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## EU database on acrylamide levels in food – update and critical review on data collection

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**EU database on acrylamide levels in food – update and critical review on data collection**

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3 **EU database of acrylamide levels in food – update and critical review of data**  
4 **collection**  
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**Abstract**

The European Commission's Directorate General Joint Research Centre has been collecting data produced by EU Member States on the acrylamide content of food since 2003. More than 9000 individual data points have been received from official food control laboratories directly or via their Competent Authorities, and from the food industry. Before being entered into the database, the data were assessed for their reliability. This paper presents an update of the database as well as results of the evaluation of data for selected food commodities in order to establish a trend concerning the content of acrylamide in food. Experience gained with the data collection and data assessment are described and recommendations for future data collection initiatives are given.

## Introduction

Whenever health concerns related to food products arise, particularly their composition, reliable data is needed for a thorough evaluation of the magnitude of potential health effects. Hence the exposure of humans to the threat can be estimated. This implies that both data on the content of the substance/group of substances in food, and on the pattern of food consumption are required. Frequently data are not available *ab initio*. Studies have to be planned to collect the required data and databases have to be designed in order to receive the data. The preparative steps prior to the data collection are of the utmost importance, since the scope of the database defines the extent of information that needs to be collected.

The finding of acrylamide in food led to a number of research projects worldwide on e.g. the formation, toxicology and mitigation of acrylamide in food. Compilations of activities have been published on the internet by both the European Commission's Directorate General Health and Consumer Protection (DG SANCO, 2005) and the World Health Organization (WHO, 2002). A part of the projects that aim to evaluate the health risk to humans comprises the collection of data on acrylamide levels in different kinds of foods. National as well as supranational organisations such as WHO (WHO, 2005) or the European Commission's Directorate General Joint Research Centre (JRC, 2006) have subsequently set up databases on acrylamide levels in food, and the JRC collects, evaluates and publishes data on a regular basis. A first overview of these two international databases was published by Lineback et al. (2005). In 2005, the Joint FAO/WHO Committee on Food Additives (JECFA, 2005) assessed the health risk caused by acrylamide on the basis of about 6750 data points for acrylamide levels in food collected on a worldwide scale, including about 4500 data points coming from the EU database. JECFA recommended continuation of the efforts to mitigate the acrylamide levels in food, especially for food that is consumed in developing countries.

Regarding mitigation, a so-called toolbox was developed in a joint effort by different sectors of the food industry (CIAA 2006). This toolbox comprises measures that could be applied for the mitigation of acrylamide in different kinds of food. It also points out where, from an industry perspective, reduction of acrylamide levels is feasible and where limitations have to be taken into

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3 account. The implementation of this toolbox concept is a complex challenge since it should not  
4 only be applied by the major food suppliers, but also by small- and medium-sized companies.  
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9 Continuous monitoring of acrylamide levels in food is needed to study the effectiveness of  
10 mitigation measures, monitoring databases such as the EU database is a very good way to study  
11 potential changes of the acrylamide content of particular food commodities or particular food  
12 categories with time. If this information is then combined with consumption data, changes in  
13 exposure of the population in general, or particular vulnerable subpopulations such as infants,  
14 elderly people or people with specific sicknesses can be estimated.  
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21 The current paper gives an update of the EU acrylamide database and reports on experience gained  
22 during the data collection. It also aims to act as a stimulus for the design of future data collection  
23 programmes.  
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### 28 **Overview on the EU acrylamide database**

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30 The EU database was designed by the JRC in close collaboration with representatives of the  
31 Confederation of the European Food and Drink Industry (CIAA) and opened for submission of  
32 data in April 2003. Official and private food control laboratories were requested to submit data on  
33 acrylamide levels in all kinds of food. Reminders to enter data into the database were given  
34 regularly to the EU Member States and the food industry. So far the publication of the acrylamide  
35 database on the JRC website has been updated five times. The most recent update dates from June  
36 2006. Data were received mainly from Germany (77.6 %) and from the CIAA (12.1%), which  
37 supplied data that were generated by food industry shortly after the discovery of acrylamide in  
38 food, but also from Austria, Belgium, Finland, Greece, Ireland, Italy, The Netherlands, Spain, and  
39 the United Kingdom (in total 10.3 %). To date, a total number of 9228 individual data sets have  
40 been put into the database. The data were produced between 2002 and 2006 and comprise a variety  
41 of food items. Most abundant food items/food groups are presented in Table 1.  
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53 [Insert Table 1 about here]  
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3 The highest number of data sets were reported for potato chips (French fries, 1666 data), followed  
4 by data on the acrylamide content of biscuits and fine bakery ware (1459 data), and gingerbread  
5 (1131 data). A considerable number of data points were also received for food for diabetics (475  
6 data) and food specially intended for babies and infants (in total 384 data sets).  
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#### 10 11 12 13 14 **Data assessment**

15 The assessment of the reliability of analysis data is not a standard procedure in the collection of  
16 data on residues/contaminants in food. The WHO for example, which collects data on a global  
17 scale via the Global Environment Monitoring System – Food Contamination Monitoring and  
18 Assessment Programme (GEMS/Food), asks for detailed information on sampling and analytical  
19 methods only if the data are to be submitted for the evaluation of the Joint FAO/WHO Meeting on  
20 Pesticide Residues (JMPR), JECFA or other FAO/WHO bodies. Other data collection and  
21 collation initiatives e.g. the Scientific Co-operations on Questions related to Food (SCOOP)  
22 frequently report problems with the comparability of data (SCOOP 2004). Significant differences  
23 in the expression of results and meaning of results that were reported below limit of detection  
24 (LOD) or limit of quantification (LOQ) led to the suggestion of harmonising further collection of  
25 data and of creating a common approach.  
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36 With the knowledge that acrylamide was only in processed food (Rosen 2002), and that analytical  
37 methods were still in the development phase in many laboratories, it was decided from the  
38 beginning to scrutinise the reliability and also comparability of reported data. Criteria that lead to  
39 the removal of data from the database were set up together with representatives of the food  
40 industry. The criteria are listed and explained in Table 2.  
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47 [Table 2 about here please]  
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51 The number of data points that were excluded from the database according to the respective  
52 criterion is also given in Table 2. Very often incomplete information caused data exclusion.  
53 Although this does not imply that the data were wrong, they were sacrificed for comparability  
54 reasons. The same applied to data that were reported as below LOQ with an LOQ above 100  
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3  $\mu\text{g}/\text{kg}$ . The performance of laboratories in proficiency tests (PTs) provided a valuable insight..  
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5 Although the performance in a PT, indicated by the z-score, is only a snapshot of the degree of  
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7 proficiency a laboratory shows in the determination of a particular analyte at a particular content  
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9 level in a particular matrix, the accumulation of a number of snapshots allows conservative  
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11 extrapolation to the general level of expertise with the respective type of analysis. In contrast,  
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13 unsatisfactory performance in a number of PTs supports questioning the reliability of the reported  
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15 data. Hence such data were discarded from the database. A descriptor that was proposed to  
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17 describe the overall performance of a laboratory in a number of PTs is the Running Z-Score (RZ)  
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19 (Thompson 1993). It represents the sum of z-scores gained in a number of PTs divided by the  
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21 number of PTs. RZ scores were omitted in the most recent update of the guidelines “The  
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23 International Harmonized Protocol for the Proficiency Testing of Analytical Laboratories”  
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25 (Thompson, 2006) and other scores were proposed. However, since RZ scores have been applied  
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27 since before 2006 for the evaluation of the data, they are kept for the moment for the assessment of  
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29 data fed into the database. Data of laboratories for which  $RZ > |2|$  was found were removed from  
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31 the data base. Only 12 data sets, which were put into the database shortly after its installation,  
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33 complied with that criterion. The laboratory that submitted this data participated in three PTs, for  
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35 which the results of two tests were far above the accepted range. However the reliability of more  
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37 than 5800 data is supported by RZ values in the range between -2 and 2.

### 37 **Evaluation of acrylamide data**

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39 From more than 9000 data received almost 7500 data passed the data assessment. Details of the  
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41 most abundant food classes are listed in Table 1. Besides the overview of accepted records,  
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43 accompanying information is given on the data distribution. In order to consider acrylamide  
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45 contents that were reported “below LOD” respectively “below LOQ”, this text information has  
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47 been replaced by numeric values corresponding to half of the reported LOD respectively LOQ.  
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49 The minimum value is for almost all food classes formed by half of the LOD of the applied  
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51 method. Analysis results above the LOQ were constantly found only for coffee and coffee  
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53 substitutes.

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55 Data for many food classes were produced regularly, while data for potato chips come nearly  
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57 exclusively from 2002 and 2003. Only about 60 of 1410 samples were analysed after 2003. This  
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3 imbalance in data amount makes the estimation of a trend in the acrylamide content of potato chips  
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5 meaningless.  
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9 The representation of other food categories in the database is more balanced. A comprehensive  
10 overview of the acrylamide levels and their distribution within the first 24 months (May 2002 to  
11 April 2004) and the second 24 months (May 2004 to April 2006) of the reporting period is given  
12 for 6 food categories (bakery products and biscuits, potato crisps, gingerbread, crisp bread, coffee  
13 and diabetics cakes and biscuits) in Table 3.  
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19 [Table 3 about here please]  
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23 The data were grouped according to the date of sampling respectively date of analysis. A shift of  
24 the distribution towards lower values was found for potato crisps, crispbread and cakes and  
25 biscuits for diabetics, whereas similar values were found for gingerbread. An increase in the  
26 acrylamide contents was found for the category “bakery products and biscuits as well as for  
27 roasted coffee beans. The amount of data generated in each of the four years of data collection was  
28 quite balanced especially for potato crisps. Therefore the variation of the distribution of acrylamide  
29 content levels was studied. This variation from year-to-year is depicted in Figure 1.  
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37 [Figure 1 about here please]  
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41 The most significant change for acrylamide content of potato crisps happened from 2002 to 2003.  
42 The apex of the acrylamide content distribution moved from about 470 µg/kg in 2002 to about 300  
43 µg/kg in 2004 and 2005. The distribution also became narrower, which means that the number of  
44 samples with high acrylamide contents was lower. The lower number or unbalanced sampling or  
45 analysis date prevented such evaluation for the other food categories. However, information based  
46 on the analysis respectively sampling date has to be interpreted with caution, especially for bakery  
47 products and biscuits. This category comprises a variety of different products with different  
48 composition and different manufacturing conditions. Precise information, especially on processing  
49 conditions and food composition, was mostly not reported. Another fact that needs attention is the  
50 analysis respectively sampling date, which is not necessarily closely linked to the production date  
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3 of the product. This means that the analysis data could be wrongly categorised. However the  
4 analysis respectively sampling date is the most complete date specification in the database.  
5 Information on either the production date or expiry date of the product is more suitable for  
6 estimation of time dependent trends. The declaration of one or the other depends on the nature of  
7 the product.  
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14 An expiry date is reported most often for potato crisp samples. Only a very low number of data  
15 sets contained information on the production date. Information on the expiry date was given for  
16 about 750 of 843 potato crisps samples. The plot of the acrylamide contents against the expiry date  
17 of these 750 potato crisps samples is depicted in Figure 2.  
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23 [Figure 2 about here please]  
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26 As mentioned before a shift towards lower levels could be established. Figure 2 shows the  
27 regression curve as well as the corresponding 95% confidence interval. The dotted curve indicates  
28 the 95% prediction level. Samples with acrylamide contents above 2500  $\mu\text{g}/\text{kg}$  were considered in  
29 the calculations, but are not depicted. Unfortunately, the number of data with specific information  
30 on production or expiry was much lower for other food categories. Figure 3 shows the  
31 development for gingerbread.  
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39 [Figure 3 about here please]  
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42 About 450 of more than 1000 data sets for gingerbread contain information on the expiry date of  
43 the product. Data at a level above 1500  $\mu\text{g}/\text{kg}$  are not shown for better visibility of lower content  
44 levels. A slight decrease of the acrylamide content was found by regression analysis. However the  
45 uncertainty of this evaluation needs to be considered, before conclusions can be drawn. Therefore,  
46 regression analysis was not performed for all food categories which are represented in the  
47 database.  
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### 53 54 55 **Critical review on the data collection** 56 57 58 59 60

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3 The biggest problem was the access to data produced in various laboratories. Much data has been  
4 generated, but was never submitted to the database. Evidence of these data can be found in  
5 different publications, on the internet or in printed media. It is only due to the strong request of the  
6 Competent Authorities that data were received for the evaluation. A major reason for not reporting  
7 data is that the filling of the spreadsheet for data submission is considered as too laborious by  
8 many laboratories, although it must be stressed that only a third of the entries were compulsory.  
9 However, at the time of the design of the database, when experiences with the determination of  
10 acrylamide in food were still low in many laboratories, the requested information was considered  
11 necessary.  
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21 The conception of the database layout is a crucial step in the whole data collection activity.  
22 Whatever the purpose of a database might be, the balance between desired information and  
23 reasonable workload for supplying this information needs to be respected. The accessibility and  
24 usefulness of information that is gathered shall be questioned, especially if the level of uncertainty  
25 of the information would nearly prohibit the drawing of conclusion. To illustrate, the influence of  
26 process conditions e.g. frying temperature of potato chips/crisps, on the acrylamide content of the  
27 final product can be easily studied in model experiments within one laboratory working under  
28 repeatability conditions. If such influence shall be studied from the collected data, two events are  
29 likely to happen. First, the analysing and data reporting food control laboratory has limited access  
30 to such level of detail of information, and second, even if such information is provided by different  
31 laboratories, it is questionable whether the reproducibility of analysis results is sufficiently high to  
32 allow the detection of any relation between the frying or baking temperature and the acrylamide  
33 content of potato crisps or biscuits from the database.  
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46 However, the access to information on the processing temperature is different if frying is applied in  
47 the laboratory, e.g. for the processing of prefabricated potato chips. In that case information on  
48 temperature could be useful for the assessment of the comparability of data.  
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53 Regarding the workload of putting data into the database, electronic means that could facilitate  
54 data collection are deemed to be necessary. There is indeed a lack of an interface between  
55 laboratory data management systems and such monitoring databases that would allow transferring  
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3 information easily, simultaneously respecting all requirements on confidentiality and security of  
4 data.  
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8 Retrospectively it has also to be stated that the different set-up of databases from which data were  
9 fed into the EU database led to differences in the information content of the respective data sets.  
10 This was caused by both a different number of fields that were filled and a difference in the level  
11 of detail of information that was given e.g. in text fields. For example, a lot of data was reported  
12 without information on production/expiry date. For the monitoring of any time dependent  
13 mitigation of the acrylamide content, exactly this type of information is required.  
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21 Practical details also need to be considered. An important question is related to the software that is  
22 used for data collation. Applying standard office software has the advantage of widespread  
23 accessibility but has the disadvantage of potential compatibility problems depending on firmware  
24 or language version. This happened with the EU database. Disparate date formats were reported.  
25 As a consequence they were not recognised, preventing the consideration of the data in trend  
26 analysis. The differences of date formats had to be cleared manually. This is not only time  
27 consuming, but of course also prone to error. In that sense any electronic tool that is not sensitive  
28 to such influences shall be preferred for data collection to standard office software.  
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37 Information on the performance of laboratories in proficiency tests (PTs) was very valuable for  
38 data assessment. Within the EU, official food control laboratories need to be accredited according  
39 to ISO 17025, meaning that they have to participate regularly in PTs. About 6800 data in the  
40 database were produced in accredited laboratories. This does not necessarily mean that the  
41 laboratories were accredited for acrylamide analysis. However, in the course of a PT organised by  
42 the JRC in 2004, 12 of 42 laboratories reporting results stated explicitly that they were accredited  
43 for the analysis of acrylamide in food. It can be expected that the number has been increased  
44 meanwhile. Owen et al. (2005) reported the participation of between 30 and 50 laboratories in each  
45 of 6 consecutive PT rounds organised by the Food Analysis Performance Assessment Scheme  
46 (FAPAS®).  
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3 Nevertheless, obtaining information on the performance of the laboratories was not easy. In most  
4 cases data was requested directly from the laboratories. The reason for this was probably a lack of  
5 specificity in the instructions on how to fill the respective field of the data submission form.  
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7 Another problem is that excel sheets are very valuable for housing static information. Dynamic  
8 information such as the performance in different PT rounds, which change with time, is difficult to  
9 integrate in a way that ambiguity is avoided. For future databases, it is recommended to develop  
10 prior to collection appropriate software solutions that consider all these aspects and make them  
11 available to the public.  
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## 20 21 **Conclusions**

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24 Despite the problems in data collection that were highlighted in this paper, it shall be stated that the  
25 database as a whole has found much appreciation especially for exposure and risk assessment  
26 studies. The number of data fed into the database is very high and is publicly accessible. An  
27 evaluation of the distribution of acrylamide contents over the data collection period was performed  
28 for food categories that are well represented in the database. A trend towards lower acrylamide  
29 content levels is indicated for at least some food categories. Regarding the data collection in  
30 general, the significance of the data could be increased if data collection systems were harmonised  
31 and data transfer simplified.  
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## 42 **Acknowledgement**

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45 The authors would like to thank all data contributing laboratories from the EU Member States and  
46 food industry.  
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## References

Confederation of the Food and Drink Industries in EU (CIAA) 2006. Available from:

<http://www.ciaa.be>. Accessed 2006 Oct 30.

European Commission, Directorate General Health and Consumer Protection (DG SANCO).

Available from:

[http://ec.europa.eu/food/food/chemicalsafety/contaminants/acryl\\_database\\_en.htm](http://ec.europa.eu/food/food/chemicalsafety/contaminants/acryl_database_en.htm). Accessed 2006 Oct 30.

European Commission Directorate General Joint Research Centre, Institute for Reference

Materials and Measurements, Available from:

<http://www.irmm.jrc.be/html/activities/acrylamide/index.htm>. Accessed 2006 Oct 30.

Lineback D, Wenzl T, Ostermann OP, De la Calle B, Anklam E, Taymans D. 2005. Overview on acrylamide monitoring databases. *Journal of AOAC International* 88:246-252.

Joint FAO/WHO Experts Committee on Food Additives. 2005. Summary and Conclusions of the sixty-fourth meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA).

Available from: [http://www.who.int/ipcs/food/jecfa/summaries/summary\\_report\\_64\\_final.pdf](http://www.who.int/ipcs/food/jecfa/summaries/summary_report_64_final.pdf).

Accessed 2006 Oct 30.

Owen LM, Castle L, Kelly J, Wilson L, Lloyd AS. 2005. Acrylamide analysis: assessment of six rounds of Food Analysis Performance Assessment Scheme (FAPAS®) proficiency testing. *Journal of AOAC International* 88:285-291.

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2  
3 Rosén, J, Hellenäs KE. 2002. Analysis of acrylamide in cooked foods by liquid chromatography  
4 tandem mass spectrometry. Analyst 127:880-882.  
5  
6  
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10 SCOOP Task 3.2.12 Final Report. 2004. Occurrence data on PAH in food. Available from:  
11 [http://ec.europa.eu/food/food/chemicalsafety/contaminants/scoop\\_3-2-12\\_final\\_report\\_pah\\_en.pdf](http://ec.europa.eu/food/food/chemicalsafety/contaminants/scoop_3-2-12_final_report_pah_en.pdf).  
12  
13 Accessed 2006 Oct 30.  
14  
15  
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20 Thompson M, Wood R. 1993. International harmonized protocol for proficiency testing of  
21 (chemical) analytical laboratories. Journal of AOAC International 76:926-940.  
22  
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27 Thompson M, Ellison SLR, Wood R. 2006. The international harmonized protocol for the  
28 proficiency testing of analytical chemistry laboratories. Pure and Applied Chemistry 78:145-196.  
29  
30  
31

32 World Health Organisation (WHO) 2002: Available from: [http://www.acrylamide-](http://www.acrylamide-food.org/research_database.htm)  
33 [food.org/research\\_database.htm](http://www.acrylamide-food.org/research_database.htm). Accessed 2006 Oct 30.  
34  
35  
36

37 World Health Organisation (WHO) 2005, Available [http://www.acrylamide-](http://www.acrylamide-food.org/data_disclaimer.cfm)  
38 [food.org/data\\_disclaimer.cfm](http://www.acrylamide-food.org/data_disclaimer.cfm)- Accessed 2006 Oct 30.  
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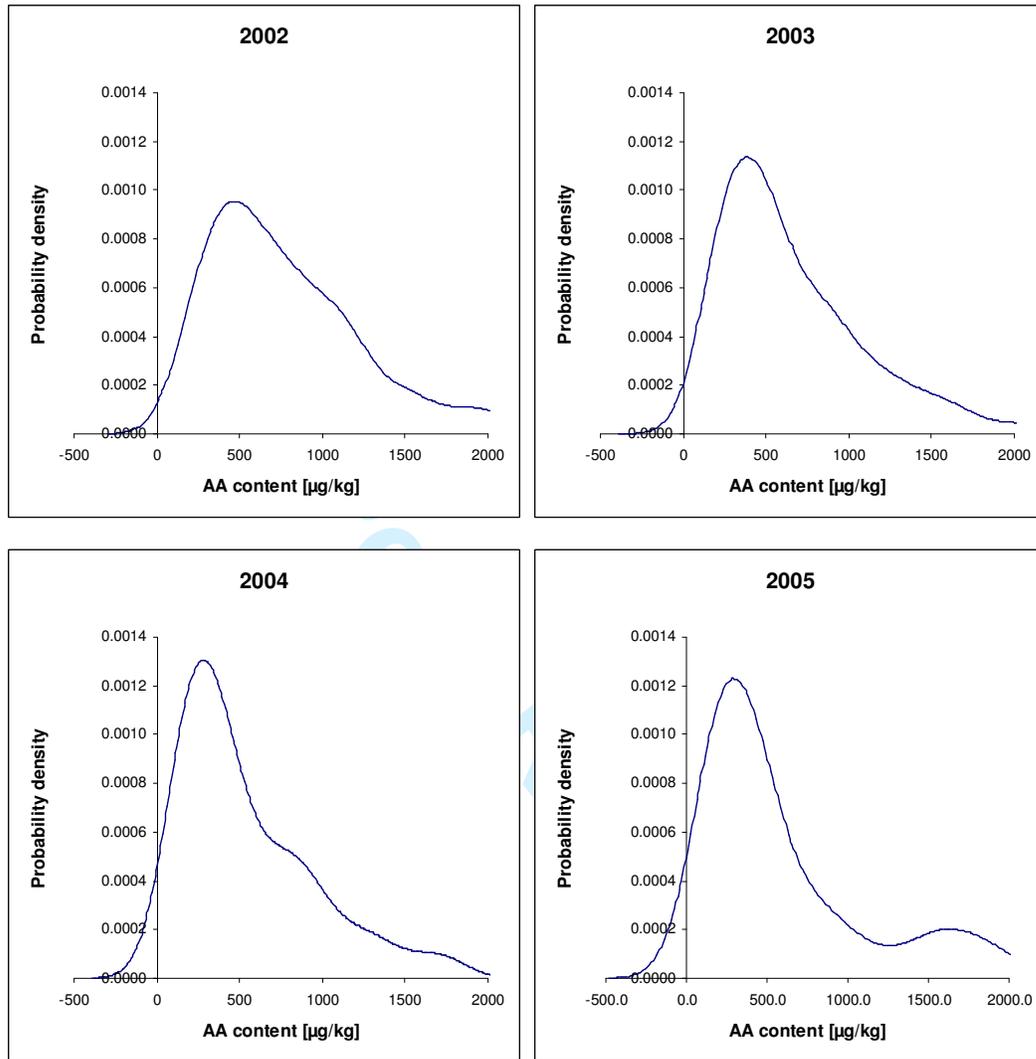
**Figure captions**

Figure 1: Kernel density plots of the acrylamide contents of potato crisp samples in dependence of the calendar year of sampling respectively analysis

Figure 2: Plot of the acrylamide content of potato crisp samples against the expiry date of the product. The solid line represents the regression curve, the medium dashed line the 95% confidence interval of the regression curve and the dotted line the 95% prediction level.

Figure 3: Plot of the acrylamide content of gingerbread samples against the expiry date of the product. The solid line represents the regression curve, the medium dashed line the 95% confidence interval of the regression curve and the dotted line the 95% prediction level

Figure 1



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Figure 2

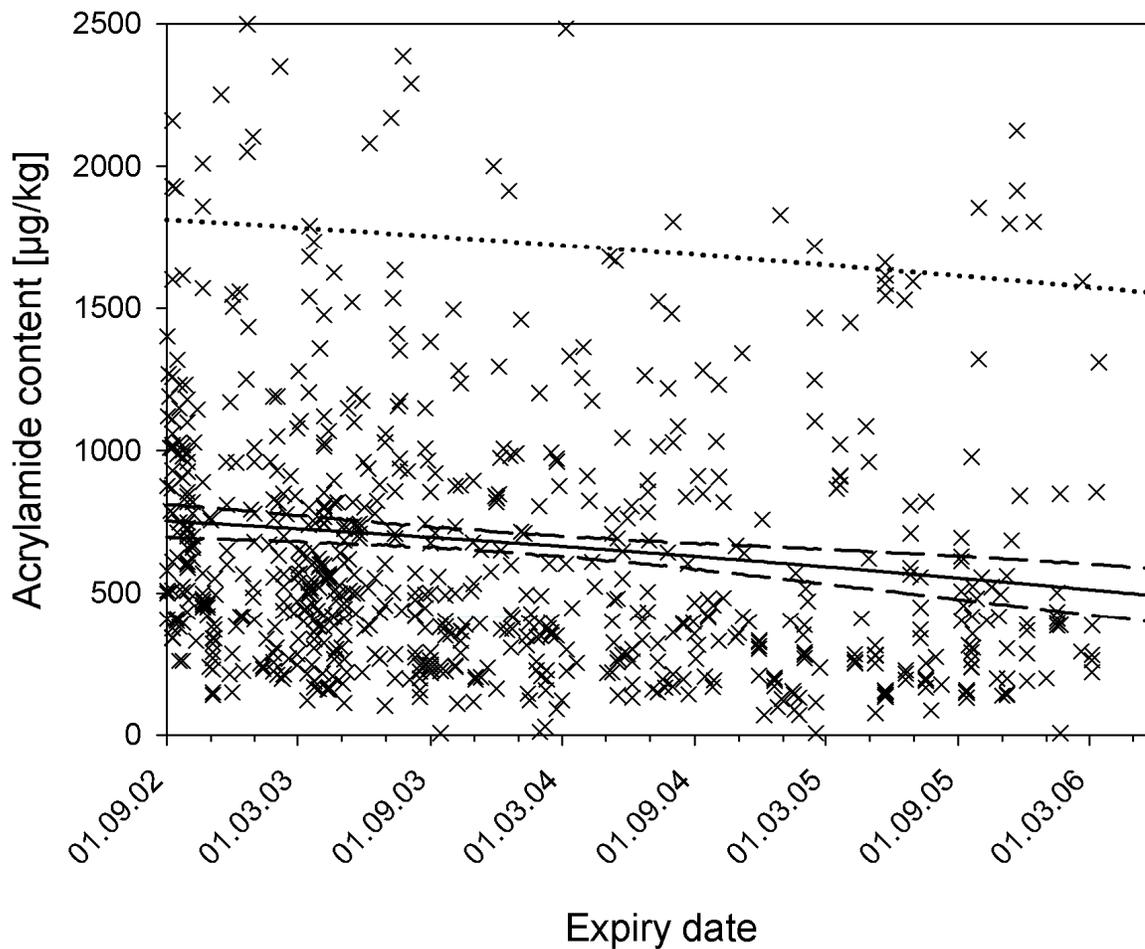
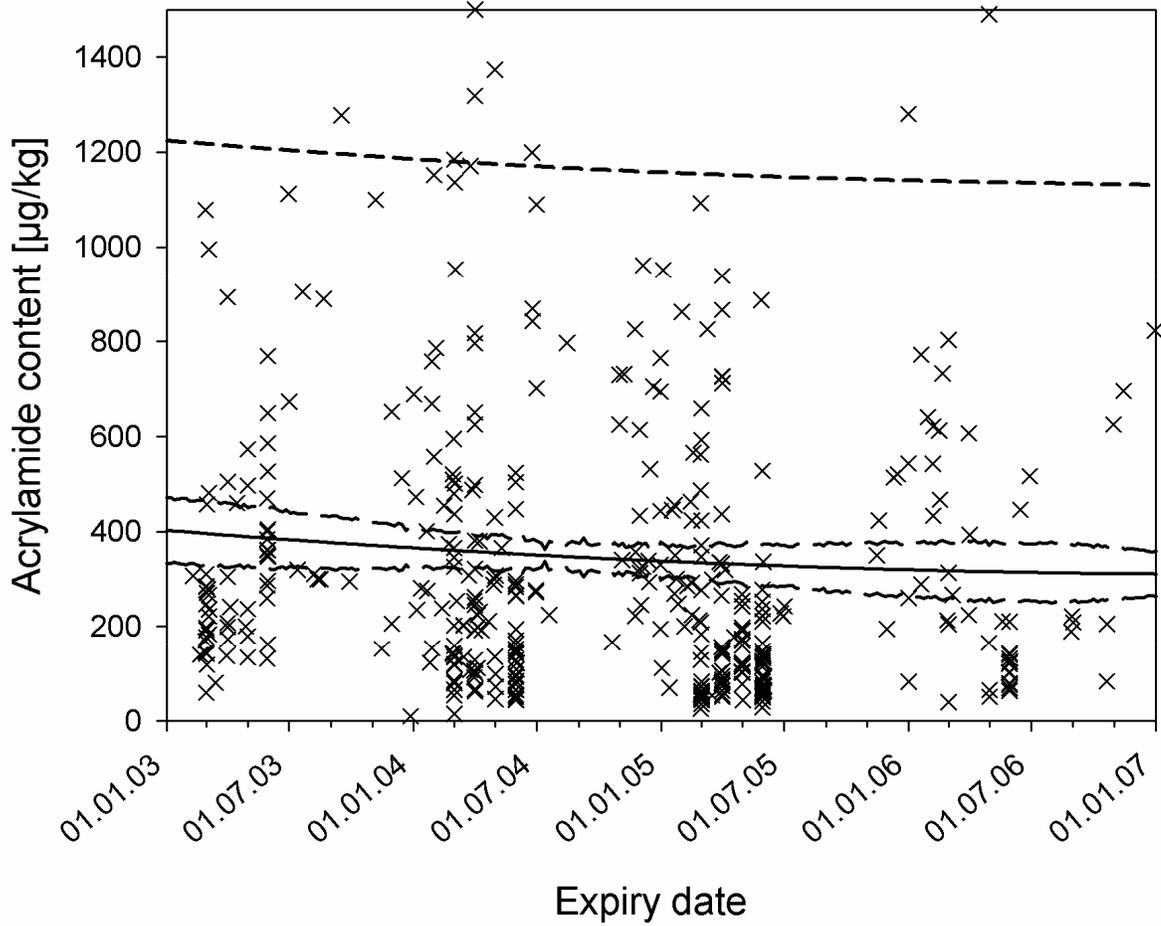


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Table 1: Overview on most abundant food items/food categories in the EU database on AA levels in food:

Number of records: number of data received; Number of accepted records: data that passed data assessment; Min: minimum AA content, 1<sup>st</sup> Quartile: 25% of data are below that content value; Median: 50% of data are below that content value; 3<sup>rd</sup> Quartile: 75% of data are below that content value; Max: maximum acrylamide content that was reported for that food category

Food	Number of records	Number of accepted records	Min µg/kg	1 <sup>st</sup> Quartile µg/kg	Median µg/kg	3 <sup>rd</sup> Quartile µg/kg	Max µg/kg
Potato chips (French fries)	1666	1408	5	85	186	363	4653
Bakery ware, biscuits	1459	1074	4	53	145	350	3324
Gingerbread	1131	1007	5	138	303	668	7834
Potato crisps	920	843	5	314	528	938	4215
Crispbread	546	455	5	79	244	505	2838
Diabetics cakes and biscuits	475	402	5	102	230	620	3044
Snacks, Popcorn, Salt crackers	442	112	5	25	145	428	3100
Cereals	410	274	5	30	70	153	1649
Coffee beans roasted	383	291	79	240	320	578	1188
Bread and toast	313	151	5	15	50	133	1987
Baby food	211	191	5	32	67	143	432
Potato pancake	133	118	10	177	385	730	3072
Infant biscuits	173	157	5	35	79	166	910
Coffee substitutes	122	108	116	497	773	1226	2955

Table 2: Data exclusion criteria and number of data that were excluded according to the respective criterion

No.	Assessment criterion	Data excluded
1	The reported AA content was below the reported LOQ.	181
2	The reported AA content was reported as “below LOQ”, with an LOQ $\geq 100 \mu\text{g}/\text{kg}$ .	53
3	The LOQ was not reported.	583
4	The reported values for LOD and LOQ were the same.	662
5	Information on LOD and LOQ was missing.	332
6	The calculated running z-score (RZ) was greater than $ 2 $ .	12
7	The reported value was greater than the LOQ, but not exactly specified, e.g. $< 100 \mu\text{g}/\text{kg}$ with a LOQ of $30 \mu\text{g}/\text{kg}$ .	93
8	Not reasonable values were reported instead of the LOQ, e.g. a date instead of a numeric value.	73

Table 3: Comparison of distribution parameter of the AA content of selected food categories that were analysed either between April 2002 and April 2004 or May 2004 and May 2006. The data were categorised according to the data of sampling or analysis of the product.

		Bakery products, biscuits		Potato crisps		Gingerbread		Crispbread		Coffee		Diabetics cakes and biscuits	
		2002-2004	2004-2006	2002-2004	2004-2006	2002-2004	2004-2006	2002-2004	2004-2006	2002-2004	2004-2006	2002-2004	2004-2006
Total number		655	413	650	189	429	578	337	117	133	158	257	145
Min	µg/kg	5	5	5	5	5	10	5	5	79	87	5	10
1 <sup>st</sup> Quartile	µg/kg	50	50	360	236	152	124	80	73	214	262	104	102
Median	µg/kg	131	163	597	391	300	304	257	228	281	432	290	184
3 <sup>rd</sup> Quartile	µg/kg	327	370	973	758	651	678	586	450	354	742	733	430
Max	µg/kg	3324	2110	3770	4215	7834	6141	2838	2380	1112	1188	3044	2831