Design Smart Material Guide No.10

Australian Packaging Covenant

Packaging Components

Australian Packaging Covenant

Contents

Purpose of this Guide

This Design Smart Material Guide for packaging components is the tenth in a series of ten guides published by the Australian Packaging Covenant (APC).

It considers the various components that are additional to the primary packaging material, including:

- Labels and adhesives
- Inks and pigments
- Lids, caps and seals

The purpose of this guide is to help you improve the environmental performance of your packaging system, without compromising on cost or functionality. It provides a ‘checklist’ of sustainability issues to keep in mind when designing and/or specifying your next package. The guide will also support your packaging reviews against the Sustainable Packaging Guidelines (SPG), as required by the APC. To facilitate this, the design considerations are grouped under the four principles of the Guidelines.

The information contained in each guide is based on ‘life cycle thinking’, which considers the sustainability impacts of packaging throughout its supply chain, during use, and at end-of-life. It considers the impacts of the whole packaging system, including primary, secondary and tertiary packaging[1], as well as its performance in delivering the product to the consumer.

[1]Primary packaging contains the sales unit product (e.g. 1.5-litre PET water bottles), secondary packaging contains the sales units (e.g. a corrugated board tray box, with shrink wrap holding six bottles), and tertiary packaging is the freight/distribution-related packaging (e.g. a pallet, with pallet wrap and a heavy duty corrugated board pallet ‘slip’).

Smarter Packaging, Less Waste, Cleaner Environment

Purpose of this Guide

Most of the guides focus on a particular type of material, and these are your first point of reference in a packaging assessment. In addition to the primary material used for the package, you will also need to think about the other components such as caps, labels, inks and adhesives. This is important for two reasons:

- Each component has its own life cycle impacts to consider: during the extraction of raw materials, component manufacture and packaging conversion
- Individual components can have a significant impact on the recoverability of the primary material used for the package.

This guide provides information on the life cycle design considerations for secondary packaging components. Where relevant, many of the design considerations examined in this guide are also found throughout the other guides in this series.

Table 1

Abbreviations used in this guide

ABS	Acrylonitrile Butadiene Styrene
EPS	Expanded Polystyrene
EVA	Ethylene Co-Vinyl Acetate
EVOH	Ethylene Vinyl Alcohol
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
MDPE	Medium Density Polyethylene
OPP	Oriented Polypropylene
OPS	Oriented Polystyrene
PA	Polyamide (Nylon)
PET	Polyethylene Terephthalate
PLA	Polylactic Acid
PS	Polystyrene
PU	Polyurethane
PVC	Polyvinyl Chloride
PVDC	Polyvinylidene Chloride
SBR	Styrene Butadiene Rubber
SIS	Styrene Isoprene Styrene
TPE	Thermoplastic Elastomers
UV	Ultra Violet
VOC	Volatile Organic Compounds

Disclaimer

This document is provided as a general guide only. Aspects relating to material extraction, material processing, transport systems and consumption patterns will impact the environmental, financial and functional performance of packaging systems. Appropriately detailed analyses of specific packaging systems are necessary to confirm the benefits of any of the design considerations outlined in this guide.

The development of this guide has largely relied on the sources listed in the Useful Further Reading section, as well as targeted consultation to confirm design aspects for the Australian context.

If you or your organisation have any questions or comments about these guides, or would like to better understand packaging assessments, please contact the Australian Packaging Covenant at apc@packagingcovenant.org.au. The APC will endeavour to review the content of these guides on a regular basis to ensure currency and alignment to industry developments.

The Life Cycle of Packaging Components

Labels and adhesives

The label is usually a relatively small packaging component, but can have a significant impact on the life cycle of a container, particularly at end-of-life. The key issues to consider are:

- Selection of the substrate material for the label
- The impact of the label, adhesive and printing inks on the recyclability of the container.

Labels can be manufactured from a wide range of materials. More information on the manufacturing processes for paper and plastics are available through the Design Smart Material Guides for Fibre- Based Packaging and Flexible Plastic Packaging.

One of the most important life cycle issues for labels and adhesives is their compatibility with the recovery and recycling processes for the packaging. The preferred options for each material are listed in Table 3 – Compatibility of packaging components with the recovery process, with more detail then provided in Table 4 – Design considerations for packaging components.

New label materials are becoming available to meet industry demands for more sustainable packaging. Alternative sources of fibre for paper labels include bagasse, a by-product of the sugar manufacturing process. Labels can also be manufactured from renewable and compostable polymers such as polylactic acid (PLA) and cellulose-based films, and these may be appropriate if your packaging is compostable, and is designed for recovery through a home or commercial composting system.

Inks and pigments

For inks and pigments, a particularly important consideration is the potential impact of printing processes on the environment and human health. The selection of printing inks can also have an impact on recoverability (see Table 3).

Printing inks have three components:

Pigments

These provide the colour and are made up of finely ground organic or inorganic materials.

Binders

These lock the pigments to the substrate and are generally composed of organic resins and polymers.

Solvents

These disperse the pigments and binders and act as carriers. These solvents are evaporated from the ink during the drying process, and are typically either water or organic chemicals (often called volatile organic compounds or VOCs).

The Life Cycle of Packaging Components

The primary risk for pigments is the presence of heavy metals (lead, cadmium, mercury and hexavalent chromium) and other toxic substances. Despite stringent regulations governing their use in Australia, Europe and the US, heavy metals may still be present in some packaging imported from overseas.

Organic solvents can contain a mixture of volatile organic compounds (VOCs), such as toluene, xylene, ethanol, ethyl acetate, propanol and propyl acetate. Depending on the types of VOCs used in printing and coating processes, there can be a range of environmental effects, including:

- Local impacts such as odour, and environmental and human toxicity
- Regional or metropolitan-wide impacts such as the formation of photochemical pollution (smog)
- Global impacts due to the conversion of VOCs to carbon dioxide, which contributes to climate change as a greenhouse gas

VOC emissions vary depending on the type of printing process and solvent used (see Table 2). Water-based inks are a viable option for flexographic printing, particularly where the packaging has an absorptive surface, such as paper and paperboard. The use of water-based inks on films and foils is also possible, but may require special treatment in order to have the inks or coatings adhere to it. Water-based inks typically require more energy and time to dry, compared to organic solvent-based inks.

The European Printing Industry Association has developed an 'exclusion list' for printing inks and related substances based on health and safety concerns (see the Useful further reading list). Packaging decision-makers need to assess all of their packaging components to identify substances that are likely to pose a health or environmental risk and endeavour to reduce that risk.

Table 2

Summary of relative VOC usage by printing process

Printing/Coating Process	Substrate	Ink System Solvent	VOC Usage
Rotogravure	Film	Organic	High
Flexography	Paper	Organic	High
	Paper	Water	Low
	Film	Water	Low
	Film	Organic	High
	Film	UV Curing	Very Low
Heat-Set Lithography	Paper	Organic	High
Offset Lithography	Paper	Mineral Oils/Vegetable Oils	Very Low

Source: Environment Protection Authority Victoria (2004) - see Further Reading

Lids, caps and seals

Information on the life cycle impacts of materials commonly used to manufacture caps and closures is provided in the Design Smart Material Guides for Rigid Plastic Packaging, Aluminium Packaging and Steel Packaging. Effective design of lids, caps and seals is essential to ensure that the product is protected and that there is no leakage or product damage through the supply chain. Other important considerations for these components include:

- Design for ease of use by consumers (accessibility) to ensure that consumers can open the package without assistance and without discomfort
- Design for efficiency, which means ensuring that all closures are an appropriate size and shape to minimise material consumption
- Design to support recovery at end of life by using materials that are compatible with the primary packaging during recovery (see Table 3).

The Life Cycle of Packaging Components

Table 3

Compatibility of packaging components with the recovery process

Primary Packaging Material	Component	Most Compatible	May Be Problematic	Not Compatible
Fibre-Based	Label	Direct print, paper labels	Plastic or foil-coated labels	
Glass	Labels and sleeves	Direct print, paper or plastic labels	Full body sleeves	
PET	Labels and sleeves	PP, OPP, HDPE, LDPE, clear PET, TPE	Direct print onto clear PET containers, paper label, full body sleeves	OPS, PVC, metallised, coloured PET on clear containers, wet-strength paper, PLA
	Adhesive	Water or caustic soluble, hot melt based on SBR or SIS		Pressure sensitive, polyurethane
	Inks	UV-curable inks with photo-initiators		Inks containing heavy metals, hazardous VOCs, water-soluble inks
	Caps	PP, HDPE, LDPE, EVA	OPS	PVC, aluminium, other metals
	Liner	PP, HDPE, LDPE, EVA		PVC, EVA with aluminium layer
	Seals	PE, PP, OPP, EPS, PET	Silicone (density <1 kg/L)	PVC, aluminium, silicone (density ≥1 kg/L)
	Handles and sports caps	PP, HDPE, LDPE, silicone (density <1 kg/L)		ABS, OPS, PVC, silicone (density ≥1 kg/L)
HDPE	Labels and sleeves	Clear HDPE, OPS, PVC, PET	Direct print onto unpigmented HDPE, LDPE, PP, OPP, wet-strength paper	Labels covered in black ink, paper, coloured HDPE (on unpigmented HDPE containers), metallised
	Adhesive	Water or caustic soluble	Hot melt based on SBR or SIS	Pressure sensitive, polyurethane
	Inks			Water-soluble inks
	Caps	HDPE, LDPE	PP	PVC, aluminium, steel
	Liner	HDPE, LDPE, EVA, PP		PS, PVC, EVA with aluminium
	Seals	PE, PP, OPP		PVC, silicone, aluminium
PVC	Labels and sleeves	HDPE, MDPE, LDPE, LLDPE, PP, OPP, PVC, PVDC	Paper, EPS	PET, PS, metallised films
	Caps	PVC, HDPE, LDPE, PP, EVA	PU	PET, PS (density >1 kg/L), thermoset plastics, aluminium, steel
	Liner		EPS (density <1 kg/L)	PET
PP	Labels and sleeves	HDPE, MDPE, LDPE, LLDPE, PP, OPP	PET, PS, paper	PVC, metallised
	Seals	PP, PE		PVC
	Caps	HDPE, LDPE, PP		PS, thermoset plastics, aluminium, steel
	Liner	HDPE, LDPE, PP	PVC, EVOH	PET, PS, thermoset plastics
Compostable Polymer	Labels and sleeves	A material that has been certified as home compostable		Conventional non-compostable plastic, e.g. PE, PP
Aluminium	Labels and sleeves	Direct print, labels	Full body sleeves	

Design Considerations for Packaging Components

Packaging design should be guided by the resource efficiency design hierarchy[1].

The hierarchy of preferred packaging design changes is: avoid, minimise, reuse, recycle, recover (energy) and dispose.

The robustness of this general hierarchy is backed by a very significant body of evidence, based on packaging life cycle assessments (LCAs).

The key design aspects to keep in mind to minimise the environmental impacts of packaging components are:

- Avoid the use of non-functional packaging components wherever possible.
- Lightweight or reduce the size of components such as caps and labels as much as possible to minimise material consumption.
- Minimise ink coverage to avoid unnecessary material consumption and to support recovery.
- Undertake a risk assessment of all chemical components including inks, pigments, coatings and adhesives to identify any potential health or environmental impacts.
- Design for the effective reprocessing of your packaging by ensuring that caps, seals, inks and labels are compatible with the likely recovery process.

As with all packaging materials, packaging components have specific design constraints, which may limit the application of the resource efficiency design hierarchy. With this in mind, we have outlined the general design considerations for plastic components in Figure 1. During material selection and packaging system design all of the aspects in Figure 1 should be considered.

Each of these design considerations is then discussed in more detail in Table 4.

[1]The resource efficiency design hierarchy is also often referred to as the waste hierarchy.

Design Considerations for Packaging Components

Figure 1

Summary of design considerations for packaging components

Design to be fit-for-purpose
SPG principle 1

Design to:
- Ensure that labels are easy to read
- Improve the openability of caps and seals

Design for resource efficiency
SPG principle 2

Design to:
- Avoid or minimise labels
- Avoid or minimise adhesives
- Minimise ink coverage

Design with low-impact materials
SPG principle 3

Design to:
- Source sustainable fibre for paper labels
- Reduce VOC emissions from printing
- Avoid heavy metals in printing inks
- Reduce VOC emissions from adhesives

Design for resource recovery
SPG principle 4

Design to/for:
- Maximise sorting efficiency
- Design labels for compatibility with recycling
- Minimise the impact of adhesives on reprocessing systems
- Minimise the impact of inks and pigments on reprocessing systems
- Design lids, caps and seals for recycling
- Ask consumers to separate different materials

Design Considerations for Packaging Components

Table 4

SPG Principle	Design to	Design Considerations	Life Cycle Importance
1 - Design to be Fit-for-Purpose	Ensure that labels are easy to read	Ensure that packaging disposal instructions and expiration dates are easy to read and understand. Print critical text with large print in a sans-serif font with high contrast on a solid background (minimum 12 point font size). Lower case is easier to read. To increase effectiveness, warnings and instructions should be presented as bullet points. Consider using large, bold print; high contrast; colour; borders; and pictorial symbols.	HIGH
	Improve the openability of caps and seals	Minimise the rotational force requirement for breaking the initial seal on screw-top containers. Rotational forces greater than 1.1 Nm (newton metre) often exceed the functional capabilities of the frail, elderly and those living with arthritis. To prevent over-tightening of caps, use steep rather than gradual threading. Ensure that screw-top caps fit in the hand. Their removal should require no more than ¼ turn for each angular movement, and no more than two angular movements should be required. Use steep rather than gradual threading to prevent over-tightening of the cap. Specify a grip span of no more than 71 mm for products required to be gripped in one hand, and incorporate serrations in caps to make them easier to grip. If using closures or seals, check the required removal force. The force required to pull or puncture the seal should not exceed 23 newtons. Avoid seals that require a tool to puncture. Provide a sufficiently large grasping point on seals and opening features. A tab that is 12mm wide by 20mm long is recommended. Check Arthritis Australia's Food Packaging Design Accessibility Guidelines (see Useful Further Reading list) for more suggestions to improve the accessibility of your packaging.	HIGH

Design Considerations for Packaging Components

2 - Design for Resource Efficiency	Avoid or minimise labels	Print directly onto containers (unless this affects recyclability – see SPG principle 4 below) or use the smallest label possible. Choose a label substrate that is as thin and light as possible without compromising performance. Weight and stiffness must suit high speed filling applications.	HIGH
	Avoid or minimise adhesives	Use the minimum amount of adhesive necessary for the label. Consider whether mechanical fastenings, such as inter-locking tabs, may be a good alternative to adhesives.	HIGH
	Minimise ink coverage	Solvent-based ink systems emit VOCs during the printing process. Inks are also a contaminant in many recycling processes. Consider whether there are any options to reduce ink coverage, for example by using embossing rather than printing. Minimise inks by limiting colour or graphics on distribution packaging, where aesthetics and brand presence are less important.	HIGH

3 - Design with Low-Impact Materials	Source sustainable fibre for paper labels	If using a paper label, ask your supplier about the source of all virgin wood fibre to ensure that it is from a sustainable source. Look for credible, third-party certification of claims. Numerous independent certification schemes exist, of which the Forest Stewardship Council (FSC) is one of the best known, independent and most reputable.	MEDIUM
	Reduce VOC emissions from printing	Solvent-based ink systems release VOC emissions that have a range of environmental impacts and exposure can be toxic. Consider switching to a water-based or UV-curable ink system to reduce VOC emissions (although keep in mind that this may require more drying time, use more energy or slow down printing processes). If this is not possible, talk to your suppliers about the strategies they have adopted or intend to adopt to use low-VOC ink systems or substitute VOCs that are less toxic or photo-chemically reactive.	HIGH
	Avoid heavy metals in printing inks	Avoid inks that use heavy metal pigments (lead, mercury, cadmium, hexavalent chromium). These are toxic to human health and the environment and their use is restricted in many countries. Undertake a risk assessment of all inks and pigments used in your packaging to identify any environmental or health risks. Change the colours used for your packaging if less hazardous alternatives are not available.	HIGH
	Reduce VOC emissions from adhesives	Solvent-based adhesives release VOC emissions that have a range of environmental impacts and exposure can be toxic. Consider the use of water-based adhesives. These do not release VOCs but require more drying time and compression time than hot melt adhesives.	MEDIUM

Design Considerations for Packaging Components

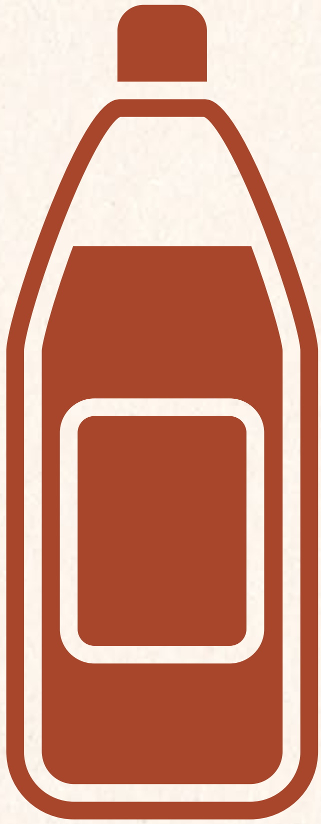
4 - Design for Resource Recovery	Maximise sorting efficiency	Most Material Recovery Facilities (MRFs) sort plastic bottles and containers into the different polymer types using optical sensors. To ensure that containers are sorted into the correct polymer group (rather than mixed plastics), labels and shrink sleeves should be as small as possible. Generally the label or sleeve shouldn't cover more than a quarter of the container, or the container should have at least 22 mm of the surface not covered. If full sleeves are desired, they need to be designed so that automatic sorting equipment can properly identify the polymer used to make the bottle. Avoid labels or sleeves that are covered in black ink, as these can't be identified by the optical sorter.	MEDIUM
	Design labels for compatibility with recycling	Labels on plastic bottles and containers can be difficult to remove during the recycling process, and may reduce the value of the end product. Consider adding vertical perforations to aid removal by consumers and/or the recycling process, and provide clear instructions to consumers on the need to remove the label and how to do so. To maximise the value of the recovered material, labels for plastic bottles and containers should be manufactured from a material that is compatible with the reprocessing system. For example, PP and LDPE labels cannot be separated from HDPE bottle flake during the washing process, and even a small amount of these materials will reduce the value of the recycled HDPE. More detail is available in the ACOR Guides for PET and HDPE (see the Useful further reading list). Paper labels on plastic containers and film are a significant problem during recycling because they are difficult to remove and if left in the recyclate may significantly devalue the recovered material. Wet-strength paper labels on plastic containers should be avoided because they contain sizing agents (which provide moisture resistance) that don't disintegrate during the washing process. Where in-mould labelling is desirable for a plastic container, for example to protect containers in contact with oils or water, use the same plastic as the container wherever possible.	MEDIUM
	Minimise the impact of adhesives on reprocessing systems	The type of adhesive and its coverage have implications for plastics recycling. Minimise the amount of adhesive used and choose one that is compatible with the recycling process (see Table 3). Consider the use of water-soluble or hot melt alkali-soluble adhesives rather than pressure sensitive or polyurethane adhesives, but confirm that these are compatible with the intended recycling system. The newer EVA hot melt adhesives may also be compatible. Avoid adhesives that are completely soluble in a caustic washing process, because these can leave a fine layer of glue residue on the recycled flake, which can turn yellow or brown during the extrusion process. Consider using thick beads rather than thin strips of hot melt adhesives, which can fragment. For plastic bottles, sleeves and wraparound or collar labels that are glued to the container at only a few points are preferred.	MEDIUM
	Minimise the impact of inks and pigments on reprocessing systems	Direct printing onto unpigmented plastic containers should be avoided (other than date coding), because this may discolour the recycled flake. If direct printing is going to be used, make sure that the ink is removable under a hot caustic washing process. Lighter pigments cause less taint than darker pigments. The most compatible inks for a plastic container are UV-curable inks with photo-initiators. Inks containing heavy metals, hazardous aromatic printing solvents and water-soluble inks should be avoided where possible.	MEDIUM

Design Considerations for Packaging Components

4 - Design for Resource Recovery		Try to avoid or minimise pigments in the plastic resin used for lids, caps and closures. Unpigmented plastic containers have a greater value due to the larger number of potential applications. Large amounts of pigment in plastic containers may increase their density and make it difficult to separate them in the washing (float-sink) process. They can also cause identification problems for the automatic polymer sorting equipment.	
	Design lids, caps and seals for recycling	Lids, caps and seals should be manufactured from the same material as the container, or a material that can be easily separated during the washing processing because it is either lighter or heavier than water (e.g. PET sinks, so caps and seals should be made from a material that floats – see Table 1 in the Design Smart Material Guide for Rigid Plastics for more information). Tamper-evident seals should be designed to completely detach from the container or to be easily removed in conventional recycling processes. Avoid PVC tamper-proof seals on PET bottles because these are difficult to remove and may cause black specks in PET containers using the recyclate. Closure systems on plastic containers that contain no liners and leave no residual rings or attachments when removed are preferred by recyclers. Metal caps, seals and inserts may be problematic in the plastics recycling process. Plastic-only trigger sprays are preferred (without metal springs and ball bearings). If the trigger includes metal components ask consumers to remove it before recycling. Avoid use of metal caps where possible, particularly if a tamper-evident ring is left behind on the bottle after opening. Foil seals that leave foil or remnants of the attaching adhesive on the container should be avoided. These will become a contaminant in the recycled material and may prevent its use in high grade applications. Ensure that peel-off aluminium lids can be completely removed by consumers, with the adhesive remaining attached to the lid. Specify caps and closures that are the same colour as the bottle or container. Pale colours are preferred because these are most valuable and easiest to recycle into high value products.	MEDIUM
	Ask consumers to separate different materials	Ask consumers to remove plastic caps on aerosols to avoid contaminating bales of aluminium with lower value plastics. If using any metal components in plastic packaging, e.g. a metal screw cap or trigger spray with a metal spring, advise consumers to separate before recycling.	

Design Example

This hypothetical design example illustrates some of the sustainability design aspects that could be considered during a packaging development or review. The brief is for a more environmentally sustainable label on a PET plastic bottle. Industry standards include paper or plastic labels, or wrap-around sleeves, with a variety of different adhesives.



Sustainable design considerations

Design for efficiency

- Choose a thin polymer label.
- Optimise the label size to avoid any unnecessary material
- Ask your label supplier whether production waste can be taken back and recycled

Material selection

PET bottles are widely recycled and the label needs to be compatible with the recycling process:

- A clear PET label is preferred because the label can be recycled with the bottle
- PP, HDPE or LDPE labels are also OK because they are lighter than water and can be removed in the washing process
- The label should be as small as possible to maximise the chance that optical sorting technologies identify the polymer of the bottle rather than the label

Printing

- Minimise colour printing – it may contaminate the recycled PET
- Avoid heavy metal-based inks

Label adhesive

Adhesives can contaminate recycled PET and therefore need to be removed during the washing process.

A small to medium-sized shrink sleeve is ideal because it can be completely removed in the recycling process without leaving behind any residual adhesive.

More innovative ideas that could be explored

- Get rid of the label, particularly for special production runs that use a distinctive bottle shape[1]
- Use a QR code to provide more sustainability and health information to customers

[1]Absolut Vodka released a limited edition ‘no label’ bottle – see: www.hypebeast.com/2009/08/absolut-vodka-no-label-edition/; some use a removable campaign sticker – see www.absolutads.com/?p=879.

Useful Further Reading

Reference	What is it?
ACOR, 2012. Recycling Guides for Fillers, Australian Council of Recycling. Between 8-20 pages.	ACOR has produced four guides on design for recycling, each one focusing on a different material: PET, HDPE, aluminium and steel. These provide a great deal of detailed information on the main reprocessing and contamination issues, including choice of labels, adhesives, seals, inks, closures and caps. Free download from: www.acor.org.au
APC, 2010. Sustainable Packaging Guidelines, Australian Packaging Covenant. 30 pages.	The SPG is the key document for APC signatories and others to use in framing APC-compliant packaging reviews. The objectives of these reviews are to optimise resources and reduce environmental impact, without compromising product quality and safety. Free download from: www.packagingcovenant.org.au
Arthritis Australia, 2012. Food packaging design accessibility guidelines. 31 pages.	This document provides more detailed guidance on accessibility principles and strategies to improve accessibility of food packaging; prepared in conjunction with NSW Health. For a complimentary copy of the Food Packaging Accessibility Guidelines and several other packaging design reports contact Arthritis Australia at: design@arthritisaustralia.com.au
Association of Postconsumer Plastic Recyclers, 2008. Design Guidelines for Plastic Bottle Recycling. 28 pages.	The US-based Association of Postconsumer Plastic Recyclers (APR) prepared this guidance document to aid packaging designers and manufacturers in designing and manufacturing plastic containers to maintain or improve recyclability. The document provides extensive detail on the reprocessing and contamination issues for each plastic polymer type. Free download from: www.plasticsrecycling.org/technical-resources/apr-design-for-recyclability-guidelines
Environment Protection Authority Victoria, 2004. Minimising VOC emissions from Victoria's printing industry. 9 pages.	This information bulletin provides a basic overview of printing processes and the potential impact on VOC emissions. Free download from: www.epa.vic.gov.au/our-work/publications/publication/2004/february/940

Useful Further Reading

European Printing Industry Association, 2007. Exclusion list for printing inks and related substances. 4 pages.

EPIA has produced voluntary recommendations for the exclusion of certain raw materials ('substances and preparations') from printing inks and related products. Free download from: www.cepe.org/EPUB/easnet.dll/GetDoc?APPL=1&DAT_IM=020A3B&TYPE=PDF

ILSI, 2011. Packaging Materials 8: Printing Inks for Food Packaging – Composition and Properties of Printing Inks. International Life Sciences Institute (ILSI), Brussels. 36 pages.

This is a fairly technical report that provides an excellent overview on the printing characteristics, properties and compositions of printing inks for food packaging, across all the major available printing processes. The report also provides detail on environmental, regulatory (for Europe), safety and toxicology aspects for printing inks, along with some information on the interaction between printed packaging and food contents. Free download from: www.ilsi.org

Packaging Resources Action Group, 2009. An introduction to packaging and recyclability. 23 pages.

The UK-based PRAG has published some very useful and succinct guidelines on design for recycling, including the choice of labels, fillers, inks, etc. Free download from: www.wrap.org.uk/sites/files/wrap/Packaging%20and%20Recyclability%20Nov%2009%20PRAG.pdf

Recoup, 2009. Plastics Packaging – Recyclability by Design, United Kingdom: Recycling Of Used Plastics Limited. 46 pages.

This guidance document was produced by Recoup (RECycling Of Used Plastics Limited), a UK-based plastics waste management research organisation, with funding by Reckitt Benckiser (UK). The document provides a great deal of detailed guidance on designing plastic packaging to facilitate mechanical recycling at end-of-life. If improving the recyclability of your packaging is a primary focus, then this document is recommended reading. Free download from: www.recoup.org/business/default.asp?goto=eco_recbydesign

Verghese, K., Lewis, H. & Fitzpatrick, L., 2012. Packaging for Sustainability. 1st ed. Boston: Springer. 384 pages.

This life cycle thinking-based reference book provides extensive detail on just about every aspect of sustainable packaging design. Beyond design, it also contains detailed information on marketing, regulatory and labelling aspects. Order from: www.springer.com/engineering/production+engineering/book/978-0-85729-987-1

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