ACRYLAMIDE LEVELS IN FOOD: PASSING THE HOT POTATO
This is a SumOfUs report based on analysis conducted by Changing Markets on acrylamide data found in foodstuffs as reported by Member States to the European Food Safety Authority (EFSA). These data were released to Changing Markets by EFSA in October 2016 following an access to documents request.

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Contaminants are toxic substances that have not been intentionally added to food. These substances may be present as a result of the packaging, handling and distribution processes, environmental contamination, or as in the case of acrylamide, a result of food production. Acrylamide forms when starchy food products are heated up - typically during cooking - at high temperatures and under low moisture conditions.

The presence of acrylamide in food cannot be fully eliminated. However, robust legislation and the application of best practice by food business operators can significantly reduce its levels in food. The European food industry has developed a number of versions of a “toolbox” outlining possible voluntary interventions for reducing acrylamide in food since 2006. In parallel, the European Commission (EC) has put in place non legally-binding recommendations for Member States to regularly test levels of acrylamide present in food as a way of monitoring the application of these measures through a harmonised sampling program.

Moreover, the EC has set a range of indicative values for the levels of acrylamide present in different food groups. These are intended to serve as a benchmark to assess the extent to which the Codes of Practice have been applied. However, a major review published by the European Food Safety Agency (EFSA) in 2015 showed that the voluntary measures had not led to a reduction in the level of acrylamide found across food groups other than potato crisps.

The analysis of acrylamide levels found in foodstuffs on the European market presented here includes newly released EFSA data for the period between 2013-2014. The results confirm that the current approach, which relies on the voluntary application of the codes of practice by the industry, has not led to a reduction in acrylamide levels found in foods. In addition, it does not provide sufficient protection to consumers, as food samples found to contain acrylamide at levels many times greater than the EC’s benchmark continue to be placed on the market.

Finally, the Commission has put forward a proposal that would essentially extend this failed approach by making the application of the code of practice mandatory while failing to set enforceable legally-binding limits for acrylamide in line with achievable reductions. The report ends with recommendations as to how the proposal can be strengthened in a way that will lead to a significant reduction of acrylamide levels in food sold in Europe.

Key findings:

- There continues to be no substantial trend across food groups towards lower levels of acrylamide. While trend analysis across major food categories suggests a slight downward trend for acrylamide levels in potato crisps and snacks, crisp bread, biscuits and crackers, acrylamide levels in French fries, gingerbread and roasted coffee suggest concentrations are unchanged or increasing;

- A very significant proportion of food products placed on the market (2,200 or 12% of the total) presented unacceptably high levels of acrylamide above the current benchmark set by the European Commission. The percentage of food samples above the benchmark levels was similar for food samples produced outside and within the European Economic Area;

- The highest acrylamide concentrations at 38,000 and 7,900 μg/Kg were found in a sample of instant coffee in Belgium and a sample of French fries in Denmark. These are 42 and 13 times higher than the current EC benchmark for these products;

- The highest acrylamide concentrations for food products targeted at babies were 1905, 1508 and 582 μg/Kg. These were found in samples of baby rusks, baby foods and in processed cereal baby products taken in Germany, UK and the Czech Republic respectively. These levels are 10, 30 and 12 times higher than the current EC benchmarks for these products. In 2014, 12% and 28% of baby foods and processed cereal foods for infants respectively exceeded the EC benchmark;

- The countries with the largest percentage of samples with levels of acrylamide above the current EC benchmark were: Greece (75%), Estonia and Sweden (20%), Belgium and Ireland (18%), Italy (17%), Norway (16%), Austria (15%), Spain and Finland (14%).
1. INTRODUCTION

In 2002, Swedish scientists made a significant discovery when they found that acrylamide, a chemical in tobacco smoke and used in industrial processes such as water treatment and papermaking, was present in everyday foods including bread, French fries, crisps and other potato snacks, coffee, cocoa products, biscuits, breakfast cereals and baby foods.

The presence of acrylamide, a probable carcinogen, is of concern because it is prevalent in many staple foods. For example, the average European consumes between 40–140 kg of potatoes, 50 kg of bread and pastries, 20 kg of confectionery products such as chocolate and biscuits, 4 kg of roasted coffee, 3.6 kg of savoury snacks and 1–8 kg of breakfast cereals per year. Experts estimate that acrylamide is present in 40% of all the calories ingested in the average diet. This is why health authorities agree that keeping acrylamide levels in food as low as reasonably achievable (ALARA) is needed.

Acrylamide in food is recognised as a major concern for public health by international organisations such as the World Health Organization (WHO) and EFSA. Indeed, exposure to acrylamide has been classified by the United Nations International Agency for Research in Cancer as a “probable carcinogen”, similarly to other toxic substances such as heavy metals, nitrates, glyphosate and bitumen.

As well as increasing the risk of cancer in consumers of all ages, acrylamide is also believed to be harmful to the nervous system. In particular, EFSA and its French counterpart have highlighted the exposure of babies and young children to acrylamide as being of particular concern.

Owing to its toxicity, EU legislation exists to reduce exposure to acrylamide from industrial sources (i.e. water treatment, cosmetics, packaging, etc.) through the setting of maximum legal limits. However, there are no restrictions on the presence of acrylamide in foods, which is believed to be by far the largest source of exposure to acrylamide for non-smokers. Instead, EU regulators have taken a soft approach based on the monitoring of acrylamide levels found in foods and the setting of indicative values, as a benchmark to verify an effective application of practices to reduce acrylamide levels.

However, the indicative values are so high that they simply serve to lock in low ambition. Indeed, investigations conducted by Member States highlight that food industry awareness of what constitutes best practice is very variable, with many operators completely unaware of the risks associated with acrylamide and many others refusing to apply preventative measures altogether for a range of reasons (i.e. lack of legal obligation, economic costs or lack of experience).

EFSA’s scientific opinion published in 2015 confirms that the voluntary approach has failed, as there is no evidence that levels of acrylamide in most food groups are decreasing. Public pressure following the publication of EFSA’s opinion led to Denmark adopting indicative values lower than the EC benchmark as the later were not considered to provide sufficient protection to consumers. This has also led the EC to start discussions on a proposal to introduce soft regulatory measures mandating the implementation of codes of practice developed by the different industry sectors themselves.

The proposed measures, supported by the food industry, are considered insufficient to protect consumers and unlikely to be effective by civil society organisations and food safety NGOs.

2. KEY FACTS ABOUT THE EU FOOD SUPPLY CHAIN

The food supply chain includes all activities required to bring food from the farm to our table. This involves a very diverse range of market players associated with the different stages of cultivation, production, processing, distribution and consumption.

In the context of reducing acrylamide’s presence in food, a number of effective interventions have been identified at the different stages of the food supply chain ranging from agronomy to final consumer guidance. Key players include farmers, food and drink manufacturers and food service providers.

Laboratory tests show that acrylamide in the diet causes cancer in animals and can damage the DNA. Scientists conclude that acrylamide in food potentially increases the cancer risk for consumer of all ages.

The exposure of some babies and young children to acrylamide gives rise to particular concern, according to EFSA and the French Food Safety Authority (ANSES).
2.1. Farming

There are 12 million farmers at the heart of the EU food supply chain. Family farms are still typical and the average farm size is 15 hectares, about ten times smaller than other developed economies such as the US. Nevertheless, EU agricultural production is the world’s second largest in terms of value after China. EU farming interests are represented by an organisation called COPA-COGECA.

EU cereal production is widespread across Member States, taking up around half of all arable land. The main crops grown are wheat, maize and barley. EU production, which stands at 300MT, is projected to increase and the EU is likely to remain a net exporter of cereals in the coming years. EU potato production stands at 59MT, and is likely to remain a net exporter of potatoes. In contrast, the EU imports almost all of the coffee and cocoa beans that it consumes.

EU agricultural production is the world’s second largest manufacturing sector in the EU with an annual turnover of €1,089 billion, employing over 4.25 million people. There are almost 300,000 companies operating in this sector. The Food and Drink manufacturing sector is represented at EU level by FoodDrinkEurope (FDE).

A specific characteristic of the sector is the wide range of company sizes. The sector is dominated by small and medium enterprises (SMEs), representing 99.1% of all the companies operating in this sector and almost 50% of total turnover. In more detail, 79.8% of all companies are micro- (≤10 employees), 16.3% are small (10-49 employees) and 3.7% are medium (50-249 employees) size enterprises.

By turnover, the largest food and drink production is that of France (€184.5 billion), followed by Germany (€172.2 billion), UK (€120.9 billion) and Spain (€93.4 billion). However, the largest number of companies are found in France (62k), Italy (55k), Spain (28k) and Poland (15k). The ratio between these indicators suggests that the smallest companies are to be found in Italy, Slovenia, Portugal and France (average <10 employees) while the largest ones are in Ireland, Greece, UK, Germany and Slovakia (average >50 employees).

Despite the prominence of small players, the sector also includes some of the largest companies in the world. These include well-known, multi-billion euro brands such as Cargill, PepsiCo, Coca-Cola, Mars, Kraft Heinz, etc. that produce a broad range of food and drink. Top EU companies producing food and drink, with annual sales above €10 billion, include Nestle, Unilever, DANONE and Ferrero.

In terms of trade, the EU remains the global exporter of food and drink products, which have doubled over the past decade to reach €98.1 billion in 2015. The EU’s top export markets for food and drink products are the US, China, Switzerland, Japan and Russia. In contrast, EU imports represented €72.9 billion over the same period, with Brazil, US, Argentina, Switzerland and China as its main trading partners. Major traded food and drink products include chocolate, confectionery, biscuits, food preparations and coffee.

2.2. Food and Drink Manufacturing

The Food and Drink industry sector is the largest manufacturing sector in the EU with an annual turnover of €1,089 billion, employing over 4.25 million people. There are almost 300,000 companies operating in this sector. The Food and Drink manufacturing sector is represented at EU level by FoodDrinkEurope (FDE).

The EU hospitality industry alone, which includes bars, restaurants, hotels, cafes and similar establishments, employs 9.5m people and contributes €11 to the EU economy. The hospitality industry is spread across 1.7 million enterprises and its interests are represented by Hospitality Europe (HOTREC). Major companies in the eating-out sector are represented by Serving Europe, and micro and small enterprises are represented by the European Association of Craft, Small and Medium-Sized Enterprises (UEAPME).

Hospitality enterprises are predominantly of small and medium size. It is estimated that 99% fit into the category of small (<50 employees), with as many as 92% of the total being defined as micro-enterprises (<10 employees).

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Major food and drink corporations are to be found in Italy, Slovenia, Portugal and France (average <10 employees) while the largest ones are in Ireland, Greece, UK, Germany and Slovakia (average >50 employees).

In contrast, there are a number of multi-billion euro players in this sector, including hoteliers such as Accor Hotels, InterContinental, Best Western, Marriott, Hilton, etc. and restaurant chains such as McDonald’s, Burger King, Starbucks, Domino’s Pizza, etc. (represented by Serving Europe).

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2.3. Hospitality and eating-out sectors

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Source: FDE and various.
3. WHAT CAN BUSINESSES DO ABOUT ACRYLAMIDE?

Although the formation of acrylamide in food cannot be completely prevented, research conducted since its discovery in food in 2002 has produced a wealth of knowledge about how responsible food business operators right along the food supply chain can reduce the amount of acrylamide present in the final product.

The effectiveness of these measures is based on influencing the chemical reaction that leads to the formation of acrylamide. They can be divided into three major groups:

- measures aimed at lowering the amount of acrylamide precursors (i.e. sugars and asparagine) in the raw materials;
- measures at different stages of food production, including making modifications to the product’s recipe and controlling conditions during the heating and cooking process;
- measures aimed at advising food service providers and customers on how to avoid further acrylamide formation during the final stages of food preparation.

Using a selection of these measures, which are product specific, food manufacturers have reported acrylamide reduction of up to 95%.

3.1. Measures to reduce the presence of acrylamide in food

3.1.1. Reduce sugars and asparagine (acylamide precursors) in raw materials

The implementation of certain agronomical practices at farm level can have a significant impact on acrylamide formation. For root vegetables, these range from selecting lower sugar tuber varieties. In addition, tubers should be stored and transported under controlled conditions including temperature (below 6°C), humidity and duration to minimise sweetening when maturing (i.e. senescence).

3.1.2. Preventative action at different stages of food production

a) Modify the basic product recipe to inhibit acrylamide formation

A number of changes in the basic product recipe can ultimately lead to significant acrylamide reductions in the final product. These include considerations about the range of secondary ingredients, additives, other agents and enzymes included in the recipe, the degree of acidity and moisture and the preparation method. For example, cutting potatoes in thicker strips leads to reductions in the acrylamide levels of fried products.

b) Control conditions during the heating and cooking process

The length and the temperature of the cooking process is the most critical part of the acrylamide formation process. Food operators can reduce acrylamide formation at this stage through implementing certain processing practices (i.e. blanching and peeling, other treatments of raw materials before cooking, etc.), optimising the cooking conditions (i.e. tight thermal input and moisture controls), monitoring the colour as part of the quality control of the final product (i.e. removing dark products).

3.1.3. Provide preventative advice for further preparation

In the case of certain products where further heating at a business outlet or at home is required, it is also important that specific recommendations are provided by food business operators in order to avoid increasing acrylamide concentration significantly. These may include product cooking instructions (i.e. temperature, cooking method, etc.) on the packaging for the consumer or specific guidance given to employees in the hospitality sector. For professional end users, this may include calibrated equipment (i.e. timers, frying curves, colour grading charts, etc.).

The umbrella bodies for the different sectors apart from COPA-COGECA (i.e. FDE, AIBI, UEAPME, Serving Europe and HOTREC) have included detailed information on the broad range of possible measures to reduce acrylamide levels in food in their respective codes of practice.
the response of food business operators has so far been disappointing. There is no evidence that such measures are being applied effectively as no major changes in acrylamide concentrations across major food groups have been observed.

4. HOW MUCH ACRYLAMIDE IS PRESENT IN OUR FOOD?

Since 2007, most Member States have been taking part in a EU-wide program to monitor the levels of acrylamide found in foods\(^3\). Data for the years 2007-2014, which has been provided by the European Food Safety Authority (EFSA) following an access to documents request, contains information on the acrylamide levels found in over 25,000 food samples\(^4\). As illustrated on the right hand side, a majority of the samples were taken in Germany. Although EFSA has previously published information on trends observed on acrylamide levels, it seems that the analysis of the post-2012 dataset has not yet been made available\(^5\). A few countries publish their own data online, including brand names, while others do not show the same level of transparency.

The analysis of this dataset as conducted by Changing Markets and presented in this report provides a number of important findings.

- There continues to be no substantial trend across food groups towards lower levels of acrylamide. While trend analysis across major food categories suggests a slight downward trend for acrylamide levels in potato crisps and snacks, crisp bread, and biscuits and crackers, acrylamide levels in French fries, gingerbread and roasted coffee suggest concentrations are unchanged or increasing;

- A very significant proportion of food products placed on the market (2,200 or 12% of the total) presented unacceptably high levels of acrylamide above the current benchmark set by the European Commission\(^6\). The percentage of food samples above the benchmark levels was similar for food samples produced outside and within the European Economic Area;

- The highest acrylamide concentrations at 38,000 and 7,900 μg/Kg were found in a sample of instant coffee sampled in Belgium and a sample of French fries sampled in Denmark. These are 42 and 13 times higher than the EC benchmarks for these products;

- The highest acrylamide concentrations on food products targeted at babies were 1905, 1508 and 582 μg/Kg. These were found in samples of baby rusk, baby foods and in processed cereal baby products taken in Germany, UK and Czech Republic respectively. These levels are 10, 30 and 12 times higher than the current EC benchmarks for these products. In 2014, 12% and 28% of baby foods and processed cereal foods for infants respectively exceeded the EC benchmark;

- The countries that had the largest percentage of samples with levels of acrylamide above the current EC benchmark are: Greece (75%), Estonia and Sweden (20%), Belgium and Ireland (18%), Italy (17%), Norway (16%), Austria (15%), Spain and Finland (14%).

5. CONCLUSIONS AND RECOMMENDATIONS

The results of the official monitoring exercise released by EFSA show that a majority of food business operators have not been implementing effectively the range of known tools to reduce the presence of acrylamide in foodstuffs. Follow-up investigations conducted by Member States point towards a range of possible reasons for this failure including the lack of awareness of acrylamide as a food safety issue, unwillingness to cover associated costs, lack of expertise in terms of implementing the changes and ultimately the lack of a legal obligation to do so.

Given the failure of the current voluntary approach, the Commission is now working on a legislative proposal with the aim of reducing the presence of acrylamide in foods. The Commission’s latest proposal includes:

- the introduction of a requirement for food business operators to apply the codes of practice as part of other measures already included under Hygiene legislation\(^7\);

- requirements for food business operators to maintain product testing records to demonstrate that they are applying their codes of practice effectively;

- a set of reference levels (indicative values) for acrylamide levels in food products to serve as a benchmark to verify the effectiveness of the application of the codes of practice;

- an indication that legal limits for specific food products in future may be introduced if businesses fail to apply the codes of practice. The proposal falls short of applying maximum levels for acrylamide in food, which would be in line with the way other contaminants are dealt with and in compliance with the precautionary approach, one of the fundamental legal principles of the EU treaties. This is a missed opportunity that should be rectified.

5.1. Recommendations for improving the Commission’s proposal

In order to ensure the effective and real reduction of acrylamide levels in the majority of food products placed on the EU market, we recommend the following key amendments:

5.1.1. Apply maximum legal limits on the levels of acrylamide in different food groups as is the case with other contaminants

The lack of clearly binding legal limits for acrylamide in food products allows food products with unacceptably high acrylamide levels to continue to be placed on the market, even in the cases where food business operators are found not to be complying with any of the measures outlined in the codes of practice. In addition, the lack of binding levels continues to allow for imported food products to contain high levels of acrylamide, as it is unclear how such food business operators that are outside the EU could be investigated by EU’s food agencies.
### ACRYLAMIDE (AA) CONCENTRATIONS FOUND IN FOODS ON SALE IN THE EU 2007-2014 (μG/KG)

#### BABY FOOD
- **BABY FOODS**: 372 samples, EC indicative value AA 50, Minimum AA 1, Average AA 61, Maximum AA 1508, Maximum value as % of EC Benchmark 3016.
- **CEREAL BASED BABY FOODS**: 228 samples, EC indicative value AA 50, Minimum AA 2, Average AA 73, Maximum AA 582, Maximum value as % of EC Benchmark 1164.
- **BISCUITS AND RUSKS CHILDREN**: 381 samples, EC indicative value AA 200, Minimum AA 3, Average AA 166, Maximum AA 1950, Maximum value as % of EC Benchmark 975.

#### BAKERY
- **SOFT BREAD (OTHER)**: 474 samples, EC indicative value AA 150, Minimum AA 3, Average AA 152, Maximum AA 2565, Maximum value as % of EC Benchmark 1710.
- **SOFT BREAD (WHEAT)**: 350 samples, EC indicative value AA 80, Minimum AA 2, Average AA 56, Maximum AA 910, Maximum value as % of EC Benchmark 1138.
- **SAVOURY AND SWEET BISCUITS**: 2415 samples, EC indicative value AA 500, Minimum AA 2, Average AA 253, Maximum AA 4988, Maximum value as % of EC Benchmark 998.
- **CRISPBREAD**: 961 samples, EC indicative value AA 450, Minimum AA 2, Average AA 228, Maximum AA 2430, Maximum value as % of EC Benchmark 540.
- **GINGERBREAD**: 1677 samples, EC indicative value AA 1000, Minimum AA 4, Average AA 483, Maximum AA 4095, Maximum value as % of EC Benchmark 410.

#### BREAKFAST CEREALS
- **BREAKFAST CEREAL (OTHER)**: 452 samples, EC indicative value AA 200, Minimum AA 2, Average AA 139, Maximum AA 1556, Maximum value as % of EC Benchmark 778.
- **BREAKFAST CEREAL (BRAN/WHOLE)**: 434 samples, EC indicative value AA 400, Minimum AA 12, Average AA 193, Maximum AA 2072, Maximum value as % of EC Benchmark 518.
- **BREAKFAST CEREAL (WHEAT/RYE)**: 70 samples, EC indicative value AA 300, Minimum AA 41, Average AA 201, Maximum AA 558, Maximum value as % of EC Benchmark 186.

#### COFFEE
- **INSTANT COFFEE**: 335 samples, EC indicative value AA 900, Minimum AA 11, Average AA 931, Maximum AA 38000, Maximum value as % of EC Benchmark 4222.
- **ROASTED COFFEE**: 1521 samples, EC indicative value AA 450, Minimum AA 5, Average AA 246, Maximum AA 3779, Maximum value as % of EC Benchmark 840.
- **COFFEE SUBSTITUTES (OTHER)**: 265 samples, EC indicative value AA 4000, Minimum AA 7, Average AA 1092, Maximum AA 5400, Maximum value as % of EC Benchmark 135.
- **COFFEE SUBSTITUTES (CEREALS)**: 19 samples, EC indicative value AA 2000, Minimum AA 81, Average AA 319, Maximum AA 1056, Maximum value as % of EC Benchmark 53.

#### POTATO PRODUCTS
- **FRENCH FRIES**: 3884 samples, EC indicative value AA 600, Minimum AA 1, Average AA 330, Maximum AA 7900, Maximum value as % of EC Benchmark 1317.
- **POTATO CRISPS & SNACKS**: 2741 samples, EC indicative value AA 1000, Minimum AA 6, Average AA 542, Maximum AA 6719, Maximum value as % of EC Benchmark 672.

*Source: European Food Safety Agency*
5.1.2. Ensure that the reference values are set towards the lower level of acrylamide concentrations found

Currently the reference values that are used to demonstrate that the codes of practice are being applied are effectively set at the 90th percentile of the results from the monitoring exercise. This means that the values are too high and do not encourage the significant reductions that could be achieved by food business operators if they were to implement the code of practice effectively. As such, these values must be set at levels towards the lower, and not the upper, range of concentrations that are observed in the data. This would be more in line with the precautionary approach.

5.1.3. Strengthen food industry monitoring requirements

As they stand now, the requirements on food business operators to sample and test their own products for acrylamide are likely to be ineffective because the minimum requirement mandates a very infrequent and non-representative sampling frequency (i.e. minimum one sample a year) and they allow business operators to replace a laboratory test with an approximate measurement of product attributes such as “colour” test. It is questionable whether the latter is an appropriate way to test a product against the indicative values. Despite the low burden implied by such requirements, these are even further simplified for certain types of businesses (i.e. restaurants, hotels, small businesses supplying ready-to-eat food).

While the rationale of minimising the administrative burden for small and micro enterprises is understandable, these groups represent over 95% of the entire sector and too much simplification may completely compromise the effectiveness of the measures. In addition, it may reduce further consumer protection as certain Member States (i.e. Italy, France, Slovenia, Portugal, etc.) are dominated by smaller size enterprises.

5.1.4. Ensure a fair and level playing field across businesses

The Commission’s proposal seems to make a somewhat arbitrary choice as to which businesses fall under the different requirements. For example, it applies the first set of criteria equally to food giants such as Nestle and certain small food manufacturers that do not supply food directly to the consumer, allowing the former to use simplified analytical requirements such as colour testing.

In addition, it further simplifies the already simple requirements for all food business operators in the hospitality and eating-out sector regardless of their size and turnovers. This leads to an unfair situation whereby multi-billion euro companies in the food business sector, such as McDonald’s and Pizza Hut, as well as hotel chains such as Marriott and Hilton, are exempted from any meaningful monitoring and treated in the same way as family-run cafes and bakeries. It is unacceptable to propose anything other than a robust sampling and testing programme for large food business operators.

5.1.5. Codes of practice allow food operators to pick and choose, and are impossible to verify without binding levels

The legislative requirements on business operators to apply the codes of practice are very general and in practice are likely to continue to allow business operators to choose which measures, if any, may be adopted to reduce the presence of acrylamide in foods. Making these measures mandatory will increase awareness of acrylamide amongst food business operators but it is unlikely to lead to changes in practices of food business operators unless more specific requirements and penalties are introduced.

While mandating the application of the codes of practice is a positive development, it is unlikely to lead to meaningful reductions of acrylamide in products unless mandatory limits and higher controls are implemented.

For all the reasons above, it is unclear why the Commission continues to shy away from setting ambitious legally-binding limits for acrylamide in food products under contaminants legislation. This is the approach that has been deemed effective in terms of reducing exposure to acrylamide from non-food sources and from other contaminants found in food. This is particularly intriguing as the Commission’s stated intention to potentially do this at a later stage in a review clause indicates little trust in the effectiveness of the proposed measures. That would also avoid the inclusion of references to two different legal basis in the proposal which is confusing.

All in all, the current proposal, ultimately fails to protect consumers, particularly those most vulnerable such as babies and infants, from being exposed to products with high levels of acrylamide. The Commission and Member States should seize the opportunity to improve it.