

FOOD SURVEY INFORMATION SHEET

January 2017

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

REPORT COVERING SAMPLING OF ACRYLAMIDE & FURAN 2014 - 2015

Summary

- This Food Surveillance Information Sheet reports the results of acrylamide and furan levels in a range of UK retail foods obtained over the period January 2014-November 2015.
- The total number of retail products sampled during the survey was 526 and represented the food groups as specified in European Commission Recommendation [\(2010/307/EU\)](#)¹ on the monitoring of acrylamide in food. 518 products were analysed for acrylamide and 250 were analysed for furan.
- The number of products found to contain acrylamide levels that exceeded the 'indicative value' (IV) for their food group was 15 in 2014 and 14 in 2015. These exceedances are based on the European Commission Recommendation [\(2013/647/EU\)](#)². Where an acrylamide level has exceeded an IV, the FSA has asked the relevant local authority to investigate, however, an exceedance does not constitute an identified health risk or legislative non-compliance and no enforcement action is required.
- For some key food categories, observed trends indicate there is a reduction in acrylamide levels. This only relates to the products sampled and may not be completely representative of the UK market.
- The results from this UK survey have been sent to the European Food Safety Authority (EFSA)³ for collation with other Member States' survey data to be used for trend analysis and exposure assessment across European countries. EFSA will use the furan data to estimate consumer exposures and support a further risk assessment.

¹ European Commission Recommendation on the monitoring of acrylamide levels in food [2010] OJ L137/8

² European Commission Recommendation on investigations into the levels of acrylamide in food [2013] OJ L301/17

³ 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.

Background

1. Acrylamide and furan are chemical substances produced naturally when some foods are subjected to high temperatures during cooking (including home-cooking) and processing. In June 2015, EFSA published its first full [risk assessment](#) of acrylamide in food and reconfirmed previous evaluations that acrylamide in food potentially increases the risk of developing cancer for consumers in all age groups. EFSA has previously published information on furan in food with regard to occurrence and exposure and further information can be found at: <http://www.efsa.europa.eu/en/press/news/datex110901>.
2. The Food Standards Agency (FSA) consider that exposure to these process contaminants should be as low as reasonably practicable (ALARP). To help try and achieve this goal and gain further information, FSA in addition to carrying out other studies on acrylamide such as total dietary exposure and acrylamide in home cooked food, is also working with the European Commission and stakeholders from industry on ways to further reduce acrylamide in food.

Acrylamide

3. Acrylamide is formed when foods containing the natural amino acid asparagine and sugars are heated at temperatures greater than 120°C. Although acrylamide does not occur in such foods subjected to lower temperatures and relatively short process times e.g. boiled potatoes, it has been found in a wide range of home-cooked and processed foods, including potato crisps, French fries, bread, crispbreads and coffee.
4. In 2011 the EU and Member States agreed to establish [indicative values](#)⁴ for acrylamide. Indicative values are intended as a trigger to initiate investigations by local authorities into food business operators' understanding of acrylamide and any action they have taken to mitigate its production. Exceedence of an 'IV' does not trigger enforcement action. In 2013 the indicative values previously introduced in 2011 were superseded by those in European Commission Recommendation [\(2013/647/EU\)](#)². Further information, including an acrylamide "toolbox" developed by FoodDrinkEurope (FDE) providing guidance to industry on practical measures to reduce acrylamide in various types of foods, can be found at: http://ec.europa.eu/food/safety/chemical_safety/contaminants/catalogue/acrylamide_en.htm.
5. The European Commission and Member States are discussing future risk management measures to find a workable regulatory framework for acrylamide.

⁴ European Commission Recommendation on investigations into the levels of acrylamide in food C(2010) 9681

Furan

6. 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 a high temperature heat treatment (e.g. roasting, frying, canning etc.).
7. 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.

European Commission

8. This survey was conducted in response to two European Commission Recommendations for pan-European activity on process contaminants: (i) European Commission Recommendation [\(2010/307/EU\)](#)¹ 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 [\(2007/196/EC\)](#)⁵, to monitor the occurrence levels of furan in foodstuffs.

EFSA

9. This acrylamide and furan data have been submitted to the European Food Safety Authority (EFSA). EFSA collates the acrylamide results with those from other Member States and, in the case of furan, these data will be used by EFSA as the basis of developing a risk assessment.

FSA Surveys

10. Information and results for all previous surveys can be accessed by clicking on the link: <https://www.food.gov.uk/acrylamide>

⁵ European Commission Recommendation on the monitoring of the presence of furan in foodstuffs [2007] OJ L88/56

Methodology

Sampling

11. A detailed sampling plan was agreed with Ventress Technical Limited (Ventress) who 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.

12. A total of 526 samples were purchased to cover the food groups in line with European Commission Recommendation (EU) No. 2010/307.

Analyses

13. The analytical contractor, Premier Analytical Services (PAS) worked closely with Ventress to arrange the transfer of 526 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 accompanying contractor's report.

Results

14. A total of 526 samples were received by PAS over the period January 2014 – November 2015 for the analysis of acrylamide and furan.

15. Samples identified for home-cooking were cooked according to manufacturers' guidelines prior to analysis. As furan is highly volatile, samples requiring furan analysis were tested as received and as consumed to allow for any losses during preparation.

Acrylamide

A total of 518 samples were analysed for acrylamide. A summary of the acrylamide concentrations (mean and range) by product category is shown in Table 1.

Table 1 - Summary of acrylamide concentrations in each product category/sub-category

Food category / sub category ^a	Description	Sampling date ^b	n	Acrylamide (µg/kg)					n>IV
				mean	min	max	SE	IV ^c	
1	French fries sold as ready to eat	2014	40	157	12	587	21	-	-
		2015	40	167	34	472	17	-	-
	<i>1.1 French fries from fresh potatoes</i>	<i>Mar-14^b</i>	<i>20</i>	<i>186</i>	<i>29</i>	<i>587</i>	<i>37</i>	<i>600</i>	<i>0</i>
		<i>Mar-15^b</i>	<i>20</i>	<i>179</i>	<i>34</i>	<i>472</i>	<i>28</i>	<i>600</i>	<i>0</i>
		<i>Nov-14^b</i>	<i>20</i>	<i>129</i>	<i>12</i>	<i>326</i>	<i>19</i>	<i>600</i>	<i>0</i>
		<i>Nov-15^b</i>	<i>20</i>	<i>154</i>	<i>41</i>	<i>362</i>	<i>20</i>	<i>600</i>	<i>0</i>

2	Potato crisps and potato-based crackers	2014	27	779	88	2542	122	-	-	
		2015	28	691	151	1909	79	-	-	
	2.1 <i>Potato crisp from fresh potatoes</i>	Mar-14 ^b	10	861	329	1873	157	1000	4	
		Mar-15 ^b	11	896	302	1909	151	1000	4	
		Nov-14 ^b	10	551	126	1010	83	1000	1	
		Dec-14 ^b	1	673	-	-	-	1000	0	
		Nov-15 ^b	11	517	166	517	65	1000	0	
	2.4 <i>Potato-based crackers</i>	2014	6	1039	88	2542	467	1000	2	
		2015	6	633	151	1221	179	1000	2	
	3	Pre-cooked French fries, potato products for home cooking	2014	29	256	6	1156	54	-	-
			2015	30	214	4	1345	55	-	-
		3.1 <i>Fries baked in the oven (oven fries)</i>	Mar-14 ^b	6	405	103	1156	157	-	-
Mar-15 ^b			6	270	18	946	147	-	-	
Nov-14 ^b			6	87	13	175	26	-	-	
Nov-15 ^b			6	156	156	489	68	-	-	
3.2 <i>Deep fried fries</i>		Mar-14 ^b	2	62	19	104	-	-	-	
		Mar-15 ^b	2	21	9	32	-	-	-	
		Nov-14 ^b	2	11	6	15	-	-	-	
		Nov-15 ^b	2	20	4	36	-	-	-	
3.3 <i>Unspecified pre-cooked French fries, potato products for home cooking</i>		Mar-14 ^b	6	477	92	1116	143	-	-	
		Mar-15 ^b	7	342	44	1345	175	-	-	
		Nov-14 ^b	7	211	23	522	62	-	-	
		Nov-15 ^b	7	199	10	616	79	-	-	
4		Soft bread	2014	20	14	4	37	2	-	-
			2015	25	22	4	136	5	-	-
		4.1 <i>Wheat based bread</i>	2014	20	14	4	37	2	80	0
			2015	24	23	4	136	6	80	1
	4.2 <i>Soft bread other than wheat based</i>	2014	0	-	-	-	-	150	0	

	<i>bread</i>								
		2015	1	12	-	-	-	-	-
5	Breakfast cereals (excluding porridge)	2014	22	174	41	541	26	-	-
		2015	22	146	21	484	23	-	-
5.1	<i>Maize, oat, spelt, barley and rice based products</i>	2014	4	77	58	94	7	200	0
		2015	4	90	69	124	12	200	0
5.3	<i>Bran products and whole grain cereals, gun puffed grain</i>	2014	18	196	41	541	29	400	2
		2015	18	158	21	484	27	400	1
6	Biscuits, crackers, crisp bread and similar (excluding pastry and cake)	2014	24	347	27	1324	67	-	-
		2015	30	299	26	2576	89	-	-
6.1	<i>Crackers with the exception of potato based crackers</i>	2014	6	233	90	544	73	500	1
		2015	6	229	71	583	82	500	1
6.2	<i>Crisp bread</i>	2014	3	210	107	327	64	450	0
		2015	3	132	40	252	63	450	0
6.3	<i>Biscuits and wafers</i>	2014	8	301	30	1056	114	500	1
		2015	11	307	33	1055	96	500	2
6.4	<i>Gingerbread</i>	2014	4	803	360	1324	199	1000	1
		2015	4	120	26	267	53	1000	0
6.5	<i>Products similar to the other products in this category</i>	2014	3	227	27	407	110	500	0
		2015	6	557	59	2576	405	500	1
7	Coffee and coffee substitutes	2014	20	455	7	940	70	-	-
		2015	20	411	25	1087	66	-	-
7.1	<i>Roasted coffee (dry)</i>	2014	8	222	157	271	14	450	0
		2015	8	168	128	235	13	450	0
7.2	<i>Instant coffee (dry)</i>	2014	6	820	629	940	47	900	2

		2015	6	629	574	742	26	900	0	
	7.3	<i>Substitute coffee (dry) mainly based on cereals</i>	2014	4	560	310	896	136	2000	0
		2015	4	711	323	1087	167	2000	0	
	7.4	<i>Other coffee substitutes (dry)</i>	2014	2	81	7	155	-	4000	0
		2015	2	136	25	247	-	4000	0	
8		Baby foods , other than processed cereal based foods	2014	20	12	3	27	1	-	-
			2015	22	13	3	60	3	-	-
	8.1	<i>Baby foods not containing prunes</i>	2014	20	12	3	27	1	50	0
		2015	20	13	3	60	3	50	1	
	8.2	<i>Baby foods, containing prunes</i>	2014	0	-	-	-	-	-	-
		2015	2	7	5	9	-	80	0	
9		Processed cereal-based foods for infants and young children	2014	20	60	4	577	29	-	-
			2015	21	31	4	218	11	-	-
	9.1	<i>Biscuits and rusks for infants and young children</i>	2014	8	65	4	165	20	200	0
		2015	7	47	7	138	17	200	0	
	9.2	<i>Other processed cereal-based foods for infants and young children</i>	2014	12	56	4	577	47	50	1
		2015	14	23	4	218	15	50	1	
10		Other products, based on cereals, potatoes, cocoa and coffee	2014	17	135	6	425	29	-	-
			2015	17	189	4	735	54	-	-
	10.2	<i>Cake and pastry</i>	2014	6	114	6	332	48	-	-
		2015	6	82	4	227	33	-	-	
	10.3	<i>Savoury snacks</i>	2014	2	72	18	126	-	-	-
		2015	2	78	77	80	-	-	-	
	10.4	<i>Other products, based on cereals</i>	2014	5	153	7	233	41	-	-
		2015	4	287	5	628	129	-	-	
	10.5	<i>Other products, based on potatoes</i>	2014	0	-	-	-	-	-	-

		2015	1	735	-	-	-	-	-
	10.6 Other products, based on cocoa	2014	4	175	22	425	88	-	-
		2015	4	170	21	464	100	-	-
11	Other products, not based on cereals, potatoes, cocoa and coffee	2014	12	436	12	1324	125	-	-
		2015	12	392	9	884	95	-	-
	Vegetable crisps	2014	4	803	360	1324	199	-	-
		2015	4	727	514	884	78	-	-
	Black olives, canned	2014	2	650	269	1031	-	-	-
		2015	2	525	331	720	-	-	-
	Prunes, canned	2014	2	189	82	295	-	-	-
		2015	2	248	72	424	-	-	-
	Liquorice candies	2014	2	157	139	175	-	-	-
		2015	2	51	35	68	-	-	-
	Dates / prunes	2014	2	14	12	16	-	-	-
		2015	2	72	9	134	-	-	-

^a EFSA categorisation for occurrence data submission; ^b products prepared from seasonal potatoes; ^c EC Indicative Values

Furan

16.A total of 250 samples was analysed for furan. A summary of the furan concentrations (mean and range) by product category is shown in Table 2.

Table 2 - Summary of Furan concentrations (mean and range) as received / consumed by product category

Food category ^a	Description	Sampling date	n	Furan (µg/kg)			
				Mean ^b	min	max	SE
5	Breakfast cereals (excluding porridge)	2014	24	38	<10	263	12
		2015	24	50	<10	382	17
6	Biscuits, crackers, crisp bread and similar (excluding pastry and cake)	2014	24	34	<10	135	8

		2015	30	32	N.D.	167	8
7	Coffee and coffee substitutes	2014	20	1562	N.D.	5009	366
		2015	20	1612	N.D.	5242	396
	Coffee and coffee substitutes, as consumed	2014	20	38	N.D.	137	11
		2015	20	50	N.D.	197	16
	<i>Roast</i>	<i>2014</i>	<i>8</i>	<i>3347</i>	<i>1786</i>	<i>5009</i>	<i>333</i>
		<i>2015</i>	<i>8</i>	<i>3544</i>	<i>1767</i>	<i>5242</i>	<i>388</i>
	<i>Roast, as consumed</i>	<i>2014</i>	<i>8</i>	<i>92</i>	<i>10</i>	<i>137</i>	<i>14</i>
		<i>2015</i>	<i>8</i>	<i>119</i>	<i>25</i>	<i>197</i>	<i>22</i>
	<i>Instant</i>	<i>2014</i>	<i>6</i>	<i>656</i>	<i>122</i>	<i>1296</i>	<i>204</i>
		<i>2015</i>	<i>6</i>	<i>556</i>	<i>156</i>	<i>1329</i>	<i>166</i>
	<i>Instant, as consumed</i>	<i>2014</i>	<i>6</i>	<i>5</i>	<i>1</i>	<i>9</i>	<i>1</i>
		<i>2015</i>	<i>6</i>	<i>5</i>	<i>2</i>	<i>10</i>	<i>1</i>
	<i>Other</i>	<i>2014</i>	<i>6</i>	<i>87</i>	<i><40</i>	<i>231</i>	<i>36</i>
		<i>2015</i>	<i>6</i>	<i>92</i>	<i><40</i>	<i>258</i>	<i>38</i>
	<i>Other, as consumed</i>	<i>2014</i>	<i>6</i>	<i>1</i>	<i><1</i>	<i>3</i>	<i><1</i>
		<i>2015</i>	<i>6</i>	<i>1</i>	<i><1</i>	<i>4</i>	<i>1</i>
8	Baby foods, other than processed cereal based foods	2014	20	31	6	76	4
		2015	22	24	3	81	4
10	Other products, based on cereals, potatoes, cocoa and coffee	2014	9	21	N.D.	77	9
		2015	2	143	82	205	-
	<i>Cereal bars</i>	<i>2014</i>	<i>2</i>	<i><10</i>	<i><10</i>	<i><10</i>	<i>-</i>
		<i>2015</i>	<i>0</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
	<i>Cocoa powder</i>	<i>2014</i>	<i>3</i>	<i><10</i>	<i><10</i>	<i>26</i>	<i>9</i>
		<i>2015</i>	<i>0</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
	<i>Corn / Tortilla chips</i>	<i>2014</i>	<i>2</i>	<i>25</i>	<i>18</i>	<i>32</i>	<i>0</i>
		<i>2015</i>	<i>0</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
	<i>Popcorn</i>	<i>2014</i>	<i>2</i>	<i>56</i>	<i>34</i>	<i>77</i>	<i>-</i>

		2015	2	143	82	205	-
11	Other products, not based on cereals, potatoes, cocoa and coffee	2014	12	11	N.D.	32	3
		2015	2	40	19	60	-
	<i>Canned prunes</i>	2014	2	22	11	32	-
		2015	2	40	19	60	-
	<i>Jams</i>	2014	4	1	<2	3	1
		2015	0	-	-	-	-
	<i>Table olives</i>	2014	2	11	11	11	-
		2015	0	-	-	-	-
	<i>Vegetable crisps</i>	2014	4	15	12	19	2
		2015	0	-	-	-	-

^a [EFSA](#) categorisation for occurrence data submission; ^b Lower bound concentrations (values < LOD = 0)

17. All brand owners have received their own results and have been given the opportunity to comment. No comments for publication have been received. Individual analytical results for each product and category including brand names, batch numbers and best before dates, (where available), can be found in the accompanying contractor's report.

Conclusion

18. The results do not increase concern about the risk to human health and the FSA has provided advice to consumers: <https://www.food.gov.uk/acrylamide>. As furan is highly volatile, levels of furan in some processed foods can be minimised by heating and stirring the contents of canned and jarred foods in an open saucepan. Furan levels in packets that are repeatedly opened and closed during use such as packs of roast coffee may also help to reduce the levels of furan during the shelf life of the product. Furan will naturally evaporate from hot food or drink in an open container.

19. This survey gives a 'snapshot' of the range of levels of acrylamide and furan that may be expected in different types of products on sale in the UK during the 2014-2015 sampling period. While the survey results may provide an indication of the levels of acrylamide and furan that consumers may typically be exposed to in certain foods, levels of these process contaminants even in different brands of the same food, can vary depending on raw materials used by the manufacturer and processing conditions. It is therefore not possible to necessarily be able to draw definitive conclusions for individual brands sampled during this survey.

20. Every effort was made to ensure that products to be sampled matched those as sampled previously with regard to brand and retailer. However this was not always possible and therefore, substitute products were sampled where necessary. The 2014-2015 sampling plan was therefore not exactly the same in terms of brands sampled and the number of samples analysed when compared to the earlier FSA acrylamide and furan surveys.
21. The survey does not cover all food prepared in the home, which may include potential major contributors to overall exposure, such as over-cooked dark chips or other potato based foods (fried, roasted or baked). As such, these survey results do not tell us about all the acrylamide or furan that consumers may be exposed to from home-cooking.
22. Although fries and other potato products for home-cooking are covered in the 2014-2015 survey, our analyses have relied upon uniform preparation of products according to the instructions provided on the packaging by the manufacturer and using consistently performing kitchen equipment. This may not be representative of how products are prepared in many homes.
23. The FSA intends to continue to collect further data on acrylamide and furan levels in UK retail foods until Dec 2018.

Summary of Units

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

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

kilogram (kg): one thousand gram

$\mu\text{g}/\text{kg}$: microgram per kilogram

Further information

Further information on this survey can be obtained from:

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Annex 1 – Statistical Trends over time

24. Based on the UK surveillance data obtained during the period 2007-2015, the FSA has modelled acrylamide levels for each food group. To estimate year-to-year differences more accurately, collectors were asked to sample similar products each year. When a sampled product is no longer available, a substitute product is sampled.
25. Table 3 shows the average percentage change in acrylamide between 2007 and 2015 for each food group. Caution is urged in the interpretation of Table 3. The percentage change is not estimated precisely due to the high variation in acrylamide concentration and the small number of products sampled. Furthermore, some groups such as Group 10 contain a diverse range of products.
26. There is strong evidence that acrylamide concentrations in the following groups are lower in 2015 than in 2007.
- Potato crisps and prefabricated potato snacks (Group 2),
 - Pre-cooked French fries/potato products for home cooking (Group 3)
 - Bread (Group 4)
 - Biscuits (Group 6)
 - Roast Coffee (Group 7)
27. For processed cereal-based baby foods (Group 9), there is strong evidence that acrylamide levels increased after 2007, peaked between 2009 and 2012 and since then have decreased. Continuing surveillance until Dec 2018 will add to the dataset and help further inform our statistical modelling.
28. It is not possible to accurately estimate changes in acrylamide levels during the period 2007-2015, or to identify whether FBOs have successfully reduced acrylamide levels in processed food through the application of the FDE toolbox. Many factors can affect final acrylamide levels in foods such as seasonality and climatic effects on the raw materials when they are being grown or that influence how they behave in storage. The observed trends in acrylamide levels relate to the products sampled and may not be completely representative of the UK market.

Table 3 – Adjusted percentage change in acrylamide levels between 2007 and 2015

Food Group	Average % change in acrylamide 2007 to 2015	95% Confidence Interval for Change
1 French fries, sold as ready-to-eat	-5%	-27% to 23%
2 Potato crisps (including prefabricated potato snacks)	-48%	-64% to -24%
3 Pre-cooked French fries/potato products for home cooking (including roast potatoes and prefabricated products)	-55%	-73% to -27%
4 Bread	-30%	-46% to -9%
5 Breakfast cereals	-25%	-48% to 9%
6 Biscuits (including infant biscuits/ rusk alternatives)	-52%	-68% to -28%
7 Roasted coffee (excluding instant coffee and coffee)	-26%	-38% to -12%
8 Jarred baby foods	-18%	-44% to 22%
9 Processed cereal-based baby foods (excluding rusks)	86%	8% to 219%
10 Other products (including instant coffee and coffee alternatives & gingerbread,)	-11%	-85% to 443%
All products	-31%	-39% to -21%