MAS
ENVIRONMENTAL

Acrylamides and food safety issues arising

Analysis of the EU Regulation by Mike Stigwood, MAS Environmental Limited

The risks. Chemical contaminants in foods are widespread across an enormous spectrum of sources from plastics to cleaning chemicals, metal (aluminium cooking pots) that can leach into foods and even changes to ingredients through the cooking process including the formation of acrylamides that is a normal outcome of some forms of high temperature cooking such as grilling and frying.

We simply do not understand their broad range of effects or the degree of risk to consumers they present. However, we do know that they do not present immediate, major or clearly identified health effects unlike food poisoning or compounds such as lead in water pipes or blue smoke emitted from char-grilling in the air. We know virtually all plastics including "food safe" plastics leach chemicals which mimic oestrogen and can affect humans but we do not know how serious this might be. To place this all in perspective, all plastics can leach into foods that they come into contact with but we have not prevented their use to wrap or cook foods within. Aluminium pans may be associated with increased aluminium adsorption that relates to dementia type illness but we have not stopped their use despite such forms of illness rising substantially in the elderly.

In general food business operators cannot evaluate the risks of such matters and it would not be practical to include it within a HACCP document. We need to proceed on a known risk basis such as allergens and food poisoning organisms and not theoretical risks that must inevitably have adverse effects on humans but to an unknown degree albeit it must be small. It must be small as we are not seeing widespread directly related cancers. In the case of acrylamides the EU has chosen to intervene in this process and take a precautionary approach whilst disregarding other potential risks.

The recent 2018 EU Regulation aimed at reducing acrylamides is a precautionary approach to food safety but it heavily exempts smaller catering businesses to permit almost any activity that is commensurate with the aims or intent of the business. The regulation is ambiguously drafted and many different interpretations can be applied which is also unhelpful and in essence it does not appear to appropriately look at risk. For example it does not attempt to prevent double or triple frying of potatoes if that is inconsistent with the end product desired but does appear to stop frying temperatures above 175^{0}C even if that means a less healthy product results where more fats are absorbed or potentially more acrylamides are produced.

Regardless of the ambiguity a couple of direct legal requirements arise and these are set out below.

The regulations provide a set of measures which should be considered to help reduce the risk of acrylamides but it does not formulate a set of rules that must be incorporated in a Food Safety Management System as the degree of risk is small and as yet not quantified with perhaps a couple of exceptions. Specifically the EU Regulation removes requirements to document and record placed upon the smaller caterer provided they follow Annex II A of the regulations. However it might be safe to include some observations in the Food Safety Management System such as frying temperature to be used. This is discussed further below.

To place the risks from acrylamides in perspective compared to other risks from food the extract below is taken from a comprehensive review of research published in 2018 in Frontiers of Nutrition.

> *There is clear evidence to show that AA (Acrylamide) is carcinogenic in rodents. However, there is paucity of facts depicting the health risk in humans as evident from numerous epidermiological and toxicological studies. There are lacunae in the past studies, especially with regard to lack of findings in estimating dietary AA intake through questionnaires and AA content database in foods,*

> *lack of repeated exposure estimations, and lack of statistical power to detect small increases in risk. Nevertheless, it is important that efforts should continue to reduce AA levels in food products. Further studies are suggested in human beings to show the detrimental effect of AA*[i].

In summary, Acrylamide is a contaminant as defined in Council Regulation (EEC) No 315/93 (2) and as such, it is a potential chemical hazard in the food chain amongst many others. It forms mainly in baked or fried carbohydrate-rich foods where raw materials contain its precursors, such as cereals, potatoes and coffee beans. This is the EU précis but in reality it is far more complex than that.

Acrylamide in food potentially increases the risk of developing cancer for consumers in all age groups. It is important to note whilst this has been found in rats there is not any clear evidence of a significant risk in humans and different bodily mechanisms means there may or may not be a human risk despite the risk to rodents. We do not really know and are acting with precaution. Since acrylamide is present in a wide range of everyday foods, this concern applies to all consumers but children are the most exposed age group on a body weight basis. Possible harmful effects of acrylamide on the nervous system, pre- and post-natal development and male reproduction were not considered to be a concern, based on current levels of dietary exposure.

It is also important to recognise that acrylamides are used elsewhere in industry but we are not normally consuming them from those other sources.

The current levels of dietary exposure to acrylamide across age groups indicate a concern with respect to its carcinogenic effects and it is considered good hygiene practice to try to reduce this. **Separate rules are formulated for small food businesses compared to those which are effectively mass producers**.

> **Small businesses** include retail activities and/or directly supply only local retail establishments where mitigation measures are very limited by the EU Regulation to the nature of their operation as set out below. **In plain English, any caterer needs to consider the points listed below.**
>
> **Large businesses** include food business operators which are part of, or franchises of, a larger, interconnected operation and that are centrally supplied should apply additional mitigation measures practicable for larger-scale businesses which includes sampling and analysis of their products. **In plain English there are wide ranging rules applicable to manufacturers etc**.
>
> **Foods covered.**
>
> (a) French fries, other cut (deep fried) products and sliced potato crisps from fresh potatoes;
> (b) potato crisps, snacks, crackers and other potato products from potato dough;
> (c) bread;
> (d) breakfast cereals (excluding porridge);
> (e) fine bakery wares: cookies, biscuits, rusks, cereal bars, scones, cornets, wafers, crumpets and gingerbread, as well as crackers, crisp breads and bread substitutes. In this category a cracker is a dry biscuit (a baked product based on cereal flour);
> (f) coffee:
> (i) roast coffee;
> (ii) instant (soluble) coffee;
> (g) coffee substitutes;
> (h) baby food and, processed cereal-based food intended for infants and young children as defined in Regulation (EU) No 609/2013.

Comment: whilst a range of foods are covered and arguably there are many things which could be done to reduce acrylamides, in the case of small caterers and retailers, rules only apply to potato products (see definition below) and bread and fine bakery wares whatever that means.
"potato" is not defined in the EU Regulation but appears from other EU Regulations to mean any tuber or part of a tuber or any plant or part of a plant of Solanum Tuberosum L or any other tuber-forming species or hybrid of the genus Solanum. **It appears therefore to exclude sweet potatoes and yams etc.**

What does a breach mean? At the current time it appears failure to comply with the Acrylamide Regulations would not be an offence until the English Regulations are amended, provided their relevance to Food Safety has been assessed as part of the food safety management system.

Food businesses that provide retail activities, and/or directly supply only local retail establishments = most caterers, **shall apply the following measures only** and are subject to the following exemptions:

They do not have to:

- Undertake sampling and analysis
- Keep a record of applied mitigation measures
- Review acrylamide levels

Comment: This is a clear derogation from any requirements to record measures to reduce acrylamide risk. In plain English the regulation removes a requirement to undertake measures such as recording the temperature of the oil.

In relation to potatoes, bread and fine bakery wares, they have to:

French fries and fried potatoes

- If compatible with the desired end product, use lower sugar potato varieties for deep frying.
- Store potatoes before deep frying above 6^0C – Note this directly conflicts with the next provision in relation to frozen products.
- Unless frozen products where cooking instructions are followed or not compatible with the desired end product, then in the case of French fries either:
    - soak for 30-120 minutes and wash before frying
    - soak in warm water for a few minutes
    - Blanch potatoes.
- When **frying French fries or other potato products you must**:
    - Use oils and fats which fry quicker or at lower temperatures. It is not sure what this compares to and does not appear limited to deep frying but is implied as such.
    - **Fry at as low a temperature as possible and below 175^0C, taking into account food safety requirements***. This appears an absolute requirement preventing frying above 175^0C but is it?
    - Clean oil removing fines and crumbs.
    - Use cooking colour guides that indicate reduced acrylamide content.
    - Display the colour guide for kitchen staff.

***For the avoidance of any doubt, if read literally, frying any potato product above 175^{0}C (as a frying temperature) is an automatic breach of EU law unless you can take account of food safety requirements.** As acrylamides are formed in the range of 120-150^{0}C and a higher cooking temperature might mean a shorter cooking time and less absorption of fat rendering it overall a healthier product it is questioned if this was meant to be an absolute value. What is the main food safety risk, increased fats adsorption and possibly more acrylamides with multiple cooking as lower temperature French fries are soggier and so need re-frying to make palatable or potentially more acrylamides if a temperature over 175^{0}C leads to increased browning (maillard reaction). Furthermore if the temperature of the oil is 180^{0}C does that mean the product exceeds 175^{0}C and does the temperature apply to the product or the oil? Does it also apply to shallow frying? It appears it applies to the temperature of the oil and shallow frying but as a regulation is unclear. One aspect of frying is that placing a cold product into oil will reduce its temperature and in reality the degree of browning will often relate to the cooking load (how full the basket is). No such restrictions apply to battered products unless potato is an ingredient.

Bread and baking products –

In so far as is compatible with the production process and hygiene requirements

- Extend yeast fermentation time
- Optimise moisture content for low moisture content products
- Lower oven temperature and extend cooking time

Also generally to

- Bake to a lighter colour
- Avoid dark roasting of crusts if due to “strong roasting” rather than a dark product.
- Toast sandwiches to an optimal colour using colour charts where available.
- Pre-packed products to be finished to accord with cooking instructions.
- Display colour guides for staff preparing.

Comment: No rules for any other products are provided whatsoever for the smaller caterers and the rules for baking above are not made subject to the desired end product or food safety and thus technically if a customer wants something baked to a darker colour than what is deemed a lighter colour it would be a breach. The same applies to toasted sandwiches which have to be toasted “to the optimal colour”. Applying a literal interpretation if a customer wants their toast well done / burnt this cannot be provided and if a toasted sandwich is slightly burnt or too dark it would be a breach of the EU Regulation. If a caterer provides a toaster and a customer burns their own toast this is not a breach as once the product is in the possession of the customer it is sold and the laws no longer apply.

Summary of absolute requirements for small not national caterers:

1. Fry potato products below 175^{0}C and as low as practical without causing food safety risks.
2. Store potatoes above 6^{0}C if frying them – presumably just before frying.
3. Bake bread and fine bakery wares and toast sandwiches to a lighter colour
4. Use colour charts posted in cooking areas to help staff meet lighter colour cooking
5. Any recording obligations are specifically removed on these requirements by EU regulation.

If you have any queries or require further clarification or advice please contact us 01223 441671 or email: admin@masenv.co.uk.

[i] Dietary Acrylamide and the Risks of Developing Cancer: Facts to Ponder - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5835509/