EXECUTIVE SUMMARY

REPORT OF THE CONSORTIUM

The occurrence and fate of Fusarium mycotoxins during milling and processing of cereal-based foods in commercial operations.

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Funded by Defra and FSA and supported by advice from HGCA (Project 2981), NABIM and SNACMA

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The overall objective of the Project was to assist industry in the management of key *Fusarium* mycotoxins in the cereal processing chain so as to best comply with current and future legislation and reduce the exposure of consumers to these contaminants. Cereals used for human food within the UK usually contain one or more Fusarium mycotoxins; deoxynivalenol (DON), nivalenol (NIV), HT2-toxin (HT2), T2-toxin (T2), Zearalenone (ZON) or fumonisin mycotoxins occurring in maize [fumonisin B_1 (FB_1), fumonisin B_2 (FB_2) and fumonisin B_3 (FB_3)]. The levels of these mycotoxins change through the processing chain.

Initial cleaning of cereal consignments at intake normally reduced mycotoxin levels but this change was very variable and difficult to predict. Milling of wheat and maize then resulted in mycotoxin concentrations in the milling streams produced that related to where the mycotoxins were sited in the whole cereal grains. Hence, the fractions derived from the endosperm tended to contain the lowest concentrations of mycotoxins and these were also related to the particle size, while the products derived from the embryo or outer seed layers contained the highest mycotoxin levels. These could be up to 5 times or more of the levels in the whole cereal, although these components are normally used for animal feed or industrial use. High levels of HT2 and T2 were found in oats at harvest but over 90% of all such mycotoxins were removed by de-hulling so that concentrations remaining in the oat flakes used to manufacture most oat-based foods were very low.

The policy to reduce the exposure of the human consumer to mycotoxins involves practices that remove the ingredients/components that contain the higher levels of mycotoxins, such as bran. These by-products are currently mainly used for animal feed but if mycotoxin concentrations exceed EC guideline limits for animal feed, alternative uses need to be developed.

During processing of the food-destined ingredients only the fumonisins usually showed chemical reaction while DON and related trichothecenes together with ZON were mostly stable. Any changes in mycotoxin concentrations (other than for the fumonisins) thus resulted from a ‘redistribution’ during milling or because of different moisture content and the diluting effect of other constituents. Legislative values are based on the mycotoxin concentrations as determined on an ‘as is’ basis. Laboratory studies confirmed that DON was unlikely to degrade under the conditions used in food manufacture although there was circumstantial evidence for the release of small amounts of bound DON as reported elsewhere. Laboratory and pilot scale studies provided an understanding of the processes that determine where and how mycotoxins accumulate in whole grains and the part that water (rain) plays. An in depth examination of extrusion at pilot scale indicated what would be expected from various commercial processes while bread, cake, biscuit manufacture were also studied.

It is concluded that manufacturers should be able to meet Statutory limits for most retail foods because mycotoxin levels tended to decline through the cereal food chain in line with the values set in the regulations in which levels are determined on an ‘as is’ basis. This is because reaction occurred (fumonisins), mycotoxins were lowest in the ingredients used for human foods produced by milling, the cereal ingredients were diluted by the presence of other components, including moisture or because the levels

in cereals at intake over the study period were low in comparison to the statutory limits. However DON in particular, but also ZON, NIV, T2, HT2 if occurring at or close to the statutory limits at intake, would not be reduced sufficiently to comply in a number of important foods processes including bread (particularly wholemeal), biscuits, breakfast cereals and snacks. Because FB_1 and FB_2 quite often occurred in relatively high concentrations the risk of not meeting the values set for retail products depended very much on the processes involved and the milled starting ingredient. For example, only a very small percentage remained in traditionally cooked cornflakes prepared from maize flaking grits while evidence from extrusion studies and milling suggested that much greater amounts would survive in cornflakes manufactured from flour by extrusion and flaking. However, cereal buyers are likely to set levels at intake at values less than required by the regulations to ensure that legislation can be met at the retail stage for those processes where the reduction in the end product is unlikely to meet that required by the regulatory levels (some companies have already implemented this).

It can be concluded that the relevant TDIs for the parent mycotoxins would not be exceeded by the consumers of these products and that, by definition, there would be no appreciable risk. In the absence of evidence for unrecognised reaction products (other than from fumonisins) or significant levels of bound mycotoxins, risk to the consumer was considered small if statutory limits were followed. It is further concluded that the intakes of putative "fumonisin breakdown products" are well below the Threshold of Toxicological Concern for Class III compounds for any age group (adults, young people and children).

PEER REVIEWED PUBLICATIONS RESULTING FROM FQS64

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Awaiting publication

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Accepted for publication

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Proposed

Edwards, S. G., Hazel C, Buttler, D., MacDonald, S. J., Patel, S., Kelleher, B. and Scudamore, K. A., (in preparation). Fate of fusarium mycotoxins during milling of wheat. Food Additives and Contaminants.

Edwards, S. G., Buttler, D., MacDonald, S. J., Kelleher, B. and Scudamore, K. A., (in preparation). Impact of water on the distribution of fusarium mycotoxins in wheat mill fractions. Food Additives and Contaminants.