

**WORKING PARTY ON CHEMICAL CONTAMINANTS FROM FOOD CONTACT MATERIALS AND ARTICLES**

**DISCUSSION PAPER: FUTURE FOOD STANDARDS AGENCY-FUNDED RESEARCH ON CHEMICAL MIGRATION FROM MATERIALS AND ARTICLES IN CONTACT WITH FOOD**

**PURPOSE**

This paper sets out the general background to FSA-funded research on chemical migration and the associated role of the Working Party. It seeks the views of the Working Party on possible future work.

By way of background this paper includes a list of research projects completed in the past year and currently in progress (Annex I), and provides details of further work which may be commissioned in FY 2003 (Annex II).

The paper also suggests topics for projects which could be commissioned in FY 2004 (Annex III). The examples given in Annex III are intended to stimulate discussion. **The Secretariat would welcome ideas from Members.**

Annex IV looks at the wider picture.

**Members are requested to consider whether they agree with the assessment that there is not a need for new projects to be commissioned as identified in Part I of Annex IV.**

**SECRETARIAT  
OCTOBER 2002**

## BACKGROUND

1. The Working Party advises the Food Standards Agency on the research and surveillance projects necessary to ensure that both consumers and industry in the UK are adequately protected from the migration of chemicals from materials and articles into food or drink. It also considers the results of such work.
2. The Food Standards Agency funds research and surveillance projects, by open competition, to underpin current and future policy on food contact materials. Periodically potential contractors receive Requirements Documents which invite bids for new scientific work. The criteria on which bids are selected include relevance to policy requirements, overall scientific quality and potential value for money.
3. The results of the projects inform policy work in a number of ways. At one level they serve to protect public health and to increase technical knowledge. At a more detailed level they inform reviews of European Commission (EC) Directives on food contact materials, e.g. on plastics or ceramics. The projects also inform UK input into discussion of future specific EC Directives anticipated in the Framework Directive (89/109), e.g. on can coatings, paper and board, ceramics, inks and rubbers. The results of projects also inform work at the Council of Europe to develop resolutions and guidelines on materials which are not yet covered by EC Directives.
4. The FSA's research work helps to provide a sound scientific basis for Council of Europe and EC proposals on chemical migration. It provides information about the nature and the levels of chemical migrants and develops methods of analysis. It also increases understanding of the factors that influence chemical migration.

## **CURRENT RESEARCH PROJECTS**

5. A list of Food Standards Agency-funded research projects on food contact materials and articles completed in the past year and projects currently in progress is at Annex I.

## **FUTURE WORK**

### **PROJECTS FOR COMMISSIONING IN 2003**

6. Details of projects, which may be commissioned in FY 2003, are at Annex II. Invitations for bids for these projects were issued in the latest Food Standards Agency Research Requirements Document, which was published in September this year. The deadline for bids is 29 November 2002.

### **PROPOSALS FOR PROJECTS FOR POSSIBLE COMMISSIONING IN 2004**

7. Areas of work in which projects might be commissioned in FY 2004 need to be identified now for detailed review and possible inclusion in next year's Requirements Document. Some possible topics are listed at Annex III.

## **STRATEGIC CONSIDERATIONS**

8. Annex IV looks at this research programme in terms of likely future needs. In part 1 of this Annex there are two types of materials for which there are apparently net needs for information (inks and kitchenware). It would be very helpful if Members could comment on the priorities that provisionally have been assigned to research on these materials.

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## ANNEX I: RECENTLY COMPLETED AND CURRENT RESEARCH PROJECTS

### Recently reported projects\*

PROJECT TITLE	Contractor
Investigations into how glass fibre reinforced plastic (GRP) vats can be repaired to minimise migration of styrene into food	Central Science Laboratory, York (CSL)
Further research on chemical migration from food contact rubber and other elastomers	RAPRA Technology Ltd., Shrewsbury (RAPRA)
Definitive test for set-off of pigments and other non-volatile substances for flexible packaging	Laser Installations Ltd., Arbroath, Dundee University and CSL
Investigation of the migration of inorganic contaminants into dry food from packaging made from recycled paper and board	Imperial College, London
Study of packaging materials used for dietary staples	PIRA International, Leatherhead (PIRA)
A systematic investigation into chemical migration from inks and associated coatings used on the food contact surface of packages	CSL
Investigation of the significant factors in elemental migration from glass in contact with food	Glass Technology Services, Sheffield

\* Reports for these projects are available in the Food Standard Agency's Library, Aviation House, 125, Kingsway, London, WC2B 6NH

## Current Research Projects

<b>PROJECT TITLE</b>	<b>Contractor</b>
Collation and review of information on the use of unusual and non-traditional types of wood used as food contact materials	Leatherhead Food Research Assoc. (LFRA) and TRADA Technology Ltd., High Wycombe
Investigation of the migration of metals from glazed ceramic ware	CSL
Methods and searchable spectroscopic libraries to identify substances migrating above a 1ppb threshold	CSL
Identification of stages in the production of paper and board packaging materials where hazards to food safety may occur	CSL
Migration test protocols for electroplated and dipped metal-ware intended for food contact	CSL
Investigation into the effects of the freeze thaw cycle on chemical migration from packaging into foods	CSL
Investigation of the migration of chemicals from agglomerate, natural cork and synthetic stoppers	CSL
Migration from recycled paper and board to dry foods. Research into the factors involved, leading to practical avoidance and amelioration measures	CSL
Strategy for assessing risk and assigning priorities to chemicals used to make food contact materials. A tiered approach with progressive refinement to calculate exposure levels	CSL
Determination of the potential for transfer from secondary packaging to foods and development of guidelines to reduce transfer to levels of no concern	King's College, London
Investigation into the migration of metals and coating materials from kitchenware products	CSL
Development of multi-methods for determining the migration of additives included in the proposed 6th amendment of Directive 90/128/EEC	RAPRA, TNO Netherlands
Investigation of chemical migration into take-away foods	CSL

Investigation into the applications of food contact laminated materials; examination of migration potential and recommendations for safe use	RAPRA
The effects of storage, temperature, damage and cooking on the migration of bisphenol A (BPA) from can coatings	PIRA
Migration of bisphenol A from polycarbonate plastic food contact materials and articles	PIRA
LC-MS method development for the screening of non-volatile and polar compounds present in paper and board and plastic food contact materials	CSL
An investigation of the breakdown products of curatives and antidegradants used to produce food contact elastomers	RAPRA, TNO Netherlands
Active packaging-current trends and potential for migration	CSL
Investigation of the nature and extent of biodegradable polymers in direct food contact applications	CSL
Domestic use, reuse and misuse of packaging in contact with food	LFRA

## **ANNEX II: RESEARCH PROPOSALS PUBLISHED IN ISSUE 9 OF THE FOOD STANDARD AGENCY'S REQUIREMENTS DOCUMENT (SEPTEMBER 2002)**

### *Substances migrating from ion-exchange resins*

Ion-exchange resins are synthetic organic macro-molecular compounds that can be used in the processing of foodstuffs. There is currently a proposal to amend Council Directive 89/109/EEC (for materials and articles intended to come into contact with foodstuffs) to include the clause:

'ion-exchange resins should be considered materials and articles intended to come into contact with foodstuffs, and therefore should be added to the lists of materials to be regulated'.

Research is needed to identify substances migrating from ion-exchange resins into food and drink raw materials and the degree to which any substances migrate. The range of substances to be researched includes impurities, reaction intermediates and decomposition products that may also migrate.

### *Potential migration of latex allergen(s) from food contact materials*

There is evidence that that some individuals may experience allergic reactions as a result of food or drink having come into contact with materials containing latex (e.g. latex gloves, food packaging that contains latex, rubber tubing). This would appear to be a real problem for some consumers.

This project will be in two parts:

- A desktop exercise to determine the extent to which materials containing latex protein are used in food contact materials and articles, and the likely levels in relevant products of allergenic proteins.
- Analytical work to determine if the allergens transfer to food and if so in what quantities.

### *Chemical migration from adhesives used in food contact materials and articles*

Adhesives are used in several applications to bond a wide range of materials to seal and join paper, board and plastic films. Whilst there are only three processes by which solidification may occur – drying, hot-melt and curing – there are many different and new types of adhesives on the market. It has been proposed that the list of groups of materials and articles covered by specific measures in the amended Framework Directive (89/109/EEC) will include 'Other adhesives not covered by the term "plastics" '.

This project will identify adhesives used in such applications as tamper-proof peelable lidding, inter-layer bonding in squeeze tubes and thermoformable food packaging material, and research the extent, if any, to which they migrate into food.

### *Colourants in plastic materials coming into contact with food*

Colourants, intentionally added to plastics to impart colour, include dyes and organic and inorganic pigments. The use of colourants in plastics is not specifically regulated at the EU level yet. Their use is controlled by the general provisions of Directive 90/128/EEC, as amended. There is growing international debate about how best to control migration these substances into food.

The objectives of this project are:

- to determine the range of colourants used in plastics in contact with food or drink on the UK market; and
- to generate information about their purity, the concentrations used and their possible migration into food or drink.

*Chemical migration from silicones used in connection with food contact materials and articles*

Silicones are not currently regulated for food contact at the EU level. They are used in a variety of ways in contact with food. For example:

- silicone resins are used in heat resistant coatings and release coatings in food production such as in bakery;
- silicone pastes are used to lubricate food processing machinery;
- silicone liquids are used as additives in plastics and coatings, release agents for moulding plastic articles, and impregnating agents for textiles; and
- silicone elastomers are used as coatings and sealants.

The objectives of this project are:

- to investigate the chemical composition and reaction products of silicones used in contact with food; and
- to identify extent, if any, that silicones migrate into food and drink.

## **ANNEX III: PROPOSALS FOR PROJECTS FOR POSSIBLE COMMISSIONING IN FY 2004**

### ***Potential migrants from packaging materials used for dietary staples***

A recently reported research project has identified product/packaging combinations in use and suggested areas of possible interest for future research. A fuller synopsis of the findings of this work is given on pages 11-15 of this paper. From this work, the following issues were raised as of potential interest:

- Cans and can coatings
- PVC cling films
- Flexible PET/PE and PA/PE laminates
- Laminated plastics – PVC/PE rigid/semi-rigid trays
- Boil in bag, cook in pack (oven or microwave) polymeric or paperboard
- Recycled board
- PVC jar / bottle seals
- HDPE bottles with printed PVC shrink sleeve
- EPS trays
- Oxygen scavengers

Ongoing FSA funded work in these areas is mentioned under the research recommendations of this completed project (pages 13/15). Do further studies need to be undertaken in any of these areas?

### ***Biocides migrating into foodstuffs***

Biocidal substances are used in the production of paper and board to improve the microbiological safety of materials intended for food contact. These water soluble chemicals are intended to be removed downstream in the production cycle and a Council of Europe resolution is being drawn up to control any biocides remaining in the finished product. At present, there is a CEN method (BS EN1104:1996) for the determination of transfer of antimicrobial substituents for paper and board intended to come into contact with food. However, it has a National forward that states that the UK voted against this draft on the grounds of inadequate sensitivity of the test and uncertainty as to the pass/fail rate. Is there therefore a need to improve the sensitivity and reliability of this method, or should work be undertaken to develop a chemical method, which has the specificity, sensitivity and reliability to determine these substances?

### **The development of multi-methods for the components of printing inks**

Printing inks applied to the non-food contact surface of materials and articles intended to come into contact with foods contain a number of substances including driers, dyes, plasticisers, pigments and solvents. The Conseil European de l'Industrie des Peintures, des Encres d'Imprimerie et des

Couleurs d'Art (CEPE) have produced an Inventory List on packaging inks used in food packaging for the Council of Europe in preparation for a planned resolution on printing inks. Are multi-methods (GC-MS and/or LC-MS) required for substances on this inventory list to establish spectra, retention times, limits of detection and limits of quantification? Should breakdown/reaction products also be considered? Is this information necessary for future migration studies where the low concentrations and lack of mass spectral information of many of the 'unknown' migrants may make identification difficult if not impossible?

## **SUMMARY OF METHODOLOGY AND MAIN FINDINGS OF THE RECENTLY-COMPLETED PROJECT: “STUDY OF PACKAGING MATERIALS USED FOR DIETARY STAPLES”**

### ***Background***

Staple items of the diet (dietary staples) are packaged in a wide variety of materials and formats. All dietary staples can be purchased in a pre-packaged format, although some may also be purchased loose or packed in-store. They are also distributed, sold and stored under a wide range of environmental conditions. It is these packaging and environmental factors, in conjunction with the nature of the foodstuff itself, which determine the potential for chemical migration to occur. For those dietary staples that are packaged, knowledge of the materials used for these items together with an assessment of consumption of these foodstuffs, provides a means of assessing the potential exposure to chemicals that may migrate into the dietary staples from the packaging materials.

Some surveys have been reported which have identified and quantified specific migration risks for individual product/pack combinations. In contrast, this study was deliberately “broad brush” in its approach, seeking to provide an overview of *potential* food migration issues that may exist for packaged dietary staples in the UK.

### ***Study rationale***

The principal objective of the study was to compile a comprehensive analysis of the product/pack relationships for the most important dietary staples in the UK. This information could then be used to identify potentially important chemical migration issues that may exist for UK dietary staples. The study focused on dietary staples in primary packaging, purchased by consumers through major retail outlets (principally the main supermarket chains) and did not take into consideration consumption in restaurants and fast food or take-away outlets.

The study applied a series of progressive steps to collate and analyse existing data and information on a number of levels of detail.

- First step, existing National Food Survey data was used to quantify and rank consumption of dietary staples in the UK. Consumption data for 1998 was used for the baseline analysis and data for the period 1995-2000 was used to identify any important trends in consumption.
- Then, for each dietary staple the market share by brand and by packaging material / format was determined. Brand shares were determined predominantly from available market research such as Mintel Food and Drink reports. Shares of packaging materials / formats for prepackaged products were determined predominantly through shelf-audits at supermarkets. Some dietary staples, such as fruit and vegetables, bread, and meat and meat products, may also be purchased loose or can be packaged in-store. Where appropriate, the proportion of prepackaged to loose/in-store packing was estimated on the basis of available data on sales distribution channels.
- Factors which may affect migration were determined for each dietary staple / packaging material / packaging format combination. In particular, the analysis considered shelf-life,

storage temperature, and the potential for recycled plastic or paper and board to be included in the structure of the primary pack.

- Potential migration issues were then identified. These were drawn from Pira International's existing knowledge and expertise of food migration issues, supported by a comprehensive literature search.
- The market and technical data were evaluated to identify issues of potential migration interest. This was a qualitative evaluation, and was not based upon a toxicological risk assessment.
- A pareto type analysis (the principle that the majority of problems (80%) are produced by a few key factors (20%)) was applied to select specific dietary staples for further consideration and clarification of the extent of potential migration issues. The dietary staples selected by the pareto analysis were subsequently grouped according to common packaging format / components which may give rise for concerns
- Finally, additional market information and consumption trends over time were presented in order to clarify the nature and possible extent of specific issues of migration interest.

### ***Achievements of the research***

The work identified the market share of packaging for over 100 dietary staples in the UK. For each of the dietary staples, the research identified the range of packaging materials and packaging formats that are used. For groups of dietary staples which may also be purchased loose or packed in-store, the research also provided an estimate of the proportion of pre-packaged to loose / packed in-store product.

For the pre-packaged dietary staples, the research identified factors which may influence chemical migration, such as environmental conditions of distribution, storage, and use, and the potential presence of post-consumer recycled material in plastic and paper based packaging.

For each packaging type/food type combination, information was obtained by shelf audit and market survey data, to enable an assessment to be made of the proportions of dietary staples in contact with particular packaging. Additionally, within each category of packaged staple foodstuff, estimates of the sub-division of usage were, where possible, calculated by brand. Estimated consumption data for packaged staples was used in conjunction with chemical knowledge-based assessments of the magnitude of risk associated with potential chemical migrants, to rate areas of possible interest for future research of food contact materials.

Ultimately, from the evaluation of this data, a number of general conclusions have been drawn on the packaging of dietary staples in the UK and the potential migration issues that this may present, whilst specific product/pack material/ pack format combinations with high migration interest have been highlighted.

## **Conclusions:**

- The majority of dietary staples purchased through retail outlets in the UK are contained in primary packaging. For some dietary staples such as bread, fruits and vegetables the proportion of pre-packed product is less significant. However, the use of primary packaging in even these dietary staples is increasing as producers seek to add value and product differentiation.
- Branded products are prevalent amongst UK dietary staples. Branding of fresh produce is less prevalent but is gaining strength in some areas as produce sectors seek opportunities to add value and product differentiation.
- Own branding represents a significant proportion of branded products for many dietary staples. In some cases own brand dominates.
- Within each dietary staple many different packaging materials and formats can be used. For each dietary staple, each brand owner will often use a number of packaging materials and formats.

Considerable efforts have been made by the packaging and food industries to reduce the migration hazards associated with packaging materials. However, despite this a number of issues of potential migration interest have been identified.

## **Summary recommendations of the research:**

- **Cans and can coatings**

‘Considering the efforts made by manufacturers, the potential migration problems are generally considered low, although further consideration of two piece drawn cans and easy open cans used for fatty or aqueous products is merited. Less common factors, such as instances where the product is cooked in the can (eg sponge puddings, meat pies) should also be considered.’

*[The FSA has commissioned a research project this year to determine the effects of storage, temperature, damage and cooking on the migration of bisphenol A from can coatings (A03035). This will include work to determine the effects of cooking food in the can on migration]*

- **PVC cling films**

‘Low migration films are available. These are extra thin and use more polymeric plasticisers. These films are designed for use with fatty foods. If appropriate PVC films are used, migration issues are reduced. However, if films are used inappropriately then the migration potential for plasticisers may be high. Further migration testing may therefore be desirable to confirm continued compliance with legal migration levels.’

*[Vinyl chloride and vinylidene chloride are two of the monomers included in a current project (A04009) to survey the migration of monomers used in plastic food contact materials and articles, to ensure that SMLs are not being exceeded].*

- **Flexible PET/PE and PA/PE laminates**

‘Products of highest potential migration interest packed in PE/PET laminates are cheeses and fish. Packaging and consumption trends for fresh fish and for cheese were highlighted. Further investigation into the extent of use of PE/PET and Nylon/PE laminates may be desirable.’

- **Laminated plastics – PVC/PE rigid / semi-rigid trays**

‘Significant migration of tin stabilisers may occur. The polyethylene contact layer may provide a limited barrier to migration. Since the laminate is bonded using polyurethane adhesive the issue of primary aromatic amine migration also arises.’

*[Project A03034 investigates the applications of food contact laminated materials and examines the migration potential with a view to giving recommendations for safe use]*

- **Boil in bag, cook in pack (oven or microwave) polymeric or paperboard**

‘Ready meals and convenience foods are gaining market share as social trends lead to more single person households and increased reliance on convenience. The packaging formats used for convenience foods and ready meals are diverse. Those which represent greatest concern are the packaging formats in which the product is cooked in the pack. Extremely high temperatures may be achieved, increasing potential for migration of some chemicals. Practical investigative work into the food migration issues identified for convenience food and ready meal packaging is recommended.’

*[Nylon 6 test materials of which many boil-in-the-bag products are made, are included in a current project (A04009) to survey the migration of monomers used in plastic food contact materials and articles, to ensure that SMLs are not being exceeded.]*

- **Recycled board**

Direct food contact for post-consumer recycled board does not occur, but market share of materials utilising a layer of recycled material sandwiched between virgin materials is high. The virgin material contact layer is often kraft coated or PE coated, but the paper and PE coating will not provide a sufficient barrier to the transmission of many migration chemicals. Packaging and consumption trends were presented for some products found to be packaged in recycled paper and board materials. Recent literature and research has highlighted concerns about a number of substances, which can be present in recycled fibre. Further research and practical investigation into the migration of substances into foodstuffs packaged in recycled board is recommended.

*[A recently reported project investigated the migration of inorganic contaminants into dry food from packaging made from recycled paper and board (A03026). The factors involved in migration from recycled paper and board to dry foods is also being investigated, with a view to practical avoidance (A03021) and recycled materials are included in the project investigating the potential for transfer from secondary packaging to foods (A03027).]*

- **PVC jar / bottle seals**

This is only really considered to be a potential issue for baby foods, where research has previously identified concerns. For small jars of baby food, the contact surface area to product volume ratio is potentially high (typically 0.11cm<sup>2</sup> per gram) as the seal polymer is often covering the entire inside of the lid. Visual inspection of a range of baby food brands identified that food contact with the undersurface of the lid is common. Further migration survey work may be advisable to verify continued compliance with migration limits. .

*[ESBO migration from plasticised lid gaskets into baby food was surveyed by JFSSG in 1999. A further survey may be undertaken by the FSA in 2004.]*

- **HDPE bottles with printed PVC shrink sleeve**

Yoghurt and milk drinks aimed specifically at children are increasingly packaged in HDPE bottles with heavily printed PVC, PET or OPP shrink sleeves. Any migration of the ink and welding solvents will be directed into the product. Further investigation of the films used and migration potential is suggested.

- **EPS trays**

Migration of styrene may occur from EPS trays into high fat (28% fat) meat, for example, high fat mince, pork with the fat on, etc. Risks are considered to be low due to the fact that the meat is chilled and then removed and cooked. There has been relatively little work done on the extent to which styrene oligomers migrate into meat from EPS trays, so this may be worthy of further investigation in the future.

- **Oxygen scavengers**

The use of oxygen scavengers, and other active packaging ingredients, is becoming increasingly prevalent. Oxygen scavengers are now widely used for higher quality prepacked ham. Some investigative work is being pursued in the EU Fair Project ACTIPAK (CT98-4170) – Evaluating safety, effectiveness, economic-environmental impact, and consumer acceptance of active and intelligent packaging. This work should be published in 2002. This study has highlighted that some migration issues may exist, but these are generally associated with the sachet materials and print rather than the active ingredients. Further investigation of these issues may be advisable, depending upon the final findings of the ACTIPAK project.

*[The Food Standards Agency has recently commissioned a project to look at current trends in Active Packaging and identify potential migration issues (A03039). It may be premature to fund further work in this area until the findings of this project are reported.]*

## ANNEX IV: STRATEGIC OUTLOOK ON FSA-FUNDED RESEARCH ON MATERIALS AND ARTICLES IN CONTACT WITH FOOD

### LIKELY POLICY NEEDS FOR RESEARCH OUTPUTS IN NEXT 5 YEARS

Part 1: By type of material:

	Policy need	Main focus	Available info.	Therefore: need for new projects
Paper & board	+++	Council of Europe (CoE)/EU	Much	No
Can coatings	+++	CoE	Much	No
Elastomers	+++	CoE	Much	No
Adhesives	+++	UK	Little	No - project starts in 2003
Recycled packaging	+++	EU/CoE	Much	No
Plastics	+++	EU	Growing amount	No-project on colourants starts 2003
Ion exchange resins	++	EU	No	No - project starts in 2003
Inks	++	CoE	Little	Yes; medium priority
Secondary packaging	++	EU	Growing amount	No
Kitchenware	++	UK	Very little	Yes; high priority
Wood	++	CoE	Growing amount	No
Glass	++	UK	Much	No
Ceramics	++	UK	Growing amount	No
Cork	++	CoE	Growing amount	No

Latex/skin allergy	+	UK	Little	No – project starts in 2003
Metals/alloys	+	CoE	Much	No
Silicones	+	UK	Little	No – project starts in 2003

Part 2: By main area of policy work:

Council of Europe (CoE)				++
UK				++
European Union (EU)				++
Codex Committee on Food Additives & Contaminants/ bilateral relations with countries outside Europe				NIL*

Note: \* possibly a new forum for policy work on chemical migration from packaging: FAO/WHO recently asked if work on this should be added to Codex committee discussions.