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# Recycled Materials in Food Contact Applications





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## Disclaimer

This document is provided as a general guide only. The use of recycled content in any packaging or product should be assessed by any organisation to ensure performance requirements and safety risks are addressed. The Australian Packaging Covenant (the Covenant) and the Australian Packaging Covenant Organisation (APCO) accept no liability or responsibility for any loss or damage resulting from the use of or reliance upon this document by any party.

## Preface

This paper was written to clarify legal and other restrictions on using recycled content in food contact packaging in Australia. There is a widespread misconception that recycled content is not permitted to be used in contact with food, arising from the content of **Australian Standard 2070:1999 Plastics materials for food contact use**. This standard stated that post-consumer recycled material was not to be used in direct contact with food. However, this standard is a voluntary, non-binding standard, without legal force, and was prepared only as a guide for industry.

Further weight has been given to the content of the standard due to its being referenced in the Food Standards Australia New Zealand **Food Standards Code**, which does have legal weight. Communications with FSANZ representatives have indicated that the Food Standards Code is currently under revision, and the reference to **AS 2070:1999** will most likely be removed in the revised version. The **Food Standard Code** itself does not make reference to the use of recycled content in packaging.

Finally, the stated purpose of **AS 2070:1999** was to harmonize guidance with international standards. This purpose is no longer met. The documents to which the standard refers have since been replaced with other directives, while the USA Food and Drug Administration has issued nearly 170 no objection letters regarding recycling processes for food contact materials, which should indicate that the standard is also inconsistent with current practices. While there is no stated intent to review the standard, **AS 2070:1999** has been assessed by Standards Australia as an 'Aged Standard', which requires review.

As a result, this document does not contain further reference to **AS 2070:1999** and its requirements, and instead focusses on current international standards and other guidance.

## Acknowledgements

The content of this document was developed by Dr Roya Khalil in conjunction with APCO.

APCO would like to thank the industry Members who provided feedback on this document.

Released February 2014.





# Introduction

Organisations use a range of materials for packaging food and other consumer goods, including steel, aluminium, glass, paper, cardboard, rigid and flexible plastics, multilayer composites, and more recently bio-plastics. For many of these materials, incorporating recycled content into the packaging will result in a better environmental outcome, while having little impact on the function or performance of the packaging.

Resources on improving the environmental performance of a range of packaging types, known as the Design Smart Material Guides are available on the APCO website. These guides detail issues that packaging designers should consider when using specific materials, such as maximising recycled content as well as the recyclability of packaging items.

Recycled content is often a viable alternative to virgin material in food contact application, with comparable strength and properties. This guide is intended to inform your discussions with material and product/packaging suppliers, to grant guidance and awareness of potential issues where these may arise. In addition, attention should be given to the continuous development and improvement of reprocessing and recycling systems, and the further potential that these may deliver. Products and product quality that were previously unachievable may become viable over time – it is important to ensure your information is current.

Recognising that potential health concerns have been perceived as a limitation on including recycled content in packaging materials for some time, APCO has developed this resource to provide information on the safety and appropriateness of using recycled content in food contact packaging.

# Background

Historically, glass, steel, aluminium, and paper have been recycled for food-contact use. For some materials, including glass and metals, contamination has never been an issue, due to the high temperatures involved in the recycling process. However, the current focus area for increasing recycled content is plastics and paper recycling, largely due to their increasing use in packaging, and the associated issues of resource depletion and waste generation.

Plastics and paper pose greater challenges for safe recycling. A range of plastics is available, each of which has different properties, and this variation complicates the recycling process and in turn the use of recycled content. Only some plastics are currently recycled in Australia, and there is variation in the processes used to recycle materials. This creates difficulties when assessing the performance and safety of some plastics for use in food-contact applications.

Paper also has qualities which can make it difficult to assess for recycling and for use as content in food grade applications. Paper fibre can be sourced from a range of waste products which vary in strength, use, and potential contaminants. The technologies required to recycle this range of products also vary, with varying chemical, physical and thermal processes used with different product streams. These processes inevitably impact on the final qualities of the recycled product.





# Overall Considerations

The following sections discuss potential opportunities and barriers regarding using recycled content in food contact situations, and relevant considerations for individuals and organisations contemplating using recycled content in their product packaging. Legislation and standards impacting on the use of recycled content are discussed later in the document.

## Opportunities to Include Recycled Content

There are a range of opportunities to include recycled materials in packaging, only some of which are currently being used. Further areas in which recycled content could be incorporated or expanded are discussed below. These opportunities have been broken down into primary, secondary and tertiary packaging considerations for ease of use.

### Primary Packaging

Opportunities to include or expand the use of recycled materials in primary packaging include:

- Alcoholic beverage containers. These are frequently made from either aluminium or glass, each of which has few restrictions on the use of recycled materials. Recycled glass and metals both have sustainability advantages over their virgin material alternatives.
- Cold fill and ambient/chilled serve products, including items such as yoghurt tubs. Existing tubs could easily be replaced with recycled PET, PP or PE.
- Water and juice containers. There are some existing varieties sold in recycled content bottles, however there is much room for expansion. Using recycled PET or PE should resolve formerly existing issues around plastic clarity.

### Secondary Packaging

Opportunities to include recycled materials in secondary packaging include:

- Flexible packaging. There is potential for shrink-wrap and/or plastic wraparound labels to be recycled and incorporated back into these materials.
- Paper labels. Recycled content could be used in more paper labels, with some limitations due to print quality. However, with environmental education of customers, this could potentially represent a beneficial claim.
- Cardboard sleeves and wraparounds. These could easily be made from recycled board, and could also be used in non-food applications.

### Tertiary Packaging

Opportunities to include recycled materials in tertiary packaging include:

- Cardboard and cartons. This is probably the greatest opportunity for incorporating recycled content, as the structural integrity of recycled paperboard is usually sufficient for physical protection during storage, transportation and handling.
- Stretch wrap films. Substantial quantities of these films are used during the stretch wrapping of pallets. This material could be collected and recycled for use in pallets or tape.
- Pallets. Additional recycled content could be incorporated into plastic pallets. Recycled cardboard pallets can also be used in some cases.





## Challenges to Including Recycled Content

The following issues should be appraised when considering using recycled materials in food- contact packaging, as they may pose barriers. These issues have been broken down into primary, secondary and tertiary packaging considerations for ease of use.

### Primary Packaging

Barriers to using recycled content in primary packaging include:

- The potential for recycled content to contain uncontrolled post-consumer material, which is particularly relevant to polymers;
- Thermal sensitivity parameters. If plastic or paper-based packaging is to be used in direct food contact, it is important to understand the potential results from microwave or conventional heating, retort processes for the preservation of food, and hot filling during processing or for consumption; and
- Chemical sensitivity parameters. These may affect the suitability of the packaging, as corrosive and/or high pH products may affect its integrity.

### Secondary Packaging

Barriers to using recycled content in secondary packaging include:

- Chemical interactions with primary packaging. Secondary packaging is unlikely to be in direct contact with the product, but if recycled content in the secondary packaging contains chemicals which leach out over time, there is potential for migration into the primary packaging and its contents. This makes it important to understand the barrier properties of the primary packaging.
- Shelving and storage of the product. Secondary packaging is likely to be exposed to UV light in display cabinets and fridges. The packaging needs to be able to withstand these conditions over the product's shelf life, without affecting the product quality.

### Tertiary Packaging

There are few impediments to using recycled content in tertiary packaging, with physical strength and performance the only significant limitation. Tertiary packaging is the most likely to suffer harsh conditions and treatment, including during transportation and storage. Packaging containing recycled content will need to withstand these conditions.

## Considerations for Using Recycled Content

The following is a range of items which should be addressed when considering incorporating recycled materials into food packaging. These are not necessarily barriers to the use of recycled content, but issues which should be considered before embracing its use.





Issues to consider before using recycled content include:

- Chemical composition of packaging materials. The chemical composition and constituents of the proposed packaging materials should be known and understood before using them in packaging. This includes both the recycled content and potential constituents which could arise from the recycled material.
- Recycled material source. It is important that the source of the recycled material is known, as it is possible for a material to be food-contact appropriate, but to have been exposed to an environment containing chemicals and vapours which are not.
- The recycling process. A range of mechanical, thermal and chemical processes are used for recycling plastics, papers, and cardboards. These processes can lead to chain scission in plastics, and/or degradation of materials at the molecular level. This can result in smaller molecules which are more able to migrate into foods due to their size.
- Percentage of recycled content. Recycled materials have historically exhibited inferior performance to virgin materials, as a result of repeated exposure to chemical and thermal processes which cause molecular changes. Higher proportions of recycled content may amplify the magnitude of this impact. Further, any potential constituent migration into foods is likely to increase with an increasing proportion of recycled content in packaging materials.
- Packaging production process. The majority of plastic packaging is produced through a thermal process such as extrusion, thermoforming, injection and/or blow moulding, which may affect the molecular structure of recycled material. Similarly, thermal and chemical processes used in paper and cardboard recycling can result in chemical alterations of materials.
- Filling process. Cold filling is likely to have a different impact on the packaging than hot filling, as heating can affect the structure of materials. The post-filling processes, including retorting may also affect the integrity of the packaging. These processes have the potential to affect the molecular structure of the packaging, with impacts on the likely migration of low molecular constituents into products.
- The type of product. The physical and chemical constituents of a product will dictate the interaction between the packaging and the product. Chemical interactions between the product and the packaging may allow migration of chemicals into the food product. In addition, different chemicals will migrate in different mediums – for example, a water-based product will behave differently to an oil-based product. The interaction of a product with its packaging needs to be considered.
- Product application and use. Not all materials are intended for all applications, and the planned application may affect the selection of the material – for example, different grades of plastics are used for ambient versus microwaveable packaging, as heating processes can thermally degrade some packaging materials. In addition, recycled constituents may be more reactive due to their shorter molecule chains.
- Storage conditions. Storage within a warehouse and/or on a retail shelf may affect the integrity of the packaging, due to the potential for UV exposure if products are placed on lighted shelves or outside. Conditions such as humidity, moisture, and temperature within a warehouse environment may also impact on recycled packaging, particularly cardboard or paper.
- Food safety test methods. The test methods prescribed by legislative guidelines can be complex and technical. It's important to have good knowledge of test methodologies relevant to your selected packaging, and to be able to implement similar procedures for internal testing. This includes testing under conditions very similar to your product application using appropriate simulants.





# Standards and Guidelines

In Australia, manufacturers are required by the Australia New Zealand Food Standards Code to ensure food packaging materials are safe and meet the requirements of **Australian Standard 1.4.3 Articles and Materials in Food Contact**<sup>1</sup>. This provides detail on materials in food contact generally, but does not specifically address packaging. It also refers to the **Australian Standard for Plastic Materials for Food Contact Use, AS 2070-1999**<sup>2</sup>, which provides a guide to industry about the production of plastic materials for food contact use. It also refers readers to the US and European Commission directives and regulations for the manufacture and use of plastics.

Several documents are provided by these entities on using specific materials in food packaging. However, general requirements for all food contact materials are laid down in Framework Regulation **EC 1935/2004**<sup>3</sup>. The Regulation establishes 17 groups of materials and articles which may be covered by specific measures. The specific measures may also cover combinations of different materials or recycled materials. In addition, good manufacturing practice for materials and articles intended to come in contact with food, including recycled material, is described in Regulation **EC 2023/2006**<sup>4</sup>. This regulation addresses appropriate quality assurance and quality control, and requires that the printed surface of food packaging not come into contact with the contents.

Further directives have been prepared to address the use of individual materials in packaging. These are summarised below.

## Plastics

**Commission Regulation (EU) No 10/2011** and its amendments address ensuring that plastics are safe for use in food-contact<sup>5</sup>. It includes a list of authorised substances for use in the manufacture of plastics, including recycled materials, and incorporates migration limits for substances that can migrate from food contact materials to food<sup>6</sup>. These include an overall limit of 10mg of substances/dm<sup>2</sup> (square decimeter) of the food contact surface for all substances that can migrate from food contact materials to food, which is also expressed as 60 mg/kg food. In addition, there are specific migration limits for individual authorised substances.

**Commission Regulation (EC) No 282/2008** requires that recycled plastics used for food packaging come from an authorised recycled process, and identifies five criteria to become an authorised process<sup>7</sup>. It also addresses the use of recycled printed plastics for food packaging and obligations arising from making these materials available.

<sup>1</sup> <http://www.foodstandards.gov.au/consumer/chemicals/foodpackaging/Pages/default.aspx>

<sup>2</sup> <http://www.saiglobal.com/PDFTemp/Previews/OSH/As/as2000/2000/2070.pdf>

<sup>3</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:338:0004:0017:en:PDF>

<sup>4</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:384:0075:0078:EN:PDF>

<sup>5</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2011R0010:20111230:EN:PDF>

<sup>6</sup> <http://www.efsa.europa.eu/en/topics/topic/plasticrecycling.htm>

<sup>7</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:086:0009:0018:EN:PDF>





The U.S. Food & Drug Administration has issued **Guidance for Industry: Use of Recycled Plastics in Food Packaging: Chemistry Considerations**<sup>8</sup>, which highlights chemical considerations that the manufacturer of recycled plastics must consider during the evaluation of a recycling process for producing material suitable for food contact applications. It includes a recommended approach for estimating the maximum level of a chemical contaminant in the recycled material, which would result in an estimated daily intake not exceeding the level at which the FDA considers that negligible risk is posed.

The Sustainable Packaging Coalition (SPC) has issued **Guidelines for Post-Consumer Recycled Content in Plastic Packaging**<sup>9</sup>. These were developed to facilitate better communications between retail buyers and converters over expectations for the use of post-consumer recycled content in various plastic packaging formats, used for specific high sales volume products. The guidelines include reference charts for snapshots of the performance requirements; regulatory, technical, and aesthetic considerations; and market availability challenges associated with the use of recycled content.

The European Food Safety Authority has published **Guidelines on submission of a dossier for safety evaluation by the EFSA of a recycling process to produce recycled plastics intended to be used for manufacture of materials and articles in contact with food**<sup>10</sup>. This gives guidance on the administrative and technical data required to be provided to the EFSA to evaluate risks around migration of substances from recycled plastic materials in food contact. The guidelines cover recycling processes for all types of plastic.

## Paper and Cardboard

Title 21 of the US **Code of Federal Regulations** addresses the use of pulp from reclaimed fibers and states that it may be used for food contact purposes provided it meets the criteria established in **Section 176.260**, “Pulp from reclaimed fibre”<sup>11</sup>. These address the sources of reclaimed fibre and exclude the use of materials which bear or contain poisonous or deleterious substances.

The Sustainable Packaging Coalition (SPC) has issued **Guidelines for Recycled Content in Paper and Paperboard Packaging**<sup>12</sup>. This document addresses opportunities and challenges for using recycled paper fibre in packaging, specifically addressing 20 common retail packaging applications.

There has been some debate around the use of recycled paper fibre in packaging due to the identification of mineral oil contamination in foods, which was traced back to the recycled fibers used in packaging, and mineral oil-based inks used to print the non-contact side of food packaging. Mechanisms for the chemical transfer are currently being explored. To address existing concerns, however, the Fraunhofer Institute for Process Engineering and Packaging completed a study of the potential for migration of inks present in cardboard packaging through some plastics, **Evaluation of different mineral oil barriers for cardboard packed food**<sup>13</sup>. This study identified that inner layer films including 12 µm PET and 15 µm PA can be effective barriers against mineral oil transfer, as can cardboard coatings based on PA or biodegradable polyesters. On the other hand, barriers based on polyolefin were described as negligibly poor.

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<http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/IngredientsAdditivesGRASPackaging/ucm120762.htm>

<sup>9</sup> <https://www.sustainablepackaging.org/resources/default.aspx> (2010)

<sup>10</sup> <http://www.efsa.europa.eu/en/efsajournal/doc/2184.pdf> (2008)

<sup>11</sup> <http://www.gpo.gov/fdsys/pkg/CFR-2011-title21-vol3/pdf/CFR-2011-title21-vol3-sec176-260.pdf>

<sup>12</sup> <https://www.sustainablepackaging.org/resources/default.aspx> (2012)

<sup>13</sup> [http://www.ivv.fraunhofer.com/no\\_html/gf3\\_34.pdf](http://www.ivv.fraunhofer.com/no_html/gf3_34.pdf)





## Glass and Metal

There do not appear to be specific legislation or standards for glass and metal recycled for use in food contact. In general, these materials are found to be unaffected by contaminants when recycled due to the high temperatures used in the recycling processes, with aluminium and steel recycled at around 680°C, and virgin glass manufactured at temperatures around 1500°C. Recycled glass cullet is reported to be recycled at a lower temperature; however this is well inside a range at which contaminants are eliminated. It should be noted that coatings and finishes on both of these materials may not be treated at the same temperatures and therefore may contain contaminants.

While the processing conditions for glass and metal recycling typically eradicate any chemical and physical contaminants, it is important to ensure that the recycling process and the manufacturing site comply with the GMP standards<sup>14</sup> and the final containers are stored and delivered under food-grade environmental conditions.

## Further Information

For further information on issue discussed in this document, you may wish to refer to the following resources.

- European Food Safety Authority: <http://www.efsa.europa.eu/>
- Waste and Resources Action Program: <http://www.wrap.org.uk/>
- Fraunhofer: <http://www.fraunhofer.de/en/about-fraunhofer.html>
- Intertek: <http://www.intertek.com/>
- The Sustainable Packaging Coalition® (SPC): <http://www.sustainablepackaging.org>
- U.S. Food and Drug Administration: <http://www.fda.gov/>

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<sup>14</sup> <http://www.fda.gov/Food/GuidanceRegulation/CGMP/ucm207458.htm>



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