FEED INDUSTRY EFFORTS TO REDUCE THE RISK OF DIOXIN CONTAMINATION OF THE FOOD CHAIN

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Introduction

Restoring consumer confidence is of utmost importance for both the legislature and the food industry. For this reason measures to reduce the risk of dioxin contamination of the food chain have been given a high priority. Foodstuffs of animal origin normally contribute to approximately 80 % of the overall dioxins exposure. The dioxin burden in animals derives mainly from feedingstuffs. Therefore feedingstuffs, and in some cases soil and sources related to housing, are of concern as potential sources of dioxins[1].

The Scientific Committee on Animal Nutrition (SCAN), in their opinion of November 2000, identified fish-meal and fish oil as the most heavily contaminated feed materials, in particular certain products of European origin. Animal fats were identified as the next most heavily contaminated materials. All other feed materials of animal or plant origin had relatively low levels of contamination. Roughages presented a wide range of contamination depending on location, degree of contamination with soil, and exposure to sources of aerial pollution. For this reason SCAN recommended that emphasis should be placed on reducing the impact of the most contaminated feed materials on overall diet contamination[2]. This is, in addition to measures to reduce the presence and release of dioxin contamination of the environment and the consequent contamination of food materials.

These findings correspond to independent industry dioxin-monitoring programmes, which have been carried out over the past two years as a response to recent cases of dioxin contamination in a range of feed materials (citrus pulp, animal fats, dried alfalfa, caolinitic clays etc).

The European compound feed industry, organised in FEFAC, therefore fully supports this integrated approach to reduce the dioxin incidence throughout the food chain, i.e. from feed materials through food-producing animals to humans. Although compound animal feedingstuffs in the EU represent approximately 30 % of the total animal feed intake, it is a significant link in the chain of production of food products derived from or produced by livestock. In the philosophy of FEFAC and its members, producing safe feed or food products is first and foremost a question of good management or manufacturing practices (GMP) at each stage from primary production to final processing. It is therefore the responsibility of each operator in the feed & food chain to implement good practices to ensure the safety and the quality of the goods it produces.

A code of good practice, including a risk analysis based on HACCP principles and risk management tools, is therefore a key element for the compound feed industry and their feed material suppliers in the prevention of dioxins and other contaminants from entering feedingstuffs and as a result foodstuffs of animal origin.

In the following paragraphs some of the principles will be discussed with special reference to the approach of Nutreco, a leading global food company. Nutreco activities cover selected stages of the value chains of salmon, pigs and poultry, including breeding, compound feed production, farming, processing and marketing.

REGULATORY ASPECTS

Materials and Methods

As yet, the Codex Alimentarius has not adopted a code of good practice for animal feeding. However, it is expected that it will be adopted by the year 2003. This code of good practice for animal feeding will cover industrial feed production, home mixing and a code of good feeding practice at farm level. Nevertheless, FEFAC has developed guidelines for a code of good practice as part of an action plan aiming at promoting food safety [3]. It is based on several national initiatives, including the successfully implemented Dutch GMP+ system for animal feeding [4]. The present FEFAC guidelines are designed to provide practical information for the implementation of a code of good practice for the production of safe and high quality animal feedingstuffs. They establish a set of principles covering (i) the sourcing of quality feed materials, (ii) the production, storage, transport and delivery of quality feed, in general, and (iii) the use of additives and veterinary medicinal substances in feed, in particular. They require record keeping to ensure there is an adequate traceability system to help manage potential contamination cases in co-operation with public authorities. Feed manufacturers can use these guidelines to compare the methods and practices they describe with their own production methods and plant management and, when necessary, improve or adapt these. Specific conditions at each plant will determine the way in which manufacturers adapt and transpose the provisions laid down in the present guidelines to establish practical rules, procedures and working instructions. These objectives should be achieved using HACCP principles or any equivalent risk management system. The code of good practice may also be developed under ISO 9000-9002 registration or other equivalent quality management programmes incorporating HACCP principles. In principle, this guide may also be used for the production or preparation of premixes.

Food safety management based on risk analysis, quality assurance, traceability, openness and transparency is a key element in the agriculture and aquaculture activities of Nutreco. Many of the food safety initiatives, including projects and results, are described in an annual Social & Environmental Report [5]. With respect to dioxins and other contaminants, a risk analysis has been carried out along all supply chains, i.e. from feed materials to animal products delivered to the food and retail industry, including parts of the chain not owned by the company. Although the process is not yet finished, implementation of risk management tools has a high priority.

Account has been taken of the environmental sources of pollution resulting in the background contamination of feed materials and also of any contamination specifically introduced by production conditions, feed and food processing and during the transport and distribution of feed materials, feedstuffs and food.

The management of the dioxin risks is mainly focused on the feed materials used in the compound feeds and premixes. Verification of the effectiveness of the measures is carried out by monitoring programmes at three stages of the value chains; i.e. feed materials, feedingstuffs and final animal products.

Recently monitoring programmes have been widened to cover certain trace elements, since sporadic cases of dioxin contamination of such products have been reported.

Most of the analyses are carried out at accredited external laboratories using high-resolution GC-MS methods. However, at one of the internal laboratories, Nutreco has invested in installing a DR-Calux® (Dioxin-Responsive Chemical Activated Luciferase gene eXpression assay) analytical system from BioDetection Systems, in special housing, specifically for analysis of dioxins and dioxin-like PCBs [6]. This method is, in particular, useful for screening. It is relatively rapid, cheap, sensitive, and has a false negative rate around 1 %, in line with standard gas chromatography and mass spectrometry methods. In addition, the sample size is small; the clean up of samples is simple and the capacity high. As DR-Calux® is a bioassay measuring the toxic response of all dioxins, furans and dioxin-like PCBs acting on the same cell receptor together and the legislation in force from 1 July 2002 is exclusively taking into account limits for dioxins and furans, a modification is being made in order to make a separation between dioxins/furans and dioxin-like PCBs [7]. This C-Split DR-Calux ® method has now been validated for fish oil and fish. In June 2002 the C-Split DR-Calux ® test will be available on a routine basis for fishmeal and fish feed. Other matrixes will follow.

Results and Discussion

FEFAC's action plan aiming at promoting feed safety, has shown first results in encouraging member associations and the main European raw material supplier organisations to take concrete initiatives for the implementation of quality assurance systems. National codes of practices for animal feeding have already been implemented in the UK, the Netherlands, Belgium, Portugal, Spain and Italy, and other member states will follow soon. The French feed industry will adopt its code of good practice in June 2002. The German feed industry committed itself from 1 January 2003 to purchase only from suppliers having a HACCP system in place, audited by a control body set up by partners of the feed chain. In addition, several feed material supplier organisations finalised their sectoral codes of practice based on HACCP principles, e.g. IFFO (fish meal and fish oil producers), or are in an advanced stage, e.g. CIDE (dehydrators of green forage), FEDIOL (oil seed crushers), EFPRA (animal meals and fats) and CEFS (sugar industry). COPA/COCEGA (crop farmers) encourages the development of risk analysis based Codes of Good Agricultural Practices while COCERAL (traders) have adopted a Code of Good Trading Practices since 2001. It should be noted that several of the supplier organisations already implemented quality assurance systems many years ago, because their primary products are used in the food industry. The new factor is that their co-products for the feed industry are now part of the scope of the HACCP system. In addition, it should be noted that individual companies usually have implemented quality assurance systems based on HACCP principles before (inter)national industry associations publish their codes of practice.

In Nutreco, the HACCP approach resulted in a change in the purchase strategy of feed materials for compound feed. In general, the policy is only to buy from suppliers with demonstrable, verified and preferably certified quality assurance systems based on HACCP principles. In addition, with respect to dioxins, all feed materials have been categorised according to their risk potential, taking into account a differentiation by geographical origin. Several feed materials are not used anymore because risk analysis at a supplier level has shown an increased risk potential without adequate risk control. As an example certain flame dried feed materials can be mentioned, in particular when the fuel used is of a doubtful quality. Typically, forages and co-products from the food industry may belong to this category. In addition, Nutreco also stopped using (mixed) feed materials from untraceable sources such as certain fats and oils, and recycled food materials. Other feed materials with a relatively increased risk potential for dioxin contamination, e.g. fish oil of North See origin and certain types of animal fats are exclusively used only after analysis. Analysis is carried out either by the supplier, who should make it demonstrable by delivering a certificate from an accredited laboratory, or by Nutreco. The latter means in practice a quarantine system in which feed materials are stored completely separated from the feed mills. In all cases, results have to be available before transportation of the feed material to the feed mills. This is necessary because in the case of contamination the high turn over in feed mills will not only result in closing down the feed mill but in a huge recall as well. As a consequence, this may have a tremendous financial impact. In order to verify the effectiveness of the purchase strategy, suppliers of feed materials with a high risk potential are audited on a regular base and such feed materials are subject to a monitoring programme. The frequency depends on the one hand on the risk profile of the feed material and the supplier, and on the other hand on the laboratory capacity. As the Calux method has recently proven to be very efficient in dioxins screening, the present capacity of 40 samples per week will probably be expanded in the near future.

As part of an internal early warning system (EWS), compound feed and final products such as meat, egg and fish are monitored for dioxins as well. In addition to the EWS function, this monitoring is used for identifying potential unknown sources of dioxin contamination. This type of information is extremely valuable in updating risk analysis of feed materials and their suppliers.

Although the risk management measures taken can never exclude a potential contamination of the food chain (a zero risk is impossible), they appear to be quite successful both in Nutreco agriculture and aquaculture. Analysis results indicate that levels in all the products are below the maximum limits

for dioxins in feed and food, which became into force in the European Union from 1 July 2002. This is illustrated in Table 1 for salmon, one of the most vulnerable species since the diet composition is mainly based on fish-meal and fish oil. Table 1 also shows that there are clear regional differences, reflecting the differences in impact of human activities on the regional environment and therefore on the marine feed materials used in the fish feed.

Table 1. Level of dioxins in salmon (Nutreco, 2001 [5])

	Content of dioxins + furans pg WHO-PCDD/F-TEQ-/-g-fresh weight
Maximum limit in muscle meat of fish (Council Regulation 2375/2001/EC)	4
Salmon (n=40)	0.35
Salmon, Europe	0.53
Salmon, Canada	0.20
Salmon, Chile	0.14

In the EU legislation, it is foreseen that the limits will be reviewed for the first time by 31 December 2004 at the latest in the light of new data on the presence of dioxins and dioxin-like PCBs, in particular with a view to the inclusion of dioxin-like PCBs in the limits. Table 2 illustrates that even when dioxin-like PCBs are included, the total TEQ level remains below the present limit of 4 pg-/-g fresh weight.

Table 2. Level of dioxins and dioxin-like PCBs in salmon (Nutreco, 2001 [5])

	Dioxins + furans pg WHO-PCDD/F-TEQ-/-g fresh weight	Dioxin-like PCBs pg WHO-PCB-TEQ-/-g fresh weight	Total TEQ pg-/-g fresh weight
Salmon, Europe (n=40)	0.35	1.54	1.89

In response to consumer concerns, Nutreco is taking steps to further reduce dioxin levels. In aquaculture the approach is mainly based on a replacement of fish oil and fishmeal by vegetable protein and oil sources. In addition, research has focused on the retention of dioxins in farmed fish, as well as the decontamination of fish oils by filtration. Any changes should have a minimal impact on the levels of health-related omega-3 polyunsaturated fatty acids in the fish meat. In agriculture, the main focus is on extension of monitoring, and further development of systems for traceability and early warning.

References

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