FOOD SURVEY INFORMATION SHEET

NUMBER 02/12 **April 2012**

A ROLLING PROGRAMME OF SURVEYS ON PROCESS CONTAMINANTS IN UK RETAIL FOODS

ACRYLAMIDE & FURAN: SURVEY 4

Summary

- This Food Surveillance Information Sheet reports the results obtained over the period November 2010 - April 2011, which is the fourth year of a rolling programme to measure the levels of the process contaminants acrylamide and furan in a range of UK retail foodstuffs.
- The total number of retail products sampled during the survey was 248 and represented the 10 food groups as specified in Commission Recommendation (EU) No. 2010/307 on the monitoring of acrylamide in food. The number of analyses carried out was 248 for acrylamide and 92 for furan.
- As with previous years' data, the acrylamide and furan results from this UK survey have been sent to the European Food Safety Authority (EFSA)[a] for collation with other Member States' survey data, trend analysis within the EU and, in the case of furan, a risk assessment.
- Statistical analyses carried out by the Agency on UK surveillance data during the period 2007-2011, suggest that there may be an upward trend in acrylamide levels in processed cereal-based baby foods (excluding rusks) and a reduction in acrylamide in some other products such as pre-cooked French fries/potato

[a] The European Food Safety Authority (EFSA) provides independent scientific advice to the European Union (EU) on existing and emerging risks associated with the food chain.

products for home-cooking and bread. For most products we found no evidence of trending. Given the relatively small number of products sampled for the UK surveys and the magnitude of these observed trends, it is not possible at this stage to draw any definitive conclusions and therefore further investigation by the Agency may be required to try and establish if changes in manufacturing practice are having the desired effect.

- Of the 248 products analysed for acrylamide during the 2010-2011 survey, 13 products were found to contain acrylamide levels that exceeded the 'indicative value' (IV) for their food group (see para 3). Where an acrylamide level has exceeded an IV, the Agency has asked the relevant local authority to investigate.
- The number and range of products analysed for furan were increased for the 2010-2011 survey. Products found to contain the lowest levels of furan were potato crisps, instant coffee and coffee substitutes. The highest levels of furan were found in sweet popcorn and roast coffee. This may possibly be due to differences in levels of natural occurring furan precursors in these products and/or their higher processing temperatures. However, no definitive conclusions can be drawn at this stage particularly regarding trends in the levels of furan and additional surveys being undertaken during 2011-2013 will help provide the Agency with further information.

Background

1. Process contaminants are chemical substances that are produced naturally in food during manufacturing or home-cooking. They are absent in the raw foods, or the raw materials used to make the food, and are only formed when components within the food or raw materials undergo chemical changes during processing. As far as acrylamide and furan are concerned, they may be formed at high temperatures during cooking, whether by manufacturers or consumers at home. Acrylamide and furan have the potential to increase the risk of cancer. That said, this risk is linked with prolonged exposure over a lifetime to foods containing high levels of acrylamide and furan. Experts, including the international Joint Food and Agriculture Organisation and the World Health Organisation Expert Committee on

Food Additives (JEFCA)[b], have concluded that current global levels of dietary exposure to acrylamide and furan indicate a human health concern (FAO/WHO, 2010)[1]. The Agency's position is that exposure to these process contaminants should be reduced to as low as reasonably practicable (ALARP). The Agency has produced advice for consumers on reducing acrylamide in the diet at http://www.food.gov.uk/safereating/chemsafe/acrylamide_branch/

Acrylamide

2. Acrylamide is formed when foods containing the natural amino acid asparagine and sugars, either present naturally or added, are heated at temperatures greater than 120°C. It has been found in a wide range of home-cooked and processed foods, including potato crisps, French fries, bread, crispbreads and coffee. However research[2] has indicated that acrylamide does not occur in such foods subjected to lower temperatures and relatively short process times e.g. boiled potatoes.

3. There are no statutory maximum acrylamide levels, however the European Commission Recommendation (C(2010) 9681 final) on investigations into the levels of acrylamide in food[3] specifies 'indicative values' for acrylamide (Table 1). These indicative values are intended as a trigger to initiate investigations by enforcement authorities into food business operators' understanding of acrylamide and any action they have taken to mitigate its production. Through such investigations it is hoped to gain a better understanding of the practical issues involved. A 'Checklist' developed by the Agency with stakeholder support, is used by local authority enforcement officers to aid these investigations, enabling the Agency to gather consistent and useful data. An acrylamide FoodDrinkEurope toolbox[c] is used by industry to provide guidance on measures to reduce acrylamide levels.

[b] The Joint FAO/WHO Expert Committee on Food Additives provides independent scientific expert advice to the Codex Alimentarius Commission (CAC) and its specialist Committees.
[c] Formerly known as CIAA (Confederation of the Food and Drink Industries of the EU) toolbox.

Table 1 Indicative acrylamide values based on the EFSA monitoring data from 2007 – 2008

Foodstuff	Indicative Value (µg/kg)	Comment
French fries ready-to-eat	600	Product sold as ready-to-eat, as defined in Part C.1. of the Annex to Recommendation 2010/307/EU
Potato crisps	1000	Product as sold, as defined in Part C.2. of the Annex to Recommendation 2010/307/EU
Soft bread	150	Product as sold, as defined in Part C.4. of the Annex to Recommendation 2010/307/EU
Breakfast cereals (excl. muesli and porridge)	400	Product as sold, as defined in Part C.5. of the Annex to Recommendation 2010/307/EU
Biscuits, crackers, wafers, crisp bread and similar, excl ginger bread	500	Product as sold, as defined in Part C.6. of the Annex to Recommendation 2010/307/EU
Roast coffee	450	Product as sold, as defined in Part C.7.1. of the Annex to Recommendation 2010/307/EU
Instant (soluble) coffee	900	Product as sold, as defined in Part C.7.2. of the Annex to Recommendation 2010/307/EU
Baby foods, other than processed cereal based foods	80	Product as sold, as defined in Part C.8. of the Annex to Recommendation 2010/307/EU
Biscuits and rusks for infants and young children	250	Product as sold, as defined in Part C.9.1. of the Annex to Recommendation 2010/307/EU
Processed cereal based foods for infants and young children, excl. biscuits and rusks	100	Product as sold, as defined in Part C.9.2. of the Annex to Recommendation 2010/307/EU

Furan

4. Furan is formed from the thermal degradation of sugars, oxidation of polyunsaturated fatty acids or the decomposition of ascorbic acid (vitamin C). It is found in a variety of products, including coffee, prefabricated potato snacks and canned and jarred products which, during processing, have been subjected to heat treatment (e.g. roasting, frying, canning etc).

5. Heat treatments vary depending on the product being processed. For example, crisps are generally fried at a lower temperature (e.g. 160 ºC) and for a shorter time (e.g. 3 minutes) compared to roasting of coffee beans which involves higher

temperatures (e.g. > 200ºC) and comparatively longer periods of time depending on whether a medium roast, medium to dark roast or dark roast coffee is required. Coffee beans are rich in carbohydrates (and amino acids) and therefore when subjected to the high temperature roasting process, higher levels of furan are formed when compared to other products such as potato crisps.

6. Furan is highly volatile; however once formed as a result of the heat treatment, it cannot evaporate from processed food contained in an airtight sealed pack until the container is opened. Residual furan that may be present in the food after first opening the container may also evaporate over time, although the amount of furan lost will be dependent on the conditions of storage. Products such as coffee, crisps, jarred baby foods and a selection of canned and jarred products were tested for the presence of furan.

European Commission Recommendations

7. This survey was conducted in response to two European Commission Recommendations for pan-European activity on process contaminants: (i) European Commission Recommendation (EC) No. 2007/331 to investigate the levels of acrylamide in food, and in particular to monitor the effectiveness of acrylamide reduction measures as specified in the FoodDrinkEurope toolbox and (ii) European Commission Recommendation (EC) No. 2007/196, to monitor the occurrence levels of furan in foodstuffs.

8. As in 2007, 2008 and 2009, the acrylamide and furan data have been submitted to the European Food Safety Authority (EFSA). EFSA will in turn collate the acrylamide results with those from other Member States and, in the case of furan[4], these data will be used by EFSA as the basis of developing a risk assessment.

9. The EU recommendation on the levels of acrylamide in food specifies ten food groups for monitoring and specific additional information to be provided for each product. The recommendation also specifies which of the potato products should be sampled twice each year: in November and March. This is intended to allow comparison of potato products produced from the newly harvested crop in November and potato products produced in the following year (March) from the stored crop.

10. In order to show the effect of storage of potatoes on acrylamide levels, a comparison of acrylamide data was made for French fries and potato crisps sampled between November 2010 and March 2011. This comparison is made as these products would have been manufactured from potatoes before and after storage, respectively. Although different varieties of potato may have been used, the sampling timescales ensure the harvesting period is defined. Depending on the conditions of storage, an increase in sugar levels within the potato may occur, known as cold temperature sweetening, which in turn can lead to an increase in acrylamide formation on cooking[5].

EFSA Reports

11. EFSA has recently published a report[6] on the monitoring and exposure assessment of acrylamide based on 10,366 acrylamide results from 23 member states and Norway for the three year period 2007- 2009. EFSA stated in their report that differences in analytical methodology, recipe composition and food processing techniques were contributory factors causing some difficulties regarding variability and interpretation of results. EFSA concluded that a three year period was insufficient to detect clear trends with regards to the levels of acrylamide. To enable trending, the number of years covered needs to be extended, while ensuring member states consistently sample the same products in different years and collect sufficient number of samples per food group. The European Commission has therefore deemed it appropriate to continue the collection of acrylamide monitoring data[7] to permit trend analysis. To this end, further UK surveys are planned for 2011-13 in line with Commission Recommendation (EU) No. 2010/307.

12. EFSA's report[8] on the monitoring and exposure assessment of furan is based on results from 20 member states for the period 2004 – 2010. They report that furan is present in a variety of heat processed foods, with the highest levels of furan being found in brewed coffee and jarred baby food. EFSA recommends that it would be beneficial if future testing focused on products where currently there are only limited results and, if possible, data should comprise samples analysed as purchased and as consumed, since furan can evaporate during preparation.

Methodology

Statistics

13. Based on UK surveillance data obtained during the period 2007-2011, the Agency has used statistical modelling to attempt to characterise any possible statistical trends in acrylamide levels for each food group (see Appendix 2).

Sampling

14. Ventress Technical Limited (Ventress) undertook the purchase and collection of samples from a wide range of retail outlets including major and smaller supermarkets and independent retailers in the UK. As with the first three years, the Agency agreed a detailed sampling plan with Ventress at the start of the sampling year after reviewing the previous results. In addition to new products being included in the 2010-2011 sampling plan, every effort was made to ensure that products to be sampled matched those as sampled in preceding years, with regard to brand and retailer. However this was not always possible and therefore, in this respect, the 2010-2011 sampling plan was not exactly the same in terms of brands sampled and the number of samples analysed when compared to the earlier surveys. This was taken into account in the statistical modelling of the survey results.

15. A total of 248 samples was purchased to cover the 10 food groups in line with the European Commission Recommendation 2007/331/EC.

Analyses

16. The analytical contractor, Premier Analytical Services (PAS) worked closely with Ventress to arrange the transfer of samples to the laboratory and ensure sample integrity. Full details of all analytical methods and procedures carried out by PAS, including analytical quality assurance, can be found in the October 2011 contractor's report, *'Survey of Acrylamide and Furan in UK Retail Products - Analysis Phase: Summary report for samples purchased between November 2010 and April 2011'* at www.foodbase.org.uk

Results

17. A total of 248 samples was received over the period November 2010 - April 2011 for the analyses of acrylamide and furan, as appropriate.

18. Potato products for home-cooking (Group 3) and microwaveable popcorn (Group 10) were cooked according to manufacturers' guidelines prior to analyses. Coffee and coffee substitutes (Group 7) requiring furan analyses were tested as received and as consumed to assess potential losses of volatile furan during preparation.

19. Information Sheets giving the results from the 2007[9], 2008[10] and 2009[11] surveys can be accessed from the FSA's website.

Acrylamide

20. All 248 of the samples were analysed for acrylamide. In accordance with the EC Recommendation, French fries sold as ready to eat (Group 1), potato crisps (Group 2) and pre-cooked French fries for home-cooking (Group 3) were sampled twice a year, in November 2010 and March 2011, to show the effects of storage on acrylamide levels. All other food groups (including the Group 2 and Group 3 prefabricated products, i.e. those made from potato flakes, etc.) were sampled just once over the same November 2010 – March 2011 period. A summary of the acrylamide concentrations (mean and range) by product category is shown in Table 2.

Table 2 - *Summary of acrylamide concentrations (mean and range)*

Product category	n	mean (µg/kg)	min (µg/kg)	max (µg/kg)
Group 1 - French fries sold as ready to eat	42	239	41	1285
Nov-10 delivery	21	255	41	660
Mar-11 delivery	21	223	53	1285
Group 2 - Potato crisps	20	835	220	2061
Nov-10 delivery	10	738	220	1859
Mar-11 delivery	10	933	444	2061
Group 3 - Pre-cooked French fries for home-cooking	16	194	21	1155
Nov-10 delivery	8	206	21	1155
Mar-11 delivery	8	183	39	491
Group 4 - Soft bread	20	16	3	51
white	8	15	7	37
wholemeal	4	24	15	33
Others (e.g. in-store bakery, rye, linseed, rolls etc)	8	14	3	51
Group 5 - Breakfast cereals	20	149	35	325
Group 6 - Biscuits & crackers	20	380	27	1573
Crackers	9	275	48	473
Crispbread	3	197	120	326
Wafers	1	154	154	154
Other (sweet)	7	625	27	1573
Group 7 - Coffee	20	501	49	1009
Roast coffee	8	212	172	243
Instant coffee	6	865	724	997
Coffee substitutes	6	521	49	1009
Group 8 - Baby food other than processed cereal based	20	13	3	27
Group 9 - Processed cereal baby food	20	65	3	598
Biscuits and rusks for infants and young children	10	110	3	598
Other processed cereal based foods for infants and young children	10	18	6	68
Group 10 - Others	50	311	5	3972
Vegetable crisps	2	2651	1330	3972
Canned black olives	1	884	884	884
Other potato products for home-cooking	6	579	44	1604
Cocoa	2	442	176	707
Prefabricated crisps	2	364	285	443
Popcorn	2	328	205	451
Microwave French fries	2	327	327	328
Canned prunes	2	305	247	362
Novelty gingerbread	2	247	51	443
Cereal bars & granola	4	135	82	259
Tortilla / corn chips	2	103	79	127
Prefabricated potato products for home-cooking	4	68	18	108
Ethnic foods	6	64	25	120
Dried fruit	2	59	49	68
Cakes	5	33	12	86
Pastries	5	29	5	57
Chocolate	1	24	24	24

Furan

21. The concentrations of furan in samples of potato crisps (Group 2), coffee (Group 7), jarred baby foods (Group 8) and other products (Group 10) are shown in Table 3.

Table 3 - *Summary of Furan concentrations (mean and range) as consumed by product category*

Product category	n	mean (µg/kg)	min (µg/kg)	max (µg/kg)
Group 2 - Potato crisps	20	8	3	13
Group 7 - Coffee and coffee substitutes	20	41	0.3	154
Roast coffee	8	97	37	154
Instant coffee	6	6	1	13
Coffee substitute	6	1	0.3	4
Group 8 - Baby foods other than processed cereal based foods	20	40	12	78
Group 10 - Other products	10	38	11	127
Vegetable crisps	2	18	15	22
Prefabricated potato snacks	2	20	11	28
Popcorn	2	85	49	127
Tortilla / corn chips	2	18	17	21
Canned prunes	2	43	38	54

22. For coffee and coffee substitutes (Group 7), the preparation of the coffee was carried out in accordance with the coffee pack/container guidelines. Losses of furan on preparation for consumption can be seen in Figure 5.

23. A detailed discussion of the results for each product category is provided in Appendix 1 and the results of the Agency's statistical trending provided in Appendix 2.

24. Mean levels of acrylamide found for *all* food groups are summarised in Appendix 3 and mean levels of furan for Groups 2, 7, 8 and 10 are summarised in Appendix 4.

25. Individual analytical results for each product and category including brand names, batch numbers and best before dates, where available can be found in Appendix 5. All brand owners have received their own results and have been given the opportunity to comment. Comments received are reported in Appendix 6.

Conclusion

26. The levels of acrylamide and furan reported currently do not increase concern about risk to human health and the Agency has therefore not changed its advice to consumers. The Agency advises that chips should only be cooked to a light golden colour; similarly, bread/bread products should be toasted to the lightest colour acceptable. Also, the Agency advises that consumers follow Department of Health advice on eating a balanced diet which can be found by clicking on the link: NHS Choices and follow Agency advice on acrylamide minimisation which can be found by clicking on the link: Acrylamide.

27. To establish clearer trends for each product group (including Group 9 where statistically there was an upward trend in acrylamide levels - see Table 4), further surveys will be carried out during the period 2011-2013. This should help refine our statistical trending and also our current risk assessments on which our consumer advice is based.

28. Due to the nature of this 2010-2011 survey and the limited dataset to date, it is important to be cautious when drawing conclusions from the reported data and trend analyses. In some groups, the effect of just one or two samples may have an undue effect on the mean. Also, the possible effect of the analytical measurement uncertainty (as reported), or accuracy, must be considered, particularly in groups of small sample size.

29. Sampling protocols may also impact on the results e.g. when a limited number of retail samples is taken for a particular product type it is possible that an individual sample may have an unusually high or low level of the contaminant (for instance, this may be due to just one darker crisp in a bag that is not typical of most bags of the same product). It is important also to consider the variety of different ways that manufacturers may process similarly branded products resulting in different levels of process contaminants being found. The sampling protocol and analytical requirements are intended to minimise all these effects as much as possible within the constraints of the survey.

30. This survey gives a snapshot of the range of levels of acrylamide and furan that may be expected in retail products on sale in the UK during the 2010-2011 sampling period and therefore an indication of the levels that consumers may typically be exposed to in certain foods. However, the survey does not cover food prepared in the home, which has the potential to be a major contributor to overall exposure. As such, these results do not tell us about all the acrylamide or furan that consumers may be exposed to from home-cooking. Although fries and other potato products for home-cooking are covered in the survey, our analyses have relied upon uniform preparation of products according to manufacturers' instructions and using consistently performing kitchen equipment. This may not be representative of how products are prepared in many homes.

31. It is also recognised that these surveys began in 2007, but that the issue of acrylamide in food has been known since 2002. Many FBOs, supported by industry-wide representative bodies, have been taking steps to reduce levels in their products since that time. Given the nature of their production, it is not possible to completely eliminate process contaminants in food as they are inherently part of the processing and/or preparation of many foods.

32. To help continue minimising acrylamide levels in food, the Agency will:

- Collect further years' data to permit better trend analyses and to ensure that current and future efforts by FBOs to reduce acrylamide are captured, particularly following amendments to the 'toolbox', better understanding of the process complexities, and improvements in technology.
- Continue to engage with stakeholders and trade associations in promoting the 'toolbox' for use by small FBOs.
- Consider establishing acrylamide as part of future UK total diet studies to assess consumer exposure from the whole diet.
- Ensure the continuation of surveillance of furan in foodstuffs, including coffee and canned baby foods, to enable more information and data to be gathered to help inform the Agency, FBOs, EFSA and the European Commission.
- For future surveys, consider increasing the number of samples for certain product categories, e.g. processed cereal-based baby foods (Group 9).

Summary of Units

microgram (µg): one thousandth of a milligram (mg)

milligram (mg): one thousandth of a gram (g)

gram (g): one thousandth of a kilogram (kg)

kilogram (kg): one thousand gram

µg/kg: microgram per kilogram

Glossary

Agency:	Food Standards Agency
ALARP:	As Low As Reasonably Practicable
EC:	European Commission
EFSA:	European Food Safety Authority
FBO:	Food Business Operator
IARC:	International Agency for Research on Cancer
IV:	Indicative Value
JECFA:	Joint FAO/WHO Expert Committee on Food Additives
PAS:	Premier Analytical Services:

References

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Further information

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Appendix 1

Acrylamide

1. Overall, comparatively low levels were found in the coffee substitutes (range 49-1009 µg/kg); prefabricated potato products for home-cooking (range 18-108 µg/kg); other processed cereal based foods for infants & young children (range 6-68 µg/kg); ethnic foods (range 25-120 µg/kg); dried fruit (range 49-68 µg/kg); cakes (range 12-86 µg/kg); pastries (range 5-57 µg/kg); chocolate (24 µg/kg, only one sample tested); soft bread (range 3-51 µg/kg); and baby foods other than processed cereal based foods (range 3-27 µg/kg).

2. Comparatively high levels of acrylamide were found in vegetable crisps (range 1330-3972 µg/kg); canned black olives (884 µg/kg, only one sample tested); instant (soluble) coffee (range 724-997 µg/kg); potato crisps from fresh potato (range 220-2061 µg/kg); and sweet biscuits (range 27-1573 µg/kg).

3. The category, other potato products for home-cooking (Group 10), in addition to having amongst the highest levels of acrylamide (1604 µg/kg), was also found to contain amongst the lowest levels of acrylamide (44 µg/kg), illustrating the wide range of results that can be found within product groups.

4. Products prepared from fresh potato (Groups 1, 2, 3 and 10) were sampled biannually to assess the effects of seasonal variation on acrylamide formation. Since the sugar content of potatoes can increase during storage, storage can result in potentially higher levels of acrylamide in the food processed from these potatoes. Therefore it would be expected for products prepared from stored potato to contain higher levels of acrylamide when compared to products prepared from potatoes straight from harvest. However some of these groups e.g. French fries sold as ready to eat (Group 1) provided unexpected results. The overall mean acrylamide concentration in the November 2010 samples (255 µg/kg) was unexpectedly slightly higher than that in March 2011 (223 µg/kg), although this seasonal difference was more apparent in the thin cut samples compared with the thick cut samples (Figure 1).

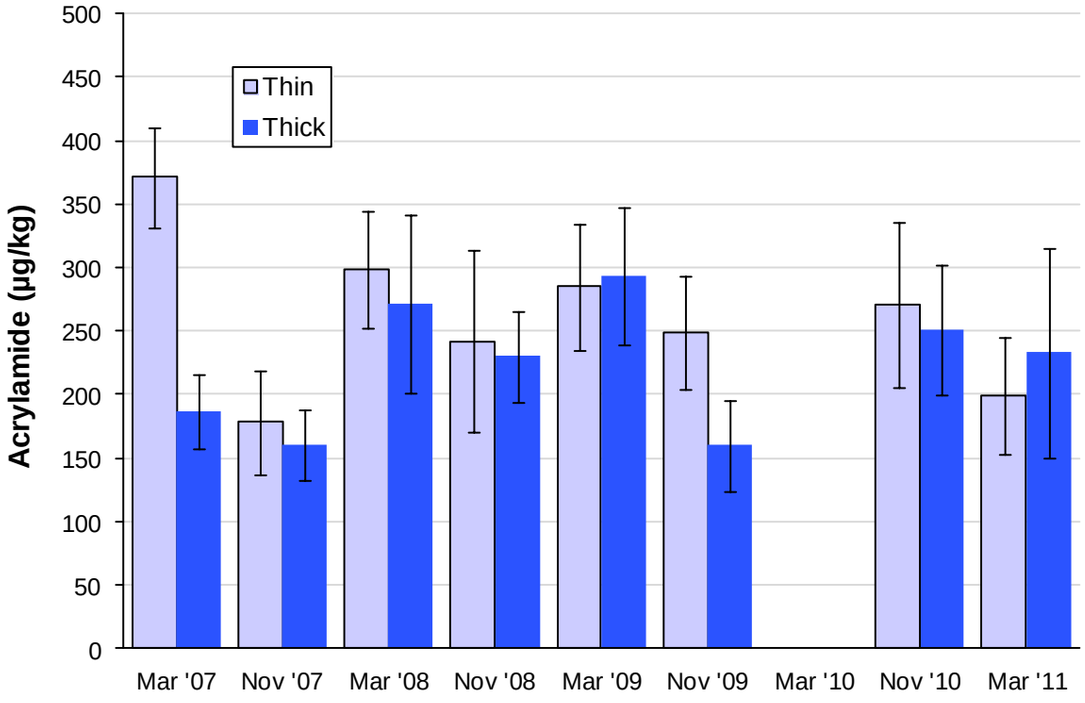


Figure 1 - *Comparison of seasonal means for acrylamide in thin and thick cut French fries sold as ready to eat (vertical bars are 2 standard errors). No sampling was undertaken during March 2010.*

5. Amounts of acrylamide in the 2010-2011 survey crisps ranged from 220 to 2061 µg/kg and did not appear to be associated with the cooking method, i.e. mean acrylamide levels in hand cooked crisps (839 µg/kg) were not significantly different from amounts in regular crisps (834 µg/kg). The seasonal trends for acrylamide in potato crisps over the period 2008-2011 are given in Figure 2.

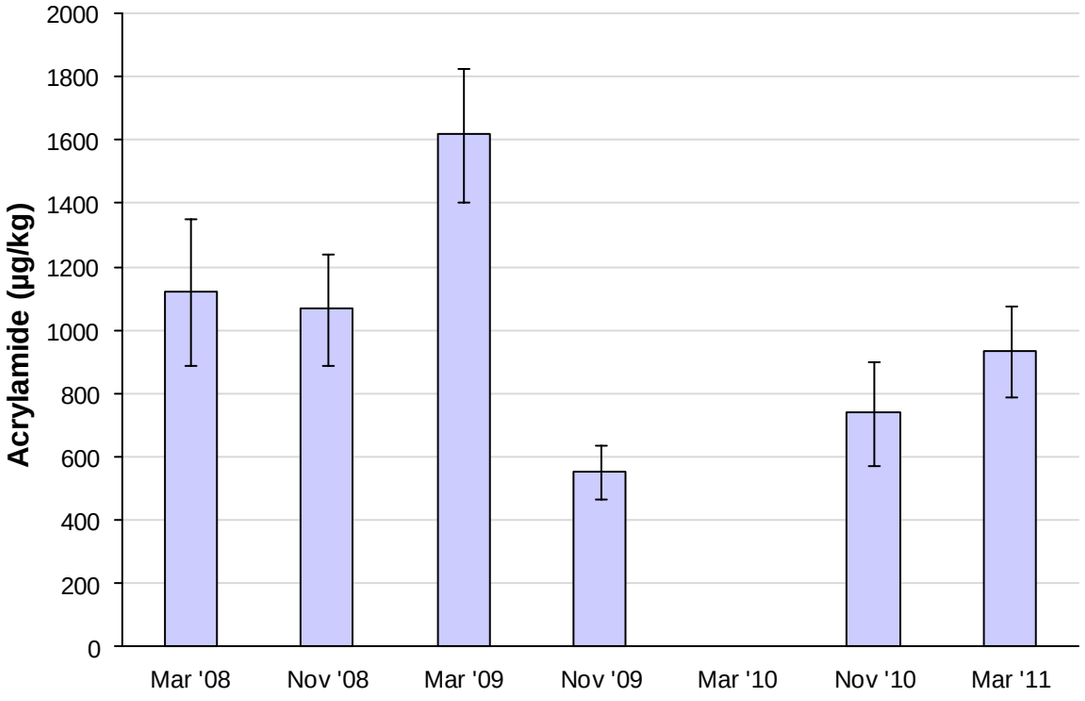


Figure 2 - *Comparison of seasonal means for acrylamide in crisps prepared from fresh potato slices (vertical bars are 2 standard errors). No sampling was undertaken during March 2010.*

6. White and wholemeal loaves, rolls and baguettes and speciality products such as soya and linseed breads, sunflower and barley breads, green olive ciabatta etc (Group 4, IV = 150 µg/kg, 20 samples), were included in the survey. Overall, the levels of acrylamide ranged from 3 - 51 µg/kg with the mean acrylamide level of 16 µg/kg being lower than in previous years (see Figure 3). White bread had a lower mean acrylamide content (15 µg/kg) compared to wholemeal bread (24 µg/kg), probably as a result of the lower asparagine content of white flour.

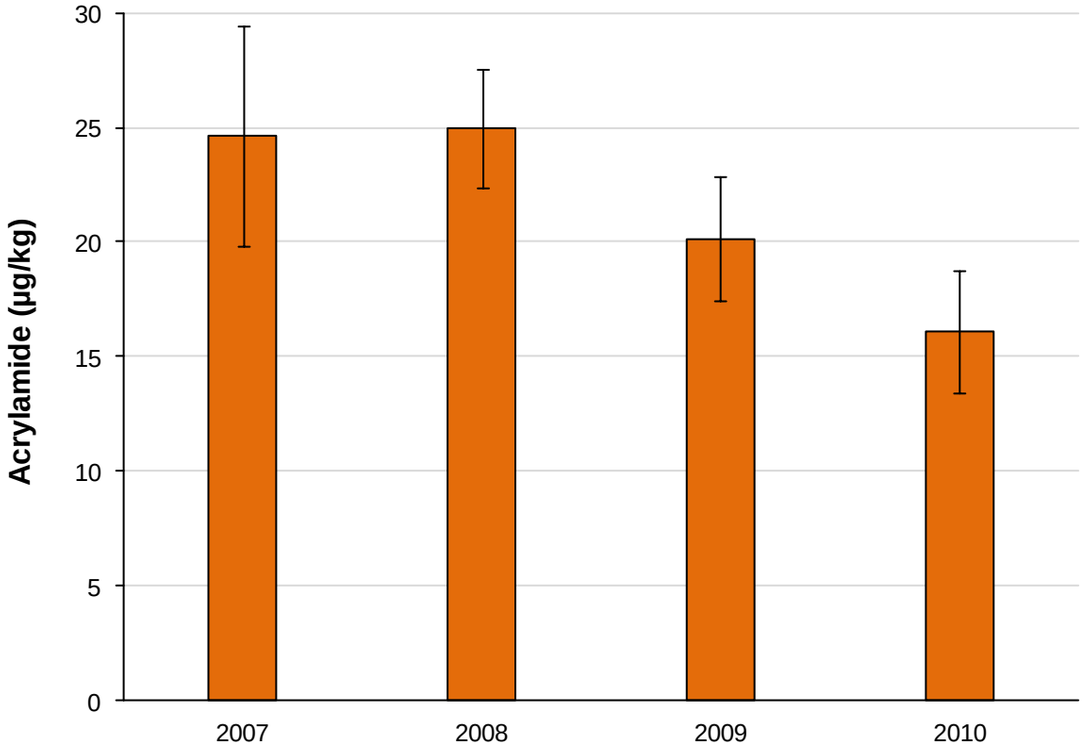


Figure 3 - *Comparison of annual mean acrylamide concentrations in retail soft bread (vertical bars are 2 standard errors).*

7. Breakfast cereals (Group 5, IV = 400 µg/kg, 20 samples) appeared to show a downward trend over the past 4 years (see Figure 4). This may be due to mitigation measures taken by industry to reduce the levels of acrylamide in these products although, from current data, taking into account the experimental error, it may be that there has been no real change.

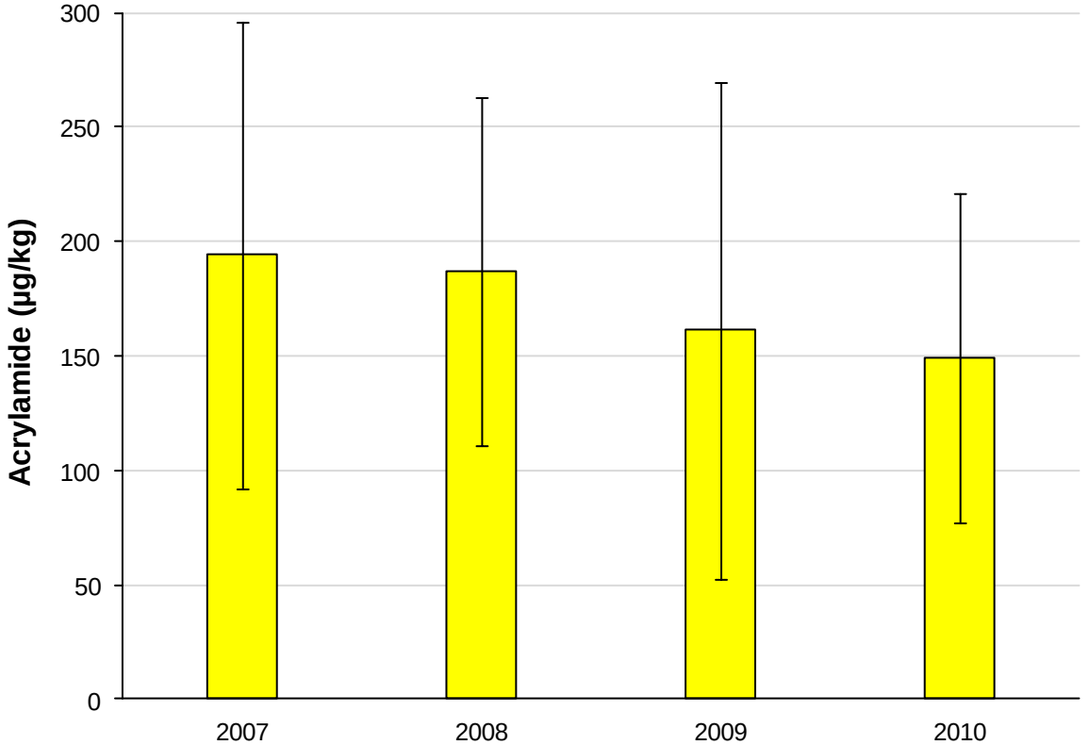


Figure 4 - *Comparison of annual mean acrylamide concentrations in breakfast cereals (vertical bars are 2 standard errors).*

8. Vegetable crisps (Group 10) accounted for the highest mean level of acrylamide (2651µg/kg) and baby food (other than processed cereal based) accounted for the lowest mean level of acrylamide (13µg/kg) being found during the 2010-2011 survey.

9. Of the 248 analyses carried out for acrylamide, 13 products were found to contain levels that exceeded their appropriate 'indicative value'.

Furan

10. Products sampled during the 2010-2011 survey and found to contain the lowest mean levels of furan (<10 µg/kg) were potato crisps, instant coffee , and coffee substitutes. The products with comparatively high levels of furan (>50 µg/kg) were popcorn and roast coffee (as consumed). Of the products found to contain furan in the 10-50 µg/kg range, baby foods in jars and pouches, had a lower mean furan level (40 µg/kg) compared to the mean furan level (47 µg/kg) that

was previously measured in 2009, however further surveillance would be required to establish clearer trends.

11. All samples from Group 7 were analysed as *received* and as *consumed* to determine potential furan losses during preparation. Losses can be observed through the expression or filtration of roasted coffee and in preparation of instant coffees[12]. Due to its high volatility, the levels of furan are also likely to decrease over time as a coffee packet is opened and closed during use.

12. Figure 5 shows a comparison of the mean levels of furan for roast coffee, instant coffee and coffee substitutes as received and as consumed. The greatest losses of furan occurred during the preparation of the roast and ground coffees, although the mean level of furan (97 µg/kg as consumed) is still higher for roast and ground coffee than the mean level of furan for instant coffee (6 µg/kg as consumed) prepared from granules. All coffees were prepared in accordance with the preparation guidelines as detailed on the coffee pack/container label.

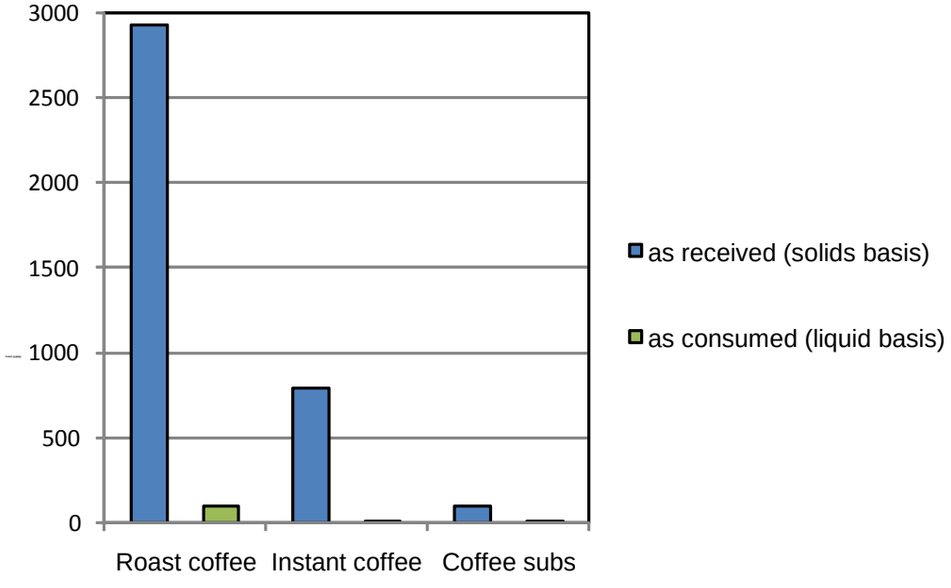


Figure 5 – *Mean levels of furan measured in roast and instant coffees and coffee substitutes expressed on an as received and as consumed basis.*

Appendix 2 – Statistical Trending

1. Based on the UK surveillance data obtained during the period 2007-2011, the Agency has used statistical models to attempt to characterise any possible trends in acrylamide levels for each food group. To enable trending, every effort is made to sample similar products each year. Where a previous year's sampled product is no longer available, slight adjustments to the sampling programme inevitably have to be made and this has been taken into account in our statistical analyses. To establish trending for the period 2007-2011, product sampled during this time has been grouped in accordance with the 2007 survey groupings.

2. For each of the ten product groups, the changes obtained from the statistical models, can be expressed as the average annual percentage change in acrylamide (see Table 4). The *wide* 95% confidence intervals indicate that the estimated changes are not very precise and for most groups, the changes over time are not statistically significant.

3. The main apparent change was in processed cereal-based baby foods (Group 9) with a mean annual percentage increase of 56.5%. This provided evidence of an upward trend in acrylamide levels for this particular Group within the products sampled.

4. Acrylamide concentrations in pre-cooked French fries/potato products for home-cooking (Group 3) and bread (Group 4) suggest an overall downward trend.

5. There was some weak evidence of a change for acrylamide concentrations in jarred baby foods (Group 8) which tended to be higher in 2008 than in other years.

6. Until further appropriate surveillance is completed, it will not be possible to determine from the statistical trending the reason for decreases and increases in acrylamide levels from this 2010-2011 survey, or to identify whether FBOs have mitigated successfully against levels of acrylamide in processed food.

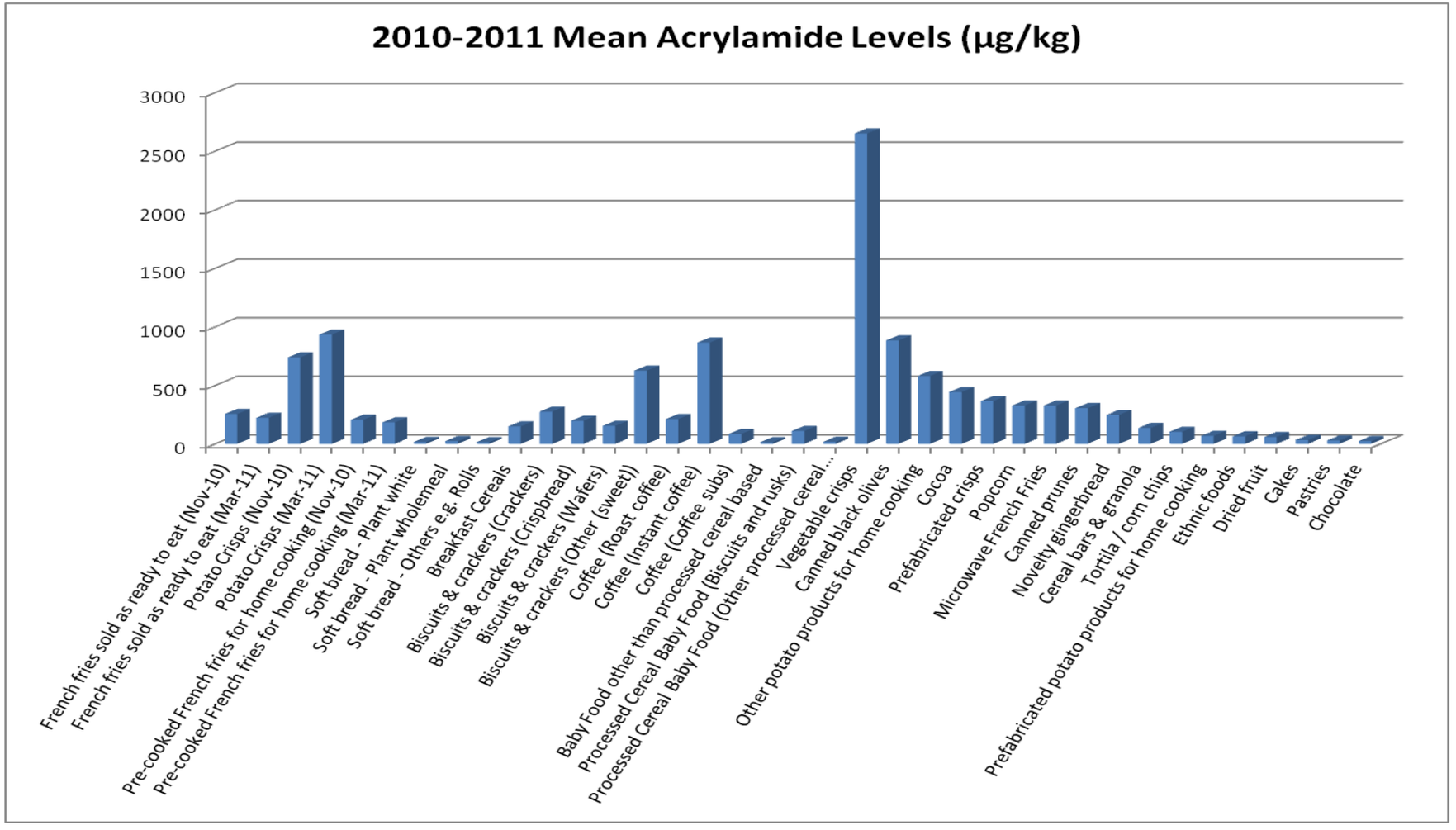
7. The observed trends in acrylamide levels relate to the products sampled and may not necessarily be completely representative of the UK market.

Table 4 - *Average annual percentage change in Acrylamide concentration in samples collected between 2007 and 2011, by 2007 classification group*

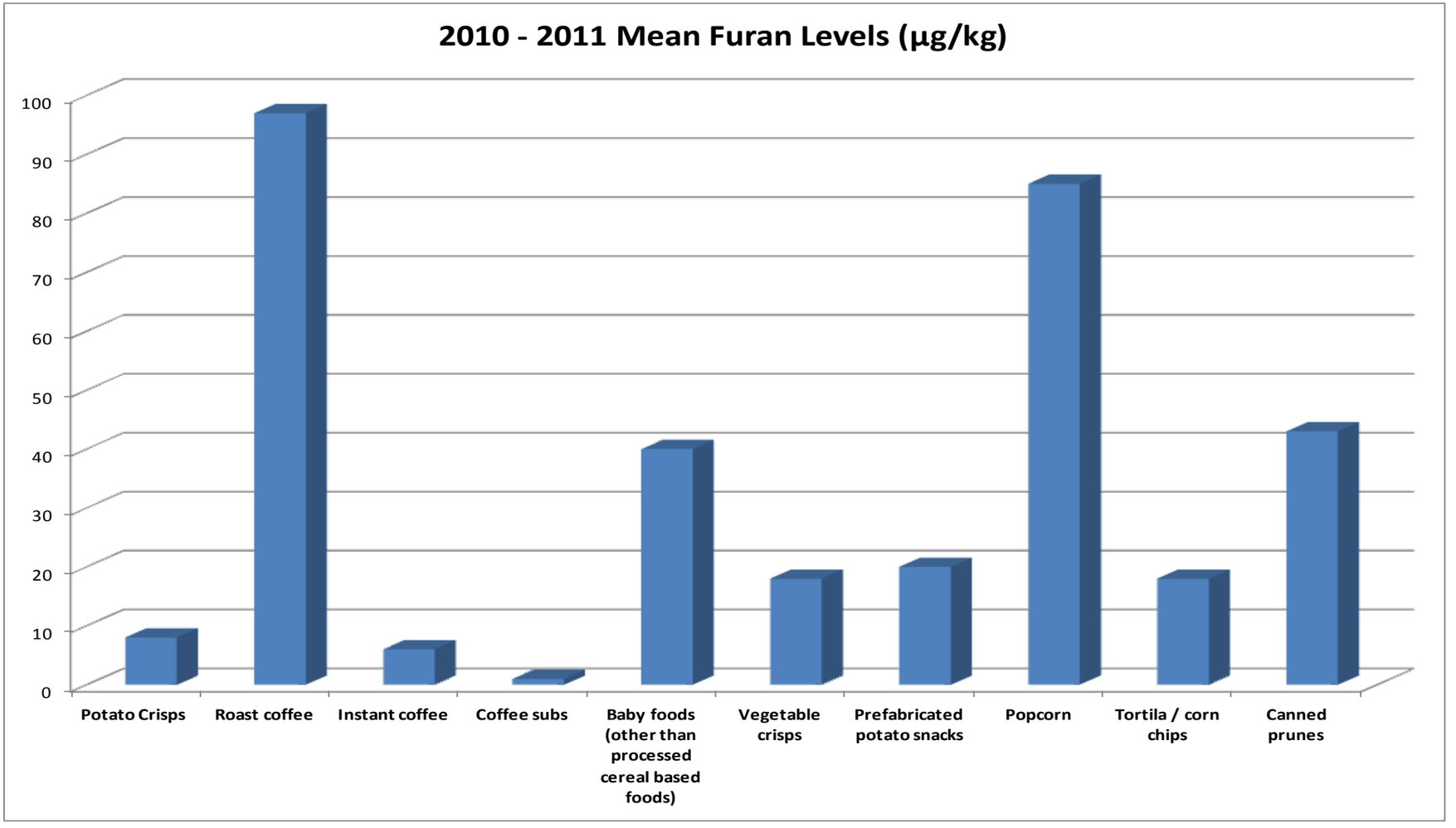
Group		Average Annual % Change	95% Confidence Interval for Change		
1	French fries, sold as ready-to-eat	3.6%	-4.3%	to	12.3%
2	Potato crisps [a]	-8.9%	-19.0%	to	2.5%
3	Pre-cooked French fries/potato products for home-cooking [b]	-12.4%	-22.8%	to	-0.6%
4	Bread	-9.8%	-17.4%	to	-1.5%
5	Breakfast cereals	-9.9%	-21.8%	to	3.8%
6	Biscuits [c]	-8.7%	-20.3%	to	4.6%
7	Roasted coffee [d]	-4.0%	-9.5%	to	1.8%
8	Jarred baby foods	0.6%	-19.9%	to	26.3%
9	Processed cereal-based baby foods [e]	56.5%	29.6%	to	89.0%
10	Other products [f]	10.7%	-10.5%	to	36.9%
	All products	-2.9%	-7.0%	to	1.3%

a. Including prefabricated potato snacks
b. Including roast potatoes and prefabricated products
c. Including infant biscuits/ rusks
d. Excluding instant coffee and coffee alternatives
e. Excluding rusks
f. Including instant coffee and coffee alternatives & gingerbread

Appendix 3 – Mean Acrylamide Levels - Groups 1-10 (2010-2011)



Appendix 4 – Mean Furan Levels (as consumed) - Groups 2,7,8 & 10 (2010-2011)



Appendix 5 - Results

Group 1 – French fries sold as ready to eat – November 2010 samples

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	WEIGHT (Kg)	STARTING MATERIAL-FRESH POTATO/PREFABRICATED Potato products only	UK TOWN WHERE PURCHASED	ACRYLAMIDE LEVEL (µg/kg)
10C-11898	Regular fries	Burger King	0.72	Not applicable	Newmarket	**343**
10C-11899	Chips	Café Fresco	0.84	Not applicable	Cardiff	**145**
10C-11900	Chips	Stavros Fish Bar	0.70	Not applicable	Cardiff	**185**
10C-11901	Chips	Zero Plus Fish Bar	0.78	Not applicable	Cardiff	**77**
10C-11902	Chips	City Restaurant	0.86	Not applicable	Edinburgh	**41**
10C-11903	Chips	The Abbey	0.66	Not applicable	Edinburgh	**660**
10C-11904	Chips	Marco's Fish Bar	0.78	Not applicable	Birmingham	**56**
10C-11905	Chips	Newton Fish Bar	0.80	Not applicable	Birmingham	**79**
10C-11906	Chips	Moto The Kitchen	0.78	Not applicable	Wolverhampton	**313**
10C-11907	Regular fries	KFC	0.48	Not applicable	Congleton	**473**
10C-11908	Chips	Hightown Fish & Chip Shop	0.42	Not applicable	Congleton	**518**
10C-11909	Side chips	The Railway Inn	0.72	Not applicable	Congleton	**533**
10C-11910	Side chips	The Trinity	0.80	Not applicable	London	**557**
10C-11911	Fries	Chicken Cottage	0.70	Not applicable	London	**172**
10C-11912	Fries	Perfect Fried Chicken	0.69	Not applicable	London	**110**

10C-11913	Chips	Silver Lounge Café	0.48	Not applicable	Larne	**169**
10C-11914	Chips	The Upper Crust	0.60	Not applicable	Larne	**300**
10C-11915	Chips	Arcade Chip Shop	0.80	Not applicable	Antrim	**115**
10C-11916	Chips	Sainsbury's Café	0.90	Not applicable	Cambridge	**124**
10C-11917	Chips	Khangs Fish & Chips	0.86	Not applicable	Cambridge	**123**
10C-11941	Large fries	McDonalds	0.62	Not applicable	Cardiff	**270**

Group 1 – French fries sold as ready to eat – March 2011 samples

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	WEIGHT (Kg)	STARTING MATERIAL-FRESH POTATO/PREFABRICATED Potato products only	UK TOWN WHERE PURCHASED	ACRYLAMIDE LEVEL (µg/kg)
10C-12089	Regular fries	Burger King	0.51	Not applicable	Newmarket	**182**
10C-12090	Chips	Café Fresco	0.71	Not applicable	Cardiff	**346**
10C-12091	Chips	Stavros Fish Bar	0.60	Not applicable	Cardiff	**119**
10C-12092	Chips	Zero Plus Fish Bar	0.82	Not applicable	Cardiff	**53**
10C-12093	Chips	City Restaurant	0.75	Not applicable	Edinburgh	**96**
10C-12094	Chips	The Abbey	0.72	Not applicable	Edinburgh	**75**
10C-12095	Chips	Marco's Fish Bar	0.82	Not applicable	Birmingham	**241**
10C-12096	Chips	Newton Fish Bar	0.90	Not applicable	Birmingham	**78**
10C-12097	Chips	Moto The Kitchen	0.66	Not applicable	Wolverhampton	**123**
10C-12098	Regular fries	KFC	0.54	Not applicable	Congleton	**331**

10C-12099	Chips	Hightown Fish & Chip Shop	0.60	Not applicable	Congleton	**592**
10C-12100	Side chips	The Railway Inn	0.74	Not applicable	Congleton	**290**
10C-12101	Side chips	The Trinity	1.04	Not applicable	London	**1285**
10C-12102	Fries	Chicken Cottage	0.90	Not applicable	London	**110**
10C-12103	Fries	Perfect Fried Chicken	0.74	Not applicable	London	**105**
10C-12104	Chips	Silver Lounge Café	0.70	Not applicable	Larne	**105**
10C-12105	Chips	The Upper Crust	0.84	Not applicable	Larne	**68**
10C-12106	Chips	Arcade Chip Shop	0.86	Not applicable	Antrim	**146**
10C-12107	Chips	Sainsbury's Café	0.90	Not applicable	Cambridge	**123**
10C-12108	Chips	Khangs Fish & Chips	0.76	Not applicable	Cambridge	**99**
10C-12132	Large fries	McDonalds	0.54	Not applicable	Cardiff	**119**

Group 2 - Potato crisp – from potato slices – November 2010

SAMPLE CODE	**PRODUCT DESCRIPTION**	**BRAND**	**BEST BEFORE DATE**	**BATCH CODE**	**DECLARED COUNTRY OF ORIGIN**	**RETAILER ADDRESS**	**Acrylamide level [4]**	**Furan level**	
								Packet A	**Packet B**
							(µg/kg)	**(µg/kg)**	**(µg/kg)**
10C-11918	Sea salt & Balsamic vinegar hand cooked crisps	Marks & Spencer	08.02.11	D 0285 Variety Markies	UK	Wolverhampton	**508**	**8**	**11**
10C-11919	Sea salt & Chardonnay wine vinegar flavour crisps	Co-op Truly Irresistible	10 01 11	10 263 3	Herefordshire, England	Birmingham	**220**	**5**	**5**
10C-11920	Ready salted crisps - 12 pack	Tesco Value	19-FEB-11	K0330 MP06	UK	Newmarket	**390**	**4**	**3**
10C-11921	Anglesey sea salt crisps	Pipers Crisps	29.01/11	2 72 L1	Lincolnshire, England	Edinburgh	**854**	**11**	**13**

10C-11922	Cheddar & onion flavour ridge cut potato chips - 6 pack	McCoy's	26 02 11	0320 10D T	UK	Congleton	**1141**	**12**	**8**
10C-11923	Lightly salted hand cooked chips	Kettle Chips	05 MAR 11	M B 0285	UK	Congleton	**320**	**6**	**6**
10C-11924	Sea salted crinkle cut potato crisps - multi pack	Seabrook	05 MAR 11	B 0311	Yorkshire, England	Congleton	**933**	**12**	**11**
10C-11925	Simply salted potato crisps - 6 bags	Walkers Lights	15-01-11	GBL 189299 4495	None declared	Edinburgh	**229**	**6**	**5**
10C-11926	Salt & black pepper hand cooked potato chips	Burts	16 02 2011	Prod: 29 09 2010 Field Butler Fried by Richard	Devon, England	Cambridge	**1859**	**11**	**11**
10C-11927	Cheese & onion flavour crisps - 6 pack	Tayto	13 FEB 11	PFW2 10314	None declared	Larne	**922**	**8**	**8**

Group 2 - Potato crisp – from potato slices – March 2011

SAMPLE CODE	**PRODUCT DESCRIPTION**	**BRAND**	**BEST BEFORE DATE**	**BATCH CODE**	**DECLARED COUNTRY OF ORIGIN**	**UK TOWN WHERE PURCHASED**	**Acrylamide level**	**Furan level**	
								Packet A	**Packet B**
							(µg/kg)	**(µg/kg)**	**(µg/kg)**
10C-12119	Sea salt & Balsamic vinegar hand cooked crisps	Marks & Spencer	21 06 11	D 1055 Variety Markies	UK	Cambridge	**932**	**11**	**9**
10C-12120	Sea salt & Chardonnay wine vinegar flavour crisps	Co-op Truly Irresistible	20 06 11	11 059 2A	Herefordshire, England	Cambridge	**444**	**8**	**8**
10C-12121	Ready salted crisps - 12 pack	Tesco Value	28-MAY-11	K1064 MP03	UK	Cambridge	**830**	**7**	**6**
10C-12122	Anglesey sea salt crisps	Pipers Crisps	22/06/11	L2 11053	Lincolnshire, England	Edinburgh	**1201**	**10**	**9**
10C-12123	Cheddar & onion flavour ridge cut potato chips - 6 pack	McCoy's	04 06 11	1051XG T	UK	Cambridge	**1057**	**9**	**10**
10C-12124	Lightly salted hand cooked chips - 5 packs	Kettle Chips	25 JUN 11	1035 2	UK	Newmarket	**767**	**8**	**8**
10C-12125	Sea salted crinkle cut potato crisps	Seabrook	21 MAY 11	A 1025	Yorkshire, England	Congleton	**2061**	**7**	**6**
10C-12126	Simply salted potato crisps - 6 bags	Walkers Lights	14-05-11	GBL 186054 7177	None declared	Cambridge	**507**	**4**	**4**

10C-12127	Salt & black pepper hand cooked potato chips	Burts	11 07 2011	1 Prod: 21 02 2011 Field Norton Fried by Sony	Devon, England	Newmarket	**648**	**6**	**7**
10C-12128	Cheese & onion flavour crisps - 16 pack	Tayto	12 JUN 11	B 11067	None declared	Larne	**887**	**6**	**6**

Group 3 - Pre-cooked French fries/potato products for home-cooking – Nov 2010 samples

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-11928	Oven chips	Heinz Weight Watchers	Jan/2012	Lot 80 193 0826	Holland	Antrim	**85**
10C-11929	Thin & crispy oven chips	Tesco	NOV 2011	Display until AUG 2011 C 0322 7 TNS	Packed in the UK using British potatoes	Antrim	**158**
10C-11930	Crispy French fries	McCain	05 2012	P18112010 05	British potatoes	Cambridge	**21**
10C-11931	Straight cut frying chips	Waitrose Essential	JAN 2012	C0282 6	UK	Cambridge	**38**
10C-11932	Fresh chunky chips	Tesco Finest	Not applicable	62B 1933	UK	Cambridge	**1155**
10C-11934	Organic oven chips	Asda Organics	MAR 2012	L0246 10 01	Belgium	Edinburgh	**48**
10C-11935	Homestyle chips	Aunt Bessie's	APR 2012	NB 0 291 3	UK	Cambridge	**106**
10C-11936	Chunky oven chips	Harry Ramsden's	APR 2012	NB 0 279 4	UK	Cambridge	**33**

Group 3 - Pre-cooked French fries/potato products for home-cooking - March 2011 samples

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12109	Oven chips	Heinz Weight Watchers	Jun/2012	7 0363 0831	Holland	Cambourne	**114**
10C-12110	Thin & crispy oven chips	Tesco	MAR 2012	Display until DEC 2011 C 1062 5 TNS	UK	Congleton	**337**
10C-12111	Crispy French fries	McCain	08 2012	P13022011 07	British potatoes	Newmarket	**41**
10C-12112	Straight cut frying chips	Waitrose Essential	APR 2012	C1025 8	UK	Newmarket	**189**
10C-12113	Chunky chips	Tesco Finest Side Dish	None declared	63D 1728	UK	Congleton	**491**

10C-12115	Organic straight cut oven chips	Asda Organics	JUL 2012	L1011 31 18	Belgium	London	**39**
10C-12116	Homestyle chips	Aunt Bessie's	AUG 2012	NB 1 049 9	UK	Cambridge	**207**
10C-12117	Chunky oven chips	Harry Ramsden's	AUG 2012	NB 1 046 8	UK	Cambridge	**46**

Group 4 – Soft Breads

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-11945	Toastie thick sliced white bread	Warburtons	16DEC	GVYUW AJLV7	None declared	Paisley	**10**
10C-11946	Demi baguettes	Co-op	15/12/2010	None declared	None declared	Paisley	**5**
10C-11947	White sliced half bloomer	Greggs	None declared	None declared	None declared	Paisley	**14**
10C-11948	Tiger loaf	Tesco Bakery	12 Dec	None declared	None declared	Cardiff	**9**
10C-11949	White finger rolls - 6 pack	Tesco Bakery	13 Dec	None declared	None declared	Cardiff	**3**
10C-11950	Wholemeal classic sliced bread	Brace's	15 DEC	E 39 B 1	None declared	Cardiff	**15**
10C-11951	Toasty pan white sliced bread - thick	Irwin's	17 DEC	CN2	None declared	Larne	**7**
10C-11952	Plain sliced white bread	Sunblest	16 DEC	0 344 BE5	Northern Ireland	Ballynure	**37**
10C-11953	Harvest Pride white premium sliced bread	Linwoods	18 DEC	A 2	None declared	Ballynure	**12**
10C-11954	Nimble wholemeal sliced bread	Hovis	17 DEC	(X42) 5 FT	British flour	Ballyclare	**33**
10C-11955	Soya & linseed bread	Burgen	17 DEC	GL1 0 345 0433	UK	Templepatrick	**10**
10C-11956	4 green olive ciabatta rolls	Marks & Spencer	22 DEC	None declared	UK	London	**51**
10C-11957	Stoneground wholemeal medium sliced bread	Waitrose	22 DEC	Display until 22 DEC FLBH10	UK	London	**26**

10C-11958	Sunflower & barley bread	Vogel's	21 DEC	C	None declared	London	**12**
10C-11959	Thick sliced white bread	Hovis	24 DEC	X72 B G B	100% British wheat	Cambridge	**12**
10C-11960	Wholemeal batch bread	Allinson	23 DEC	ST06 0351 1652	UK	Cambridge	**21**
10C-11961	Stonebaked walnut cob	Sainsbury's Taste the Difference	None declared	None declared	French white flour Produced in the UK	Cambridge	**9**
10C-11962	Thick sliced white bread	Roberts Bakery	03 JAN	FRS3 03 C 362 1410 R	Not declared	Stockport	**14**
10C-11963	Large burger buns	Asda	31-12-10	None declared	None declared	Leicester	**11**
10C-11964	Soft white loaf - medium	Kingsmill	04 JAN	WA07 363 0 0103	UK	London	**11**

Group 5 - Breakfast Cereals

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-11965	Organic spelt honey puffs	Sharpham Park	10/2011	082410SHA	British spelt	Newmarket	**163**
10C-11966	Organic whole wheat cereal biscuits	Weetabix Organic	05/11/2011	10309 2	England	Newmarket	**63**
10C-11967	Force - toasted wholewheat flakes	Nestlé	30/09/2011	02750953	None declared	Newmarket	**100**
10C-11968	Puffed wheat	The Good Grain Co.	30 NOV 11	312 C 5	None declared	Cambridge	**299**
10C-11969	Bran flakes	Tesco	17/08/2011	03210953 P3 B3	UK	Cambridge	**182**
10C-11970	Wheat pillows	Tesco	07 Aug 2011	10315 WW	Germany	Cambridge	**151**
10C-11971	Wholegrain bran flakes	Sainsbury's	29/11/2011	03330953 P4 B2	UK	Cambridge	**176**
10C-11972	Cornflakes - toasted flakes of golden corn	Kellogg's	18 11 11	03 MC	None declared	Cambridge	**116**

10C-11973	Shreddies - whole wheat malted cereal	Nestlé	31.07.2011	02980952 L2	British wheat	Cambridge	**121**
10C-11974	Puffed wheat	Sugar Puffs	30SEP11	266 8 A	None declared	Stockport	**181**
10C-11975	Whole wheat cereal biscuits	Morrisons	07/12/2011	0341 2	UK	Stockport	**137**
10C-11976	Frosted wheats - shredded wholewheat with sugar topping	Kellogg's	11 12 11	32 MC	None declared	Stockport	**183**
10C-11977	Shredded wheat - wholegrain wheat cereal biscuits	Nestlé	31.08.2011	03290952 M	British wheat	Stockport	**186**
10C-11978	Whole wheat cereal	Sunny-Bisk	30/11/2011	UK1	None declared	Leicester	**35**
10C-11979	Golden puffs	Asda	FEB 2011	0 059 LAi	EU	Leicester	**325**
10C-11980	Malted wheats	Asda	09/12/2011	0343 A	UK	Leicester	**86**
10C-11981	Crunchy bran - high fibre cereal	Weetabix	07/12/2011	0341 9	England	Leicester	**118**
10C-11982	Organic bran flakes	Tree of Life	Jul 2011	ORG 53057	UK	Cambridge	**72**
10C-11983	Wheat & wheat bran flakes	Co-op	14/08/2011	03180953 P3 B2	UK using British wheat & wheat bran	Cambridge	**184**
10C-11984	Whole wheat biscuits	Waitrose Essential	05/12/2011	0339 2	UK	Cambridge	**101**

Group 6 – Biscuits & Crackers

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-11991	Cream crackers	Waitrose Essential	03 SEP 11	0 336 BB	UK	Cambridge	**48**
10C-11992	Organic wholewheat digestives	Doves Farm Organic	26-JUN-11	03 21	English wheat	Cambridge	**298**
10C-11993	Dark rye crispbread	Ryvita	09 2011	0342 1B	None declared	Cambourne	**144**
10C-11994	Ginger biscuits	Fox's Crinkles	06 08 11	C S	None declared	Cambourne	**1004**
10C-11995	Rich tea biscuits	Asda Smart Price	02 JUL 11	T1 0357	UK	Cambridge	**360**
10C-11996	Crunchy ginger biscuits	McVitie's Ginger Nuts	07 05 11	0301 C 2 UBGA4TFPAX1 JM UB9K8L1GXP7 3 UB2YWR1A9P K6	UK	Cambridge	**1573**
10C-11997	Salted savoury snack biscuits	TUC Original	16/07/11	0 348 1A	UK	Cambridge	**419**
10C-11998	Ginger nut biscuits	Tesco	JUN 11	0354 1	UK	Cambridge	**817**
10C-11999	Cream crackers	Tesco	17 SEP 11	1 007 BB	UK	Cambridge	**80**
10C-12000	Extra wheatgerm crackers	Hovis	17 09 11	1004 B	None declared	Cambridge	**302**
10C-12001	High bake water biscuits	Sainsbury's	11 06 11	0336 3 C	UK	Cambridge	**355**
10C-12002	Crispy wheat & rye crackers	McVitie's Krackawheat	04 JUN 11	T2D	UK	Cambridge	**473**
10C-12003	Malted milk biscuits	Marks & Spencer	20 08 11	0 352 016 Display until 06 08 11	UK	Newmarket	**295**
10C-12004	Original rye crispbread	Finn Crisp	12112011	Production date: 12112010/	Finland	Newmarket	**120**
10C-12005	Flatbreads - mixed seeds	Jacob's	04 06 11	0330 C	UK	Newmarket	**238**
10C-12006	Scottish shortbread	Highland Kitchen	16 12 2011	450	Scotland	Newmarket	**27**
10C-12007	Scandinavian bran crispbread	Slimming World	02072013	None declared	Norway	Cambridge	**326**
10C-12008	Cream crackers	Co-op	07 2011	0348 1	UK	Cambridge	**410**
10C-12009	Luxury fan wafer biscuits	Askey's	DEC 11	0347G11X	UK	Cambridge	**154**
10C-12010	Rough oatmeal oatcakes	Nairn's Oatcakes	21 JUL 2011	0251 C2	Scotland	Cambridge	**148**

Group 7 - Coffee

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level	Furan level					
								As received		As consumed			
								Packet A	Packet B	Packet A	Packet B	Packet A	Packet B
							(µg/kg)	(µg/kg solids)	(µg/kg solids)	(µg/kg solids)	(µg/kg solids)	(µg/kg beverage)	(µg/kg beverage)
10C-12011	Fresh ground decaffeinated coffee in one-cup bags	Lyons	JUN 12	0343	Packed in the UK	Cambridge	**239**	**2360**	**2416**	**1609**	**1611**	**56**	**56**
10C-12012	Espresso roasted & ground coffee	Waitrose	OCT 11	10301	Italy	Newmarket	**223**	**3129**	**3034**	**931**	**796**	**43**	**37**
10C-12013	Fairtrade Guatemala Arabica ground coffee	Percol	MAY 2012	L36 0320	Guatemala	Cambridge	**179**	**2037**	**2053**	**1066**	**1177**	**75**	**82**
10C-12014	Guatemala, Santa Ana ground coffee	Union Hand Roasted	29-JUL-11	None declared	Guatemala	Cambridge	**189**	**3988**	**4021**	**2207**	**2158**	**154**	**151**
10C-12015	Java Sumatra roast & ground coffee	Tesco Finest	DEC/11	G0 347 R5	Indonesia Packed in the UK	Cambridge	**243**	**2917**	**3071**	**1531**	**1692**	**107**	**118**
10C-12016	Colombian Fairtrade coffee beans	Sainsbury's Taste the Difference	29NOV 2011	0333A 1	Grown in the Columbian Andes Packed in the UK	Cambridge	**224**	**3758**	**3688**	**1927**	**1991**	**135**	**139**
10C-12017	Colombian ground coffee	Marks & Spencer	SEP 2011	0265 03	Colombia Packed in the UK	Cambridge	**172**	**2847**	**2775**	**1514**	**1496**	**106**	**105**
10C-12018	Monsoon Malabar coffee beans	Whittard of Chelsea	None declared	None declared	India	Cambridge	**227**	**2341**	**2384**	**1364**	**1273**	**95**	**89**
10C-12019	Freeze dried soluble coffee	Nescafé Gold Blend	11 2012	03101080 AC	None declared	Cambourne	**913**	**1683**	**1813**	**1352**	**1430**	**12**	**13**
10C-12020	Freeze dried decaffeinated soluble coffee	Nescafé Gold Blend Decaff	11 2012	03191080 AD	None declared	Cambourne	**997**	**1534**	**1540**	**1213**	**1213**	**11**	**11**
10C-12021	Freeze dried instant coffee	Kenco	OCT 12	L0302	None declared	Cambourne	**880**	**232**	**232**	**163**	**160**	**1.5**	**1.4**
10C-12022	Freeze dried decaffeinated instant coffee	Kenco Decaff	OCT 12	L0280	None declared	Cambourne	**855**	**307**	**322**	**235**	**225**	**2.1**	**2.0**
10C-12023	Freeze dried instant coffee	Carte Noire	10/12	L0 284	EU	Cambridge	**823**	**505**	**478**	**373**	**359**	**3.4**	**3.2**

10C-12024	Freeze dried decaffeinated instant coffee	Carte Noire Décaféiné	10/12	L0 277	EU	Cambridge	**724**	**465**	**442**	**320**	**317**	**2.9**	**2.9**
10C-12025	Chicory & coffee essence	Camp	26 08 12	L0249	EU	Cambridge	**319**	**36**	**35**	**57**	**51**	**0.9**	**0.8**
10C-12026	Instant dandelion coffee compound	Symington s	APR 2012	BN 89670	None declared	Cambridge	**49**	**1.6**	**1.0**	**28**	**19**	**0.4**	**0.3**
10C-12027	Yannoh instant organic grain coffee substitute	Lima	31.05.2012	L10037	Switzerland	Cambridge	**1009**	**78**	**76**	**85**	**84**	**1.3**	**1.3**
10C-12028	Uplifting coffee alternative	Whole Earth Wake Up	OCTOBER 2012	L0303	Italy	Cambridge	**540**	**334**	**284**	**245**	**240**	**3.7**	**3.6**
10C-12029	Caffeine free instant cereal drink	Barley Cup Original	21.06.2012	0424B	Poland	Cambridge	**560**	**60**	**66**	**47**	**46**	**0.7**	**0.7**
10C-12030	Biomalt - organic grain beverage	Biona	12-12	L9343	Germany	Cambridge	**648**	**78**	**79**	**62**	**60**	**0.9**	**0.9**

Group 8 - Baby Foods (other than processed cereal based)

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level	Furan level	
								Container A	Container B
							(µg/kg)	(µg/kg)	(µg/kg)
10C-12041	Organic tender carrots & potatoes	Hipp Organic	12/11	L74803 P11/09 436792 436825 436837 436843 436851	Germany or Austria	Cambridge	**17**	**38**	**37**
10C-12042	Creamy parsnip and potato	Cow & Gate Baby Balance	10.11.2012	120301/	EU	Cambourne	**9**	**70**	**72**
10C-12043	Organic squash & sweet potato puree	Plum	03/06/2012	F	EU	Cambridge	**19**	**52**	**53**
10C-12044	Organic parsnip, carrot & Cheddar mash	Plum	11/10/2011	F	France	Cambourne	**3**	**46**	**45**
10C-12045	Organic creamy vegetables with wholemeal noodles	Boots Baby Organic	10/2011	L75905 Nr035319 Nr035331 Nr035423 Nr035530	Germany	London	**12**	**17**	**20**

10C-12046	Organic vegetable & lentil bake	Hipp Organic	06/12	L88062 P09/10 022938 022952 022966 022982	Germany or Austria	London	**6**	**20**	**21**
10C-12047	Pasta and creamy carbonara	Cow & Gate Baby Balance	20.04.2013	117673 A/4032,00	EU	London	**5**	**12**	**12**
10C-12048	Vegetable and chicken casserole	Heinz Mum's Own Recipe	05/2012	8356 0328 C	EU	London	**8**	**38**	**48**
10C-12049	Organic mixed vegetable medley	Hipp Organic	06/12	L93725 P12/10 055791 055865 055902 055909	Germany or Austria	London	**8**	**22**	**23**
10C-12050	Spaghetti bolognese	Heinz Mum's Own Recipe Little Bites	03.2012	None declared	EU	London	**13**	**39**	**48**
10C-12051	Spaghetti bolognese	Cow & Gate Little Steamed Meals	21/01/2012	AT	EU	London	**20**	**36**	**36**
10C-12052	Organic lasagne	Hipp Organic	14.11.11	L96284	Austria	London	**7**	**32**	**17**
10C-12053	Organic wholegrain pasta and pea pesto	Organix	06.04.2012	L 2721XOF:008-1 0801	Spain	London	**8**	**39**	**39**
10C-12054	Organic vegetable bake with lentils	Ella's Kitchen	DEC 2011	L0342 LB	EU	Cambridge	**25**	**78**	**73**
10C-12055	Organic root vegetable and beef stew	Asda Little Angels	19 01 2012	-2	UK	Cambridge	**10**	**40**	**54**
10C-12056	Organic pasta pomodoro	Baby Zilli	21 12 2011	-1	UK	Cambridge	**16**	**52**	**53**
10C-12057	Organic root vegetable and beef ragout	Plum	11/12/2011	None declared	France	Newmarket	**17**	**43**	**70**
10C-12058	Organic carrot, parsnip and beef hash	Organix	25.11.2012	L 3093XT3:006-1 0901	Spain	Cambridge	**27**	**30**	**28**
10C-12059	Organic apple, pork and root vegetable casserole	Organix	22.12.2012	L 3094XL7:009-1 0901	Spain	Cambridge	**20**	**34**	**35**
10C-12060	Chicken and parsnip bake	Heinz Mum's Own Recipe	03/2012	8378 B 0350	EU	Cambridge	**15**	**45**	**47**

Group 9 – Processed cereal baby foods

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	RETAILER ADDRESS	Acrylamide level (µg/kg)
10C-12061	Pure baby rice	Heinz First Food	1ST JUN 2012	L10342KR001	England	Cambridge	**16**
10C-12062	Creamy oat porridge	Heinz Breakfast	1ST MAY 2012	L10313KR001	England	Cambridge	**7**
10C-12063	Pure baby rice	Cow & Gate Baby Balance	04/12/2012	0000002506 0000002513 0000002520 0000002527 0000002534	EU	Cambridge	**10**
10C-12064	Multigrain banana porridge	Cow & Gate Baby Balance	29/11/2012	0000012437 0000012443 0000012449	EU	Cambridge	**14**
10C-12065	Farley's rusks original	Heinz	01.06.2012	0348	England	Cambourne	**40**
10C-12066	Organic fruit & porridge	Boots Baby Organic	06.12.11	L 490	Switzerland	London	**13**
10C-12067	Organic creamy porridge	Hipp Organic	10.01.2012	11.10.2010 412 A 6022100	Croatia	London	**11**
10C-12068	Organic baby rice	Hipp Organic	28.03.2012	6061090 392 B 28.09.2010	Croatia	London	**36**
10C-12069	Organic ultimate four grain porridge	Plum	11.12.11	L-15295	Germany	Newmarket	**22**
10C-12070	Organic apple and ginger cookies	Ella's Kitchen	27 07 2011	135301 10	EU	Cambridge	**108**
10C-12071	Banana finger biscotti	Heinz Biscotti	30/11/11	0335 1A	Italy	Cambridge	**598**
10C-12072	Organic carrot & pumpkin rice cakes	Hipp Organic Little Nibbles	23 06 2011	L230611 B	Belgium	Cambridge	**49**
10C-12073	Vanilla cookies	Heinz First Steps	31/12/11	L0340 1	EU	Cambridge	**32**
10C-12074	Organic soft rusks	Organix Finger Foods	19 OCT. 2011	110303	Belgium	Cambridge	**35**
10C-12075	Organic gingerbread men	Organix Goodies	03.01.2012	L003 B	Germany	Cambridge	**139**
10C-12076	Multigrain breakfast	Aptamil	20.09.2011	71226	EU	Newmarket	**6**

10C-12077	Breakfast wheaty biscuits	Cow & Gate Sunny Start	19/12/2011	UK4	UK	Newmarket	**82**
10C-12078	Organic spelt fingers with pomegranate	Plum	05/08/2011	A	Germany	Newmarket	**15**
10C-12079	Organic four grain cereal	Organix	MARCH 12	00920-A	Spain	Newmarket	**68**
10C-12081	Organic apple and orange soft oaty bars	Organix Goodies	DEC 11	1/005	UK	Cambourne	**3**

Group 10 - Other products

Group 10-Vegetable Crisps

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level	Furan level	
								Packet A	Packet B
							(µg/kg)	(µg/kg)	(µg/kg)
10C-11985	Hand cooked vegetable crisps	Tyrrell's	04 04 11	10333 2	England	Newmarket	**1330**	**17**	**15**
10C-11986	Vegetable hand-cooked crisps	Asda Extra Special	12-MAR-11	0322 C2	Wales	Leicester	**3972**	**22**	**19**

Group 10-Prefabricated Potato Snacks

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level	Furan level	
								Packet A	Packet B
							(µg/kg)	(µg/kg)	(µg/kg)
10C-11942	Pringles original savoury snack	Pringles	11/2011	L0230275520 1948	Belgium	Birmingham	**443**	**28**	**27**
10C-11943	Teddy shaped potato snack - 6 pack	Pom-bear	02 APR 11	03K1	None declared	Birmingham	**285**	**11**	**12**

Group 10-Canned Prunes

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level	Furan level	
								Can A	Can B
							(µg/kg)	(µg/kg)	(µg/kg)
10C-12136	Prunes in syrup	Tesco	FEB 2013	1038 L12.7 PRY V9	UK	Congleton	**247**	**38**	**38**
10C-12137	Californian prunes in fruit juice	Sainsbury's	FEB 2013	1039 L12.8 07S V2	UK	Cambridge	**362**	**42**	**54**

Group 10 - Popcorn

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level	Furan level	
								Packet A	Packet B
							(µg/kg)	(µg/kg)	(µg/kg)
10C-11987	Sweet popcorn	Butterkist Cinema	06 2011	L41 0342	UK	Cambridge	**205**	**56**	**49**
10C-11988	Sweet microwave popcorn	Popz	06.12.2012	06.12.20 10	None declared	Cambridge	**451**	**127**	**109**

Group 10 - Tortila corn chips

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level [	Furan level	
								Packet A	Packet B
							(µg/kg)	(µg/kg)	(µg/kg)
10C-11989	Cool original flavour corn chips	Doritos	26 03 11	GBC 110 353 2054A	None declared	Stockport	**79**	**21**	**-**
10C-11990	Tortilla chips	Tesco Value	12 MAR 11	0 3517A C	UK	Cambridge	**127**	**17**	**17**

Group 10 - Potato products (Home cook)

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	USE BY DATE	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-11933	Roast potatoes	Sainsbury's	02DEC	Not applicable	BU4 L4	Packed in the UK using British potatoes	Edinburgh	**346**
10C-11937	Crispy potatoes	Sainsbury's	Not applicable	APR/2012	C70 283	Netherlands	Cambridge	**656**
10C-11939	Roast potatoes	Asda	Not applicable	28 OCT 2011	C0301 4 EPM	UK	Edinburgh	**44**
10C-11944	Micro chips	McCain	Not applicable	AUG 2011	S 10 11 10 2	British potatoes	Edinburgh	**327**
10C-12114	Roast potatoes	Sainsbury's	15MAR	None declared	BU4 L4	UK	Cambridge	**716**
10C-12118	Crispy potatoes	Sainsbury's	None declared	Jul/2012	9 1 027 0314	Netherlands	Cambridge	**1604**
10C-12130	Oven cook roast potatoes	Asda	None declared	10 DEC 2011	C0344 4 EPM	UK	Cambridge	**107**
10C-12135	Micro chips	McCain	None declared	NOV 2011	S 07 02 11 2	British potatoes	Cambourne	**328**

Group 10 - Prefabricated potato (Home cook)

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-11938	Potato waffles - 12	Birds Eye	05 2012	L0317SL124	Not declared	Edinburgh	**108**
10C-11940	Smiles	McCain	04/2012	W 21 10 2010 2 A	Not declared	Edinburgh	**18**
10C-12129	Potato waffles - 12	Birds Eye	08 2012	L1054BL124	Not declared	Cambridge	**75**
10C-12131	Smiles	McCain	06/2012	W 17 12 2010 1B	Not declared	Newmarket	**73**

Group 10 – Cakes

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12031	Chocolate flavoured sponge covered with milk chocolate	Cadbury Mini Rolls	23 FEB	J349 N A	None declared	Cambourne	**15**
10C-12032	Chocolate chunk muffins	Asda	18 JAN 11	SBL0289 M3	None declared	Cambridge	**12**
10C-12033	Chocolate slices	Mr Kipling	31 JAN	J004 E82	UK	Cambridge	**25**
10C-12034	Tea loaf	Yorkshire Tea	07 FEB 11	10-347-08	None declared	Cambridge	**29**
10C-12035	Jamaica ginger cake	McVitie's	22 MAR 11	F2Y	UK	Cambridge	**86**
10C-12036	Sweet pastry case	Morrisons The Best	17.11.2011	321	France	Cambourne	**18**
10C-12037	All-butter pastry cases	Asda Extra Special	02.12.2011	336	France	Cambridge	**57**
10C-12038	Savoury puff pastry cases	Marks & Spencer	27/07/2011	Display until 13/07/2011 H10329035	France	Cambridge	**51**
10C-12039	Savoury pastry case	Sainsbury's	13 MAY 11	1021A	UK	Cambridge	**5**
10C-12040	All butter pastry cases	Tesco Finest	08.2011	[2008]653]	Poland	Cambridge	**16**

Group 10 - Cereal bars and Granola

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12080	Cranberry and apricot granola	The Oat-So-Good Company	08FEB2012	B080211	None declared	Cambridge	**116**
10C-12082	Crunchy granola bars - oats & honey	Nature Valley	18/11/2011	L2501637254	Spain	London	**259**
10C-12083	Prebiotic seed & oat granola	Marks & Spencer	JUN 2011	0349	UK	Cambridge	**83**
10C-12084	Wholegrain oat cereal bars - butterscotch	Jordans	21 08 11	1020/2	UK	Cambridge	**82**

Group 10 - Cocoa

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12087	Organic cocoa	Green & Black's Organic	JAN 2013	L1006	EU	London	**176**
10C-12088	Bournville cocoa	Cadbury	01 2013	1018X	None declared	London	**707**

Group 10 - Chocolate

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12138	Smooth milk chocolate	Galaxy	06/11/11	W06UG2#0	None declared	Cambridge	**24**

Group 10 - Canned Black Olives

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12145	Sliced black olives in brine	Tesco	OCT 2012	0301	Spain	Cambridge	**884**

Group 10 - Ethnic Foods

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12139	Papadum	Perfect Bite	None declared	None declared	None declared	London	**120**
10C-12140	Papadam	Fardeen	None declared	None declared	None declared	London	**53**
10C-12141	Onion bhaji	Perfect Bite	None declared	None declared	None declared	London	**72**
10C-12142	Onion bhaji	Fardeen	None declared	None declared	None declared	London	**82**
10C-12143	Pancake rolls	Rice House	None declared	None declared	None declared	London	**25**
10C-12144	Crispy pancake roll	The Odeon	None declared	None declared	None declared	London	**34**

Group 10-Dried Fruit

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12146	Soft prunes	Crazy Jack Organic	MAR 2012	L0 333 H0 61	Produce of various countries Packed in the UK	Cambridge	**49**
10C-12147	Dates without stones	Whitworths	MAR 2012	L0344A 740 2	Produce of more than one country Packed in the UK	Cambridge	**68**

Group 10 - Novelty Gingerbread

SAMPLE CODE	PRODUCT DESCRIPTION	BRAND	BEST BEFORE DATE	BATCH CODE	DECLARED COUNTRY OF ORIGIN	UK TOWN WHERE PURCHASED	Acrylamide level (µg/kg)
10C-12085	36 mini gingerbread men mini bites	Asda Bakery	14 MAR	None declared	UK	London	**443**
10C-12086	Gingerbread butterfly	Waitrose Patesserie	None declared	Date sold 28/02/11	UK	Newmarket	**51**

Appendix 6 - Comments from Brand Owners

United Biscuits

United Biscuits (UB) recognises the concern over acrylamide in a wide variety of food and drinks – both home prepared and manufactured - and we are continuously testing and applying approaches to minimise levels of acrylamide in our products.

Last Autumn, we implemented an improved recipe for McVitie's Ginger Nuts which reduced acrylamide levels in the biscuit by around 70%.

It is important to emphasise that levels of acrylamide formation in foods based on natural commodities, like crisps, are also dependent on factors such as harvest season and climatic conditions. These factors have significantly contributed to the fluctuating levels of acrylamide in McCoy's samples taken by the FSA in the past, with earlier reports indicating samples as low as 248ppb (parts per billion).

We will continue to research methods to consistently minimise acrylamide levels, while maintaining the quality and great taste of our products and meeting consumer expectations.

Nestle UK Ltd

It is in the interests of the food industry to ensure that products are produced in such a way that the formation of acrylamide is minimized, whilst maintaining product quality and safety. Nestlé is taking a number of actions in this direction, and has funded several research projects aimed at understanding the formation of acrylamide as well as devising strategies for mitigation. These studies have helped to provide the basis for developing the *Food Drink Europe* (formerly the CIAA) "Acrylamide Toolbox" that defines concrete measures to reduce acrylamide in certain food categories. However, so far there are technical barriers for eliminating acrylamide in coffee, which is clearly stipulated in the Toolbox. Nestlé, in collaboration with other members of the *European Coffee Federation* and external scientists, has been working for a number of years on different approaches to reduce the acrylamide levels in coffee. Despite these efforts, and despite all the other global research efforts in this field, it is not yet technically possible to reduce the acrylamide levels in coffee without impacting the quality of the products.

It is important to note that there is currently no scientific evidence to suggest that any particular product has any negative impact on people's health in the context of acrylamide exposure. Acrylamide is found in such a wide range of cooked foods that a whole-diet approach is required to meaningfully reduce human exposure to acrylamide.

The safety and quality of its products is a non-negotiable priority for Nestlé.