentially consists of two operations:

1. Direct tipping of the MSW onto the ground at the site.
2. Compaction of the MSW into the ground at the site.
   There are several options relating to this sanitary landfill or conventional landfill (CL) model, such as low-density (the most common), high-density and bioreactors (Reinhart and Townsend, 1998).

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- The landfill system through previous compaction of the waste or balefill (BL), inverts the operations:

1. Balers compress the MSW into dense, self-contained bales.
2. Placement of the bales into the landfill site.
   This change in the procedure involves a whole series of important consequences affecting the operation and the potential environmental impacts of a CL: increase of the operation time of the landfill (large amount of waste in a small area), reduction of inflammation hazards and clean and tidy management and transportation (Tamaddon et al., 1995). Although the technique of compacting MSW into bales is not new, it is becoming more common and its intensive use is relatively recent. Nevertheless it has not been widely adopted. Some landfills in USA, Russia and Spain, among others, use this technique.

- More recently, treatment of MSW has progressed towards the compression and wrapping of the waste with a stretch plastic film, into air-tight bales. Nowadays, just few a landfills using plastic-wrapping technology (LPBs) exist in Germany, Italy, Portugal, Sweden, Korea and Lebanon.

Most published studies on bales (e.g. Stone, 1975; Hentrich et al., 1979; Fund. L.T.Quevedo, 1993; McAdams, 1994) concern the baling process without wrapping. Limited literature exists on the performance of the wrapped bales (Tamaddon et al., 1995; DEKRA, 1996; Sieger and Kewitz, 1997; Robles-Martínez and Gourdon, 1999, 2000; Hogland et al., 2000, 2001a,b; Andreottola et al., 2001; Baldasano and Gassó, 2001) and on the use of wrapped bales in landfills (El-Fadel et al., 2002).

Table 1 reproduces from Baldasano and Gassó (2001) a qualitative assessment of the main environmental impacts of the three methods representing the evolution of MSW landfills. Section 2 reviews the main technical and environmental aspects of this procedure and Section 3 includes a detailed cost analysis of MSW landfilling by baling-wrapping technology versus the conventional system.

2. Baling-wrapping technology for MSW

2.1. Methods for baling-wrapping MSW

Basically two types of mechanical presses allow the compression of MSW. They have been developed from those already existing for compression of materials such as textiles, paper, straw, etc. These presses use different compression techniques to produce bales with different geometric forms and characteristics. There are two types of bales: rectangular and cylindrical.

Cylindrical bales are produced by a single mechanical press which both compresses and plastic-wraps the MSW. However, the rectangular bale technique involves two separate machines working in sequence: first the press compacts the waste into bales, then a second machine linked in series wraps the bales in plastic. A major difference between the two systems is the degree of compression, which is lower for the cylindrical technique. In the case of highly compressed rectangular bales, the process results in the pressing-out of a liquid when compressing materials with a high moisture content diminishing the potential generation of leachates. However, the compression liquid has to be treated. The quantities of liquid produced with the cylindrical technique are negligible compared to the rectangular method.

In general, the baling-wrapping facility consists of a reception area that constitutes the feed for a conveyor belt, which in turn feeds measured doses into a continuous automatic press. The produced bales can be transported and stacked by a forklift truck or a front loader fitted with a special loading device. In both cases, the same material is used as plastic-wrapping film: low-density polyethylene (LDPE) with a thickness of 25–35 µm. This material has a high, although not total, degree of resistance to perforation and tearing. Its stretching produces adhesive effects which facilitate a stable union between the different layers of LDPE. Approximately 1.5–2.5 kg of this material is required for wrapping each bale, depending on the size and the shape of the bale and the number of layers required.

Table 1
Advantages and drawbacks of cylindrical and rectangular bales (Baldasano and Gassó, 2001)

Aspects	CL	BL	LPB
Visual impact	***	**	*
Leachates	***	**	*
Odours—Emission of gases	***	**	*
Airborne debris	***	*	*
Birds	***	**	*
Spontaneous ignition	**	*	*
Density	***	*	*
Contribution of materials	***	**	*
Operating labour	***	**	**
Reception infrastructure	**	***	***
Moving machinery	***	*	*
Services infrastructure	**	**	**
Closure	***	**	*
Future recycling	***	**	*

Assessment: * Good; ** Medium; *** Poor. CL, conventional landfill; BL, landfill using compacted bales; LPB, landfill using plastic-wrapped compacted bales.

With regard to the stability of the LDPE film against UV-light, the maximum storage time of the bales, without covering the bale stock, should be 12 months. By covering the bale stock with a 1.5 mm thick UV stabilised PE-film or with sand, a long term storage is possible (Sieger and Kewitz, 1997). The colour of LDPE film most commonly used is white, although other colours may also be used. Pointed or sharp edged objects within the waste can perforate the LDPE film. Birds can also affect the LDPE film. The main reasons for wrapping MSW with the LDPE film are:

- It protects the MSW from moisture, rainwater or any other liquids.
- The internal surface of the LDPE film is adhesive, so that the different layers of the wrapping adhere to each other.
- The wrapped material inside the bale preserves its properties.
- Protection from atmospheric conditions enables the outdoor storage of the MSW.
- Less fire risk. Self ignition is avoided.
- Odours are considerably reduced.

2.1.1. The rectangular wrapped bale technique

These systems consist of a metal conveyor belt, which acts as the waste receiver and feeds doses of waste into the rectangular continuous automatic press, where only the compression process is performed. There are essentially two types of compression boxes: the closed tunnel type and the open tunnel type. The former type reaches higher densities and the released liquid from compression can be collected at a single point, via a system of holes in the box. The latter type requires a controlled drainage system positioned under the tunnel. The previous shredding of the MSW is not technically required by the rectangular method. The quantity of liquid pressed out depends on the moisture content of the waste. As an example, the facility of Valdedominguez in Madrid (Spain) using the rectangular bale technique produces approximately 9 l/t when compressing MSW with 45% of moisture content. In the case of Cerceda in Galicia (Spain), the quantity of liquid is approximately 18 l/t when compressing MSW with 62% of moisture content.

Essentially, they use two different materials to band the bale before the wrapping process in order to ensure that the bales do not break open: an automatic binding system using tough polyester bands, with a variable number of bindings depending on the type of waste and an automatic binding system using steel wire, which causes punctures and tears in the LDPE film. The LDPE wrapping system for rectangular bales involves a specifically designed wrapping machine which can be adjusted for different sizes and takes the bale from the press. This machine allows the bale to be wrapped in several layers in a crisscross fashion, providing a high degree of insulation and stability. Generally the bales are wrapped vertically twice and horizontally once. The number of LDPE layers can be regulated. It uses on average of 1.5 kg of LDPE per tonne of MSW.

2.1.2. The cylindrical wrapped bale technique

The material is fed into a cylindrical chamber until the compression pressure is reached. The compression degree of the bale increases as the material is forced into the chamber. The tumbling and crushing makes the air expelled and not compressed, therefore the oxygen content in the bale is minimized (Sieger and Kewitz, 1997). A plastic net is introduced to fix the shape of the bale and to prevent the compressed material from expanding when the press is opened. When the press opens, the bale is transferred to the wrapping unit, which is separated from the compression unit but integrated into the same machine. The bale is then wrapped with LDPE film. It uses on average 2.5 kg of LDPE per tonne of MSW. Once the bale is removed, a new cycle begins. It does not require prior shredding of the material, although in some machines of this type it is advisable.

Due to the increased mobility of these machines, they are especially useful for temporary storage of refuse to be used later for energy generation. This is the case when storing waste generated in summer to be burnt at a later date, in order to use its heating potential in central heating systems. Another example of this is when dealing with excess waste during peak periods in incinerators by storing the waste and incinerating it later when decreased demand allows it to be reintroduced to the treatment programme.

Table 2 reproduces from Baldasano and Gassó (2001) a series of advantages and drawbacks of cylindrical bales versus rectangular bales.

2.2. Performance of the wrapped bales

The behaviour the wrapped bales differs substantially from the processes that occur in a CL, or in the treatment of MSW based on aerobic processes (composting) or anaerobic fermentation (biomethanisation). In this section the performance of the wrapped bales is briefly reviewed from a biological and physical point of view. The most extensive studies about the biological performance of the wrapped bales have been carried out by Tamaddon et al. (1995) and Hogland et al. (2001a) for Bala Press (Lund, Sweden), by DEKRA (1996) for RPP (Munich, Germany) and recently the world's first doctoral thesis on this topic written at the INSA in Lyon, France (Robles-Martínez, 1999). Robles-Martínez and Gourdon (1999) showed that over several weeks of incubation, the microbial activity inside the bales was inhibited in the acidogenic phase due to accumulation of volatile fatty acids which acidified the medium.

Robles-Martínez and Gourdon (2000) report on assays with bales over a significantly longer periods (27–34 months). All these studies were carried out exclusively on cylindrical bales. Hogland et al. (2000,2001a,b) studied the effects of composition, structural integrity variation and temperature on gas emission from eight bales (six cylindrical and two rectangular) to observe if the bales exhibited any tendencies for self-ignition, and performed burning tests.

DEKRA (1996) monitored the behaviour of MSW wrapped bales during 9 months. The following observations were made:

1. After being wrapped in LDPE film, air (oxygen) and water are prevented from entering the waste.
2. First, a rapid process of aerobic fermentation takes place, which consumes almost all of the available oxygen inside the bale, leaving just trace levels. As a logical consequence, this produces CO_2. The production of CO_2 only takes place during a few days, depending on the amount of oxygen present inside the bale. After reaching a maximum of around 30%, CO_2 levels subsequently stabilise at between 20 and 25%. Fig. 1A presents the evolution in time of the O_2, CO_2 and CH_4 concentrations inside of a bale in the studies carried out by DEKRA (1996).
3. As a result of this aerobic fermentation process, the temperature increases several degrees inside the wrapped bale during the first few days. This temperature rise is limited by high moisture content; it also causes a certain amount of water evaporation, which can escape to the exterior through the LDPE film in the form of water vapour. In the study carried out in Munich, the interior temperature of the wrapped bales was never greater than 40 °C, as shown in Fig. 1B, which makes self-ignition improbable.
4. Once the oxygen has been almost consumed, the aerobic process practically stops and an anaerobic phase should begin, but only traces of CH_4 appear. As Robles-Martínez and Gourdon

Table 2
Qualitative assessment of the environmental impact of three types of landfill (Baldasano and Gassó, 2001)

Cylindrical bales	Rectangular bales
Compacting into circular forms avoids ventilation processes	Compacting into rectangular forms results in layers which create ventilation channels
Circular compaction process There are no hollow spaces in the compacted material as the air is expelled in the rolling process and is not compressed together with the material	Longitudinal compaction process
Easy to stack, up to 9 layers	*Due to their rectangular form, they stack very well*
Their circular shape favours better drainage of water	Their shape creates a greater contact surface area
Compaction does not produce liquids	Compaction does produce liquid
The moisture content of the compacted materials is maintained	*The moisture content of the compacted materials is reduced*
Independent studies on their behaviour have been carry out	Existing studies are very limited
Already in use in several landfills	Already in use in several landfills
Mobile and fixed units	Fixed units
More compact design	
Operations of baling and plastic-wrapping are integrated in a single machine	Operations of baling and plastic-wrapping performed sequentially by two different machines
Capacity: 12–15 t MSW/h	*Greater capacities: 36–40 t MSW/h and 28–32 t refuse/hour.*
Requires use of plastic net to hold the material	Require use of a strip to hold the material. Strips can be made of plastic (polyester) or metal (steel)
Area index of approximately 2.5 t/m^2	*Area index of approximately 4 t/m^2*

Italics indicate advantages.

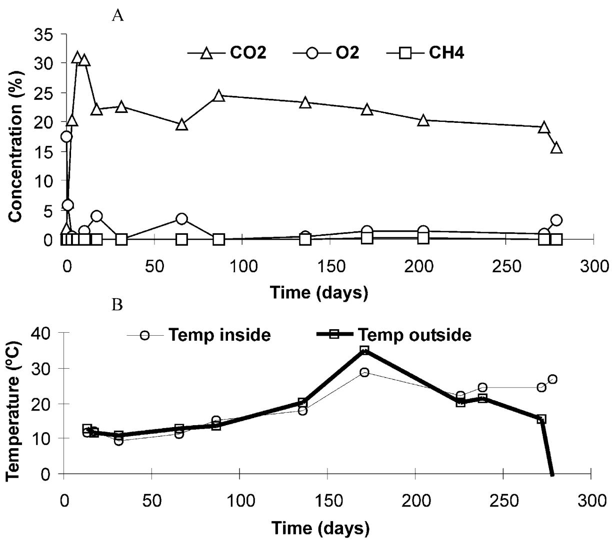


Fig. 1. Graphs from the experiments carried out in Munich (DEKRA, 1996). (A) Evolution over time of the O_2, CO_2 and CH_4 concentrations (%) inside a bale. (B) Temperature evolution inside and outside of the bale.

(1999) stated, under such conditions, facultative anaerobic bacteria liberates carboxylic acids in the medium which are not degraded by the acetogenic or methanogenic bacteria whose activity is inhibited by the low residual oxygen content.

5. After the initial period, the temperature changes inside the plastic-wrapped bale are essentially correlated with temperature changes in the exterior.
6. pH measurements taken after several weeks of storage gave slightly acidic results (pH values of 5–6). This is explained by the fact that organic acids were formed during the first phase of decomposition.
7. In the majority of tests (>96%) performed to check emissions of gases from the bales, organic compounds were not detected, and those emissions that were detected had very low values.
8. Measurements of mass loss indicated an average loss of ±30 kg of mass in packages of 850 kg after 9 months, which means a loss of 3.5% of the mass of the bale.

The reasons for the lack of anaerobic fermentation are the following:

- The environment produced inside the wrapped bale was too acidic for the micro-organisms to develop.
- The methanogenic bacteria need to work together with acidogenic and acetogenic bacteria in order to be able to continue the process of digestion.
- The water content, probably due to the compaction and/or evaporation, was insufficient to support the bacterial metabolism.
- The water or moisture content is of great importance for micro-organisms, since the process takes place primarily in the liquid phase. In the case of a too low moisture content (in general, <20–30%), microbial activity is drastically diminished.

It may be concluded that the material inside the bales, taking into consideration whether it is garbage or fraction rejected at the sorting plant, was stabilised without producing methane, in a non-methanogenic acidic phase, with a relatively high concentration of CO_2. The temperature inside the bales tended to be very similar to the temperature in the exterior, differing by around 4 °C. Tamaddon et al. (1995) obtained similar results and they pointed out that odours escaped from the microscopic holes which exist on the LDPE film. Fatty acids were believed to be the main cause. Robles-Martínez and Gourdon (2000) monitored two bales. The fist bale was produced in July 1997 and stored for a year before transportation to the laboratory with a freshly prepared second bale. CH_4 was not detected after 8 months in the fresh bale and after 20 months in the aged bale. However, the oxygen contents was higher and CO_2 contents lower in the aged bale than in the fresh one. The authors related this phenomenon to the relatively deteriorated state of the LDPE envelope of the aged bale. The aged bale was under aerobic conditions whereas the fresh bale under anoxic conditions.

From the analysis of the biological behaviour of the plastic-wrapped bales over time, based on the three systematically monitoring studies (Tamaddon et al., 1995; DEKRA, 1996; Robles-Martínez and Gourdon, 2000) it can be concluded that this form of storage blocks biological changes in the wrapped waste on the short and half-term. This system requires optimum packaging conditions in an enclosed medium, not saturated with water and without contact with the air or circulation of liquids. As stated by Robles-Martínez and Gourdon (2000), the deterioration with time of the LDPE film can lead to air penetrating inside the bale inducing aerobic biodegradation.

A series of physical characteristics of the cylindrical plastic-wrapped bales were also examined by DEKRA (1996) in order to test strength in case of falling from a specified height, the tension of the LDPE film when aged, and behaviour when subjected to processes of compression (ability to support weight), testing by continuous washing with water, combustion testing, etc. In general terms, the results obtained from the various tests conducted can be considered satisfactory.

Table 3
Prices of urban waste management in landfill sites in European Union countries (1998) (€/t) (Vidal, 2000)

EU country	Minimum (€/t)	Maximum (€/t)	Green taxes (€/t)
Spain	3.61	19.83	0.00
Portugal	15.03		0.00
United Kingdom	18.03	21.04	8.41
Belgium	25.84		0.00
Italy (south)	27.05	33.06	10.70
France	44.47	66.11	6.01
Norway	60.10		0.00
Denmark	59.50	66.11	34.86
Holland	66.11		13.70
Sweden	34.26	106.38	26.68
Italy (north)	64.31	106.98	10.70
Switzerland	60.10	122.01	0.00
Germany	53.49	150.25	0.00
Austria	168.28	192.32	0.00

3. Cost analysis

The prices of MSW disposal in landfills in different European countries in 1998 from Vidal (2000) are listed in Table 3. Taking into account that the European Directive 1999/31 sets advanced design and operation criteria for MSW landfills, the lower level price for some European countries does not appear to be enough to cover the construction costs required by the legislation requirements, and there are no guarantees that the operation and maintenance costs of the facility will be covered after its closure (Baldasano et al., 2001). In order to make a large cost comparison of MSW landfilling by baling-wrapping technology versus the conventional system it was necessary to develop a cost model allowing the variation of the main design and operation parameters. The results are presented comparatively under different implementation scenarios considering all the requirements of the European Directive 1999/31.

3.1. The cost model

The model contains two parts or sub-models, LPBM and CLM, which represent a LPB and a CL, respectively. It considers a truncated pyramid-shaped, square-based vessel resting on the smaller base which is filled by a lower cover, layers of plastic-wrapped bales (LPBM) or layers of compacted waste (CLM), intermediate covers, and an upper cover. Fig. 2 shows the processes involved in both types of landfill.

The facility can manage two types of waste: municipal solid waste (MSW) and pre-sorted refuse. The model allows for optional prior shredding of the MSW and separation of organic matter and metals. This possibility was considered because Directive 1999/31 includes the objective of significantly reducing the biodegradable fraction of waste destined for landfills in forthcoming years.

As pointed out in Section 2, the process of compressing and plastic-wrapping can be carried out through different systems that can be classified according to the geometry of the produced bales (rectangular or cylindrical). The LPBM offers the possibility of performing the calculation for both types of geometry, along with variations in the type of machinery and therefore energy consumption, maintenance costs, operating labour requirements, dimensions and characteristics of the bales, etc. The three most significant input variables for the model are the following:

- Depth of the vessel: H (m).
- Amount of waste entering the facility annually: Q (t/year).
- Operation time of the landfill site: Years (year).

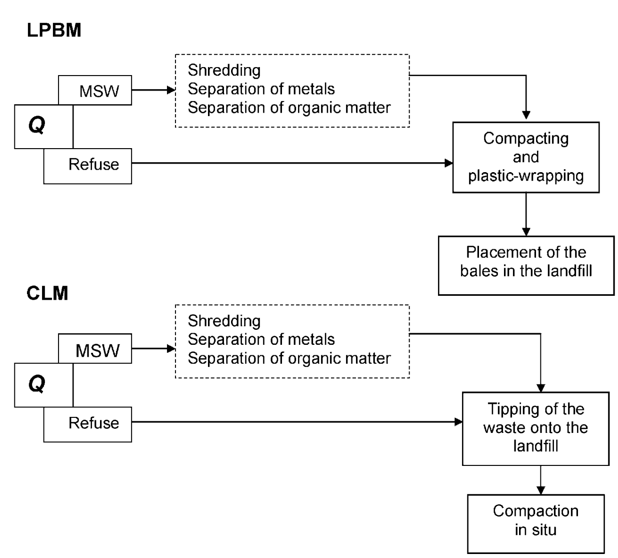


Fig. 2. Considered processes in the LPBM and the CLM.

The comparative analysis has been set up based on four large groups of costs:

Investment costs

- Operation and maintenance costs (O & M).
- Sealing and closure costs.
- General costs.

3.2. Definition of scenarios

The practical use of the model is to obtain and compare the costs of both systems under similar conditions in different implementation scenarios. Given that many variables are involved, the model was run under several values of Q and H representing a large range of scenarios. The other input data and conditions were fixed. The LPBM was used to run a LRPB and a LCPB. The CLM was used to run a CL. The main characteristics of the waste are given in Table 4. In addition, it was decided to apply a preliminary shredding and separation of metals and organic matter from the MSW fraction of the waste. The characteristics of this preliminary treatment are given in Table 5. The main features of the compacting and plastic-wrapping machinery and the bales are listed in Table 6. The minimum thickness of the lining material of the vessel which is determined by local legislation, and its acquisition and installation costs are set out in Table 7. The operation time of the landfill were fixed at 15 years and the working days at 300 days per year with 8-hour working days. A useful life of 5 years was established for the machines. Table 8 details the most significant unit costs used.

3.3. Results and discussion

The results obtained for several values of Q were examined. The used values were 25,000, 50,000, 100,000,

Table 4
Fixed characteristics of the waste entering the landfills

Type of waste	Humidity (%)	Density (kg/m^3)	Metals (% by weight)	Organic matter (% by weight)	Entering fraction (%)
MSW	40–50	250–300	4.1	44.2	80
Refuse	20–40	175			20

Table 5
Fixed characteristics of the preliminary treatment

Preliminary treatment	Value	Unit
Shredding capacity	55	t/h
Consumption of diesel in shredding	75	l/h
Electrical consumption in the magnetic separator (with conveyor belt for metals and support structure)	8.5	kW
Electrical consumption of the disk separator	70	kW
Efficiency for biodegradable matter and metal separation	80	%

Table 6
Characteristics of the compacting machinery and the produced bales

Characteristics of the compacting machinery and the bales	LRPB	LCPB
Type of press	Closed box	Circular box
Compacting line capacity (bales/h)	19.5	25
Energy consumption (kWh/bale)	8.8	2.4
Bale diameter (m)		1.18
Bale height (m)	1.13	1.18
Bale width (m)	1.30	
MSW (40–50% moisture content) bale density (kg/m^3)	≈1,100	≈800
MSW bale weight (t/bale)	1.91	1.0
Refuse (20–40% moisture content) bale density (kg/m^3)	≈800	≈500
Refuse bale weight (t/bale)	1.38	0.63
Baling material	Polyester	Not bound
Baling cost (€/bale)	1.20	0
Plastic-wrapping material	LDPE	LDPE
Plastic-wrapping cost (€/bale)	3.91	3.05

200,000 and 400,000 t/year, which represent populations of 52,687, 105,374, 210,748, 421,496 and 842,993 respectively, assuming a waste generation ratio of 1.3 kg/person/day. H was taken as 20 m.

3.3.1. Investment costs

Fig. 3 presents the investment costs for the three systems (LRPB, LCPB and CL) showing that the LRPB requires a lower investment for the whole range of Q values. Fig. 4 summarises the individual components of the investment cost in terms of percentage for a LRPB and for a CL with Q = 100,000 t/year. Most of the cost, about 40–65%, is due to the land acquisition. The preparation of the vessel, the machinery acquisition and sundry expenses are also significant. Given that Q determines the required capacity of the vessel, the densities achieved with each method (Table 9) are essential to explain the costs differences. The LRPB optimises the required volume of the vessel whereas the capacity of the LCPB is reduced because significant gaps appear as the cylindrical bales are stacked. There are differences in the land acquisition cost among the three methods. The land acquisition cost per m^2 used was 120.20 € and the differences are highly dependent on this parameter.

3.3.2. O & M, sealing and closure, and general costs

These three costs are grouped together since the model considers sealing and closure costs as final O & M costs, and the general costs as a percentage of the whole O & M costs. Table 10 shows the main O&M involved in the model showing the differences between the three systems. Fig. 5 presents the total O&M, sealing and closure and general costs for the three systems.

Energy consumption, spare parts, machinery renewal, operating labor requirements, maintenance, and baling and plastic-wrapping (in LPBS) generate the majority of the costs which are higher for an LRPB. Fig. 6 summarises the individual components involved in this section in terms of percentage in the case of a LRPB and of a CL for Q = 100,000 t/year.

As shown in Fig. 5, a CL involves lower O&M costs than a LPB and the cost difference increases with Q. In a CL, there is no baling and plastic-wrapping of bales

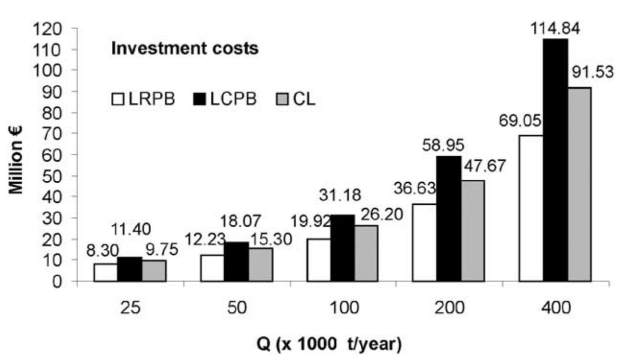


Fig. 3. Investment costs (M€) against value of Q.

Table 7
Characteristics of the landfill vessel lining

	Thickness (m)	Cost
Lining of the landfill vessel		
Upper cover	*2.5*	
Settling layer	0.5	2.81 €/m^3
Clay layer	0.9	6.31 €/m^3
Gravel layer	0.3	17.43 €/m^3
Soil layer	0.5	1.35 €/m^3
Topsoil layer	0.3	6.37 €/m^3
Intermediate covers (soil)	*0.3*	1.35 €/m^3
Lower cover	*1.003*	
Clay layer	0.5	6.31 €/m^3
HDP sheet	0.0015	2.77 €/m^2
Geotextile sheet	0.0015	1.95 €/m^2
Gravel layer	0.5	17.43 €/m^3

Table 8
Main unit costs

	Value
Price per m^2 of land	120.20 € /m^2
Price of kWh	0.09 € /kWh
Price of diesel	0.72 € /l
Cost of earth moving	0.93 € /m^3

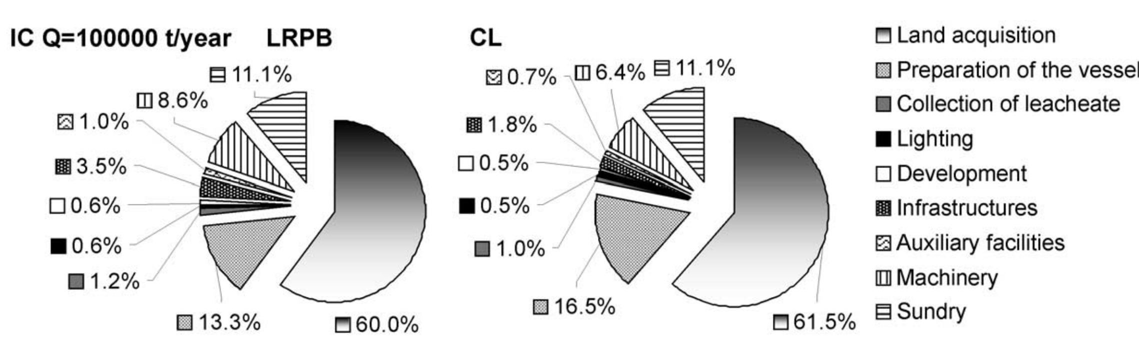


Fig. 4. Individual components of the investment costs (%) of a LRPB and a CL for Q = 100,000 t/year.

Table 9
Densities achieved by each method

Type of landfill	Bale volume (m^3)	Bale mass (kg)	Bale density (kg/ m^3)	Vessel density (kg/ m^3)
LRPB	1.73	1.39	800	≈776[a]
LCPB	1.36	0.68	500	≈445[b]
CL				600

[a] The bales are not perfectly rectangular, so gaps appear as they are stacked. The model assumes that 3% of the capacity is unused.
[b] The cylindrical geometry involves a considerable loss of space.

Table 10
Main O&M costs considered for a LRPB, a LCPB and a CL

O&M costs	LRPB	LCPB	CL
1—Operating labour	x	x	x
2—Energy consumption	x	x	x
3—Spare parts	x	x	x
4—Machinery Renewal	x	x	x
5—Tying and wrapping	x	x	
6—Maintenance, repairs	x	x	x
7—Intermediate covers	x	x	x
8—Assurance	x	x	x
9—Treatment of compacting liquids	x		
10—Treatment of lecheates and gas recovery			x
11—Ground water monitoring and sample analysis	x	x	x
12—Unexpected costs	x	x	x

x: included.

and therefore the majority of the O&M costs are reduced. Between the two baling methods, the rectangular compacting machinery has a greater capacity than the cylindrical compacting machinery. This significantly reduces the working hours and energy requirements in the former case. The baling and plastic-wrapping accounts for 3.91 €/bale in the rectangular method and 3.05 €/bale in the cylindrical method. However, the number of produced bales is higher in the latter case for a given amount of waste because the density achieved is considerably lower and therefore the total cost of baling and plastic-wrapping is more profitable in the rectangular method (2.17 €/t) than in the cylindrical method (3.29 €/t).

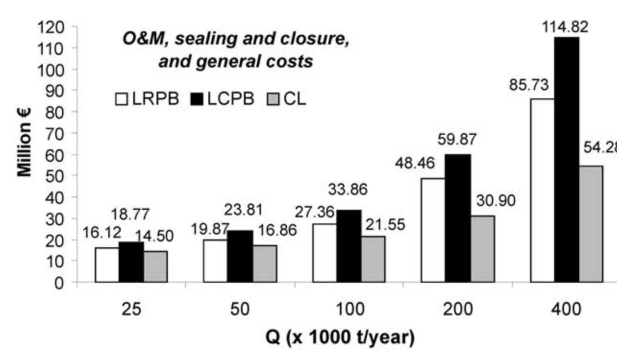


Fig. 5. O&M, sealing and closure, and general costs (M€) against value of Q.

3.3.3. Unit cost

The treatment cost per tonne of waste decreases with the increasing capacity of the landfill, as shown in Fig. 7A. For the whole range of Q values, a LRPB is a competitive option compared with a CL. The use of rectangular bales optimises the landfill area reducing the costs in land acquisition, preparation of the landfill and other related costs, and compensating for the increased costs of machinery, energy and operating labour required by the method, compared to the CL. The LCPB suffers mainly from the lower density within the bales, the inefficient use of the landfill capacity due to the cylindrical geometry and the lower capacity of the machinery.

3.3.4. Effect of the landfill depth

Fig. 7B examines the unit cost that results from varying H between 10 m and 30 m for Q = 100,000 t/year. An increase of H introduces a steep reduction in the treatment cost per tonne. This reduction is mainly due to the space occupation factor. It should be borne in mind that this model sets an earth moving of 0.93 €/m^3 which does not vary with H. The unit cost decreases more rapidly for a CL than for a LRPB.

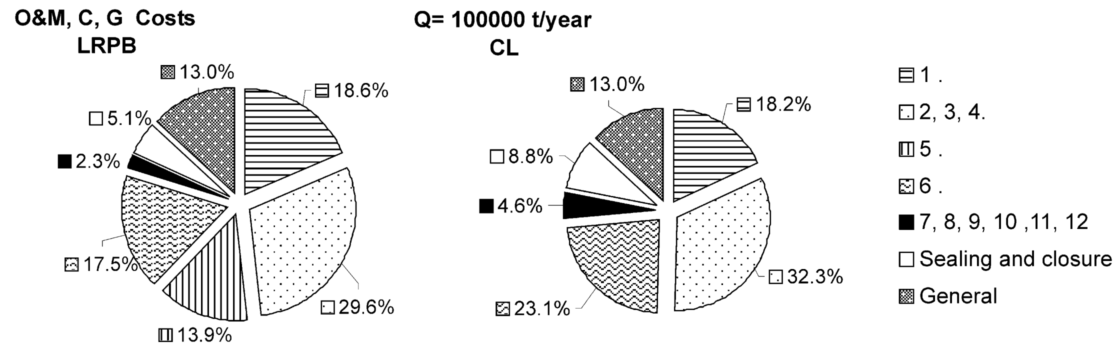
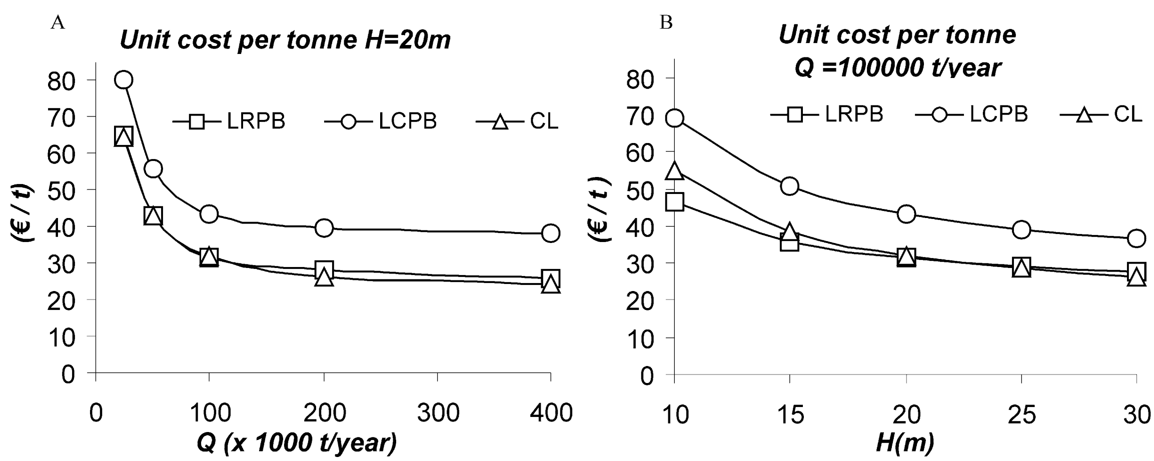


Fig. 6. Individual components of the O&M, sealing and closure, and general costs (%) of a LRPB and a CL for Q = 100,000 t/year.



Q (x 1000 t/year)	25	50	100	200	400
LRPB (€/t)	65.11	42.81	31.52	28.36	25.80
LCPB (€/t)	80.44	55.84	43.36	39.61	38.28
CL (€/t)	64.65	42.88	31.83	26.19	24.30

H (m)	10	15	20	25	30
LRPB (€/t)	46.37	35.82	31.52	29.05	27.66
LCPB (€/t)	68.95	50.77	43.36	39.09	36.67
CL (€/t)	55.11	38.71	31.83	28.51	26.28

Fig. 7. Unit cost per tonne (€/t). (A) Against value of Q for H = 20 m; (B) Against value of H for Q = 100,000 t/year.

When H increases, the differences relate to the degree of land occupation decrease. Fig. 7B shows that the cost is higher for the CL between 10 m and 22 m approximately. Beyond 22 m the LRPB is slightly less economical.

4. Conclusions

4.1. Conclusions regarding the use of plastic-wrapped bales for MSW landfilling

This system assures that emissions are highly reduced in the short and half-term compared with a CL. This refers to both the emission of gases and the production of leachates, once the plastic-wrapped bales have been deposited in a landfill where the current concepts of design and control are applied, or stored for their subsequent incineration. However, comparisons between different management options must include the long-term impacts as showed by Finndeven (1995). For CLs this has been done among others by Belevi and Baccini (1989), and Döberl et al. (2002). In the case of LPBs, the long-term impacts of the baling-wrapping remain uncertain. The existing LPB's are relatively new and therefore experience in such systems is limited in time. Future monitoring will help assessing long-term impacts of this technology.

LPBs are much less potentially problematic than CLs, in environmental conditions ranging from extreme weather situations (heavy rain, for example) to normal or typical conditions. The dispersion of light wastes (plastics, papers) by the wind is eliminated. Since a LPB is primarily based on compaction, the effects of strong winds on the waste is avoided. It also totally eliminates the factors of visual impact of a CL. It results in a significant reduction of the covering material, with a greater utilisation of the volume of the storage area (in a LRPB), reducing the consumption of materials and fuel.

Subsidence problems should diminish, due the greater density and consistency of the bales. However, in the case of plastic-wrapped bales, questions of mechanical stability in function of the number of layers of bales should be taken into serious consideration. The classic vectors of pollution of CLs are practically avoided, since it is more difficult for birds, rats, and dogs to gain access to the waste. The same applies to spontaneous combustion.

The integration of this system in a transfer station allows the flow of vehicles to be reduced, since the bales can be easily transported and handled, reducing the consumption of fuel for the transport of the MSW. It is possible to transport the plastic-wrapped bales by road or rail (or other means), and special vehicles or containers are not necessary. The load's surface area is not subject to problems of corrosion or special problems of soiling.

The use of bales also simplifies the operations of transport within the controlled disposal area. It also reduces the needs for heavy machinery inside safety storage areas, as the bales are handled by means of a telescopic fork lift truck. A telescopic mast enables stacking in layers. Special hydraulic pincers allow the safe handling of the bales without damaging the LDPE film. Bales may be damaged if the driver is not careful when handling the bales.

Given its characteristics, this system can also be used as filling material for the restoration of quarries with suitable geo-hydrological conditions. It can also be used for the temporary storage of MSW, enabling the subsequent recovery of the stored materials (material or thermal recycling). The UV resistance of the LDPE ensures that the material can be stored outdoors for one year.

4.2. Conclusions regarding the cost analysis

From an environmental point of view, LPB's are a promising option for waste disposal introducing cleaner technology which eliminates much of the contamination vectors which are present in a CL. Furthermore, the EU Directive 1999/31 attempts to impose a steep reduction in the biodegradable matter to be managed in landfills so that only waste which is rejected from other plants is admitted to landfills. It also encourages composting, recycling, separate collection and the closure of many uncontrolled landfills. This is a context which further favours the use of plastic-wrapped bales, which resolves the problems of leachate and biogas generation.

In addition, LRPBs have proved to be an economically competitive option compared to CLs. The model assumed for both systems the same security criteria and the conditions of construction, operation and maintenance and postclosure, required by European Directive 1999/3, although many of them are not really necessary for the baling-wrapping method.

Assuming an operation time of 15 years and a H of 20 m, the resulting unit costs per tonne for Q increasing from 25,000 t/year to 400,000 t/year, range between 65 €/t and 25 €/t in a LRPB, 80 €/t and 38 €/t in a LCPB, and 65 €/t and 24 €/t in a CL. The increased capacity of the waste disposal zone when using rectangular bales due to the high density of the bales compensates for the increased O&M costs of the method. It must be taken into account that an increase of H introduces a steep reduction in the final cost per tonne. The land acquisition cost per m^2 used was 120.20 €. The differences between the methods are highly dependent on those two parameters.

The reduced land requirement of LRPBs makes them preferable, not only from an economic point of view, but also considering the land availability, which is increasingly scarce.

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E-waste Campaign Implementation Support Grants

Grant Funding

- $10,000 in funding available from SV
- Option 1 – Face to face
- Option 2 – Collateral
- Completed by Sept 30, 2019

Grant Proposal – Wyndham

Face to Face

- Pop Up E-waste drop offs/Pick Ups (x 5) = $6,350
- Trailer refurbishment = $2,000
- E-waste info sessions = in-house cost
- Pop Up Recycling Day March = existing funding

wyndhamcity
city. coast. country

Grant Proposal

Resources

- Steel signage for Transfer Station = $500
- Banners = $1000
- VMS boards = $1620
- Postcards/posters = $500
- Social media =$200
- Wyndham News = existing budget
- E-newsletters = no cost

Waste Audit & Bin Inspection Results

- Kerbside Audit conducted by EC Sustainable
  - 200 garbage, 200 x recycling & 100 x green bins
  - Comparison of 2 bin x 3 bin households
  - Cross section of City
  - Audit held every 2nd year
  - In accordance with SV's residual waste guidelines

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Contamination

	2014	2016	2018
Recycling	22.58%	24.94%	20%
Organics	2.49%	19.43%	2.4%

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city. coast. country

Generation Rates

Data indicator		Unit of measurement	Result	
			2016 ##	2018
Generation rate when a bin was presented	By weight	Weight (kg/hh/wk) – waste	11.50	11.78
		Weight (kg/hh/wk) – recycling	5.35	4.66
		Weight (kg/hh/wk) – organics	4.08	3.04

Unrecovered Resources

Data indicator		Unit of measurement	Result	
			2016 ##	2018
Unrecovered resources in the waste bin at the kerbside	Recyclable	Weight (kg/hh/wk)	1.39	1.66
		Percentage (% by weight)	12.1	14.1
	Compliant Food	Weight (kg/hh/wk) ++	1.76	3.46
		Percentage (% by weight)	15.3	29.4 *
	Garden / vegetation	Weight (kg/hh/wk) ++	0.64	0.85
		Percentage (% by weight)	5.6	7.2

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Resource Recovery & Diversion

Data indicator		Unit of measurement	Result	
			2016 ##	2018
Resource recovery rate	Recycling bin	Percentage (% by weight)	72	67
	Organics bin ^	Percentage (% by weight)	55	41
Diversion rate at the kerbside	Current	Percentage (% by weight)	NA <<	32.7 ^
	Maximum, with current bin systems #	Percentage (% by weight)	NA <<	63.3

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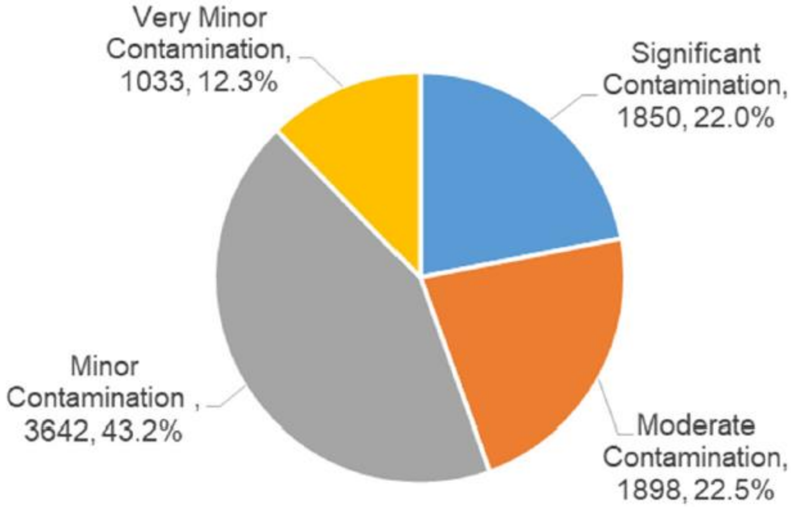
Bin Inspection Summary

- 12,003 inspections completed July – Nov
- 212 repeat inspections

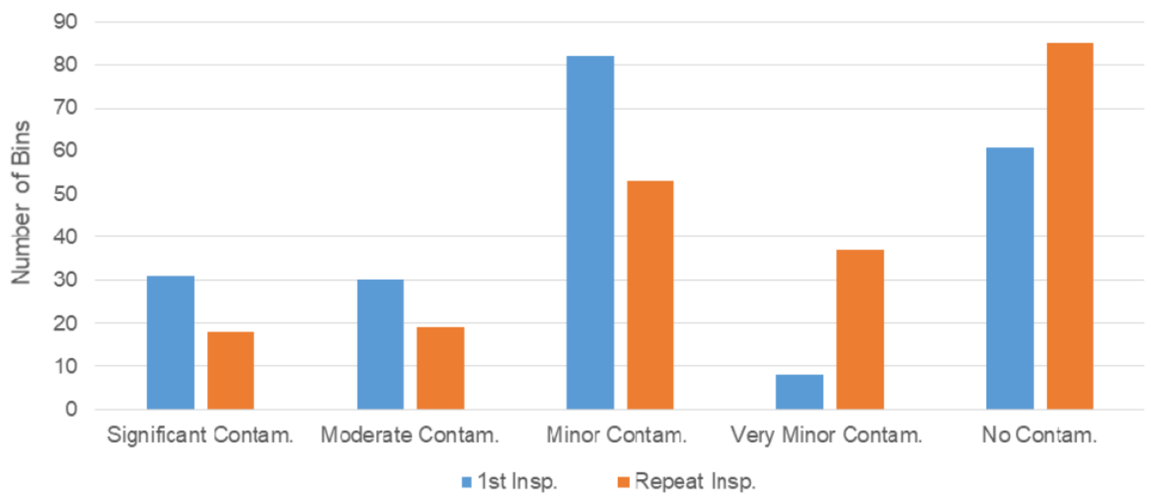


Contamination

Contaminant	No. of Bins Containing Item	% of All Bins
Soft Plastics	5432	45.3%
Garbage/Food	924	7.7%
Bagged Recycling	2898	24.1%
Garden Waste	280	2.3%
Polystyrene	829	6.9%
Clothing/ Shoes/ Linen/ Textiles	458	3.8%
Paper Towel, Tissues, Wipes	1252	10.4%
Other	2307	19.2%

Repeat Inspections

	No. of Bins	Contamination Rate	
		1st Inspection	Repeat Inspection
Tarneit - Wed Collection Area 2	132	74.2%	62.1%
Tarneit -Thu Collection Area 1	80	66.3%	56.3%
Total Repeat Inspections	212	71.2%	59.9%



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Worst Performing Suburbs

- Truganina (average 79.26%)
- Tarneit/Tarneit West (average 73.18%)


Car battery


Bagged garbage


Garden waste

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Next Steps

- Targeted campaign on bagged recyclables & soft plastics
  - – Bin stickers
  - – Social media
  - – Bus advertising
  - – Multicultural press
- Worst performing areas – Truganina & Tarneit
- Bin Inspections – Round 2 Feb
- Wormlovers/Discount green waste bins

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Cell 5 Liner

Baled Landfilling in South Australia