Intra-Species Recycling - Opinion *on :* the risk born by recycling animal by-products as feed with regard to propagating TSE in non-ruminant farmed animals. Adopted on 17 September 1999

1. The questions:

The Scientific Steering Committee was requested to address the following questions:

Q1 What evidence is there for and against the possibility of the occurrence of TSEs in pigs, poultry, fish or other species which are fed animal/fish by-products [1] *?*

Q2 What incidence of transmissible spongiform encephalopathies can be expected as a consequence of recycling animal by-products as feed within a species should a case of TSE occur?

Q3 At what stage (incidence level) would this be detectable?

The resulting risk assessment should contain a cost benefit analysis and consider the implications for farming and aquaculture practices and changes in this area.

1.1 The context of the question

Intra species recycling is common practice in farm animals, in particular pigs, poultry and fish but it also happens for other farmed animals.

Concern has been raised as to the theoretical risk that intra species recycling could lead, for example, to the adaptation of agents to the host and/or the building up of an infectivity pool which could create a health risk for the consumer and/or lead to an epidemic in animals.

In particular TSEs are of specific concern.

With regard to legislation the question was raised in order to improve the scientific basis for the updating of the animal waste disposal legislation and other legislative texts in the field of veterinary public health.

1.2 Acknowledgement

This opinion is largely based on the report of a Working Group, which provided the SSC with a valuable input. The report is available on the Internet as a separate document.

2. Scope

a The SSC considers that the issue of (intra-species) recycling of pigs, poultry and fish as feed with respect to TSE risks cannot be addressed independently from the issue of TSEs in ruminants. Ruminants indeed are recycled into feed for other species and therefore it is appropriate to evaluate the risk that they contribute as a potential source of infection or presence of infectivity in animals of another species (e.g., fish, poultry and pigs).

b The cost benefit aspects and the implications for farming and aquaculture practices and changes in this area, were not addressed by the Scientific Steering Committee at this stage partly because the SSC felt that this is not part of its mandate. It also wouldrequire substantial information on current industrial practices, their economic implications and the potential for change. It is further evident that a total interdiction of utilisation of meat-and-bone meal may lead to environmental problems in terms of destruction of animal by-products.

c The present opinion, on purpose, does not cover the ethical part of the issue of (intra-species) recycling of animals as feed, as this was not part of the mandate given to the SSC.

d As requested in the question, the opinion deals with the *risks related to TSEs.* However, the Scientific Steering Committee signals that (intra-species) recycling should also form the object of an evaluation, which puts the issue in a broader context:

- The experience of the emergence of BSE is a vivid illustration of the need to consider precautionary measures before one has absolute proof that a problem has occurred. The possibility of emerging viruses with unusual characteristics must be evaluated.

- It is also recognised by the SSC that TSEs have been found in many species and that experimental evidence, that a particular species can sustain a pathological infection when the agent is administered through any route (e.g., the intra-cerebral and intravenous routes), is cause for concern, because as yet we have so little information about the natural occurrence of TSEs in different species. The ability to discern such infections in limited short term experiments is also difficult.

- It should also be noted that recycling is a means whereby unusual infectious agents can accumulate and/or be amplified by virtue of the constant recycling in a susceptible species.

- Recycling might also lead to accumulation of biomagnifying toxic substances.

- Many infections are totally or partly species-specific, but infectivity may in some cases adapt to new host species. In this context the possible emergence and propagation, after several cycles of recycling, of micro-organisms that are resistant to the standard recycling/rendering processes could also be mentioned.

- The feeding of herbivorous animals with animal proteins derived from the same or other species has presented new biological challenges to these species which originally evolved to cope with very different feed systems based on plants.

- The importance of the biological mechanisms involved in the inter-species barriers to cross-infection. If intra-species recycling does occur, the usual ability to protect the system with inter-species barriers is lost. In the context of TSE, the question also arises as to whatextend the standard procedures for handling animal materials and waste (e.g. "133°C/20'/3 bars") modify dangers of intra-species recycling.

e. The present report deals with (i) species-specific TSEs that might possibly exist in swine, poultry and fish and with (ii) ruminant TSEs (primarily the BSE agent) that may possibly occur in these animal species as a result of feeding [2] them with animal by-products.These by-products are not from fallen stock, nor condemned material as defined in the opinion on "Fallen Stock" [3] of the SSC, unless the "fallen stock" materials were considered as safe for use as animal feed under certain conditions. These conditions remain valid. The present opinion is also limited to recycling into animal feed products and excludes other uses, for example as vaccines (see footnote [2]).

f. The Scientific Steering Committee considers that ruminant-derived milk, gelatine from bones or hides/skins, dicalcium-phosphate from bones, hydrolysed proteins from hides and tallow derivatives, when used as a feed or feed-ingredient (additive), should not be considered as being possibly "ruminant intra-species recycled", provided the recommendations made in the SSC opinions on the safety of these products, including the opinion on "Fallen stock [3]" are applied.

3. Opinion

***3.1* On the question *"What evidence there is for and against the possibility of the occurrence of TSEs in pigs, poultry, fish or other species which are fed animal/fish by-products",* the SSC concludes as follows:**

3.11 Pigs

3.111 Experimental Evidence

There is evidence that pigs can get infected and become clinically ill with BSE through intra-cerebral inoculation with infectious BSE material. Experimental oral exposure of 8 weeks old piglets, however, failed to produce the disease in pigs maintained for 7 years after exposure. Also the mouse bioassay of a range of neural and non-neural tissues from these pigs has not detected any infectivity.

In view of the fact that several animal species, that proved susceptible to TSE by i/c-inoculation have also been shown to be susceptible by the oral route, and in view of the limitations of the oral exposure studies in pigs currently available, and of the relative insensitivity of the mouse bioassay, compared to i/c inoculation of calves, the SSC recognises that further studies would be needed to clarify whether pigs are susceptible to TSE agents via the oral route.

3.112 Epidemiological evidence

According to Wells et al. (1998) extensive exposure of the UK pig population to MBM containing the BSE agent took place in the early phases of the cattle BSE epidemic (before 1988/89). Yet no clinical cases of BSE were observed in the pig population. This population included a large number of breeding animals (sows and boars) retained to at least four years of age, i.e. probably getting old enough to develop the disease if infected, especially considering the likely exposure of these animals to high ***amounts*** *of infectivity*.

Considering the facts that

- in most areas of Europe, including the UK, such intensively farmed pigs are closely monitored for health and disease by the farmer and his veterinarian, and

- that new infectious pig disease entities have been described in European pig populations during the same time period, i.e. have been observed by this monitoring system,

it is evident that disease ***monitoring*** of most European pig populations must be considered overall to be efficient.

It therefore can be assumed that a new emerging clinical disease condition would be detected at a reasonably low incidence level. This is also true for BSE in pigs because existing clinical conditions, which might resemble BSE/TSE, are probably few and uncommon. However, a small number of cases could have gone unnoticed or undiagnosed, i.e. at a low clinical incidence. The same holds true for "healthy carriers", should they exist.

3.12 Poultry

3.121 Experimental evidence

As yet there is no evidence that TSEs can be induced in poultry via i/c inoculation or oral challenge. On the other hand infectivity could be recovered from poultry inoculated *via* the i/v route with TME. However, this could also be explained as residual inoculum (Marsh et all, 1969).

3.122 Epidemiological evidence

It has to be assumed that in the UK poultry have been exposed like pigs to high amounts of BSE-infectivity before feeding them with ruminant MBM was banned. Current disease monitoring systems are regarded to be unlikely to identify cases of TSEs in poultry, not at least because of the short life-span of most of the commercially reared animals. However, higher incidence levels would probably not have gone unnoticed under all circumstances.

3.13 Fish

3.131 Experimental evidence

Concerning the susceptibility of fish, it is the understanding of the SSC that a project is ongoing in the context of the FAIR [4] programme, funded by the European Union, addressing the issue of TSE in farmed Salmon but so far no data have been reported.

3.132 Epidemiological evidence

Current disease monitoring systems are regarded to be unlikely to identify sporadic cases of TSEs in farmed fish. Anecdotal monitoring [5] of wild fish over a period of 25 years for neurological disorders, on the other hand, has not lead to any indications of spongiform encephalopathies in these fish **.**

3.14 Pigs, poultry and fish

- The occurrence of TSEs has not been reported for pigs, poultry and fish.

- On the other hand for some of the other species that could be fed animal/fish by-products, namely felines, several zoo animal species including primates, TSE cases have been reported.

- *The possibility of pigs, poultry or fish to act, after oral challenge under field conditions, as healthy carriers in the spread of TSE-agents is still hypothetical and no results of experiments conducted as yet are available to support this hypothesis.*

3.2* On the qu *estion "What incidence of transmissible spongiform encephalopathies can be expected as a consequence of recycling animal by-products as feed within a species should a case of TSE occur?"* the SSC*:

- Considers that the risk of occurrence of "a first (clinical) case" can never be completely excluded as was shown by the BSE epidemic in the UK. Such a first case can theoretically lead to a significant incidence risk of TSE within the species. However, given the present state of scientific knowledge, the expected incidence cannot readily be predicted.

- The SSC recommends that further research is encouraged, preferably addressing targeted surveys, the possible existence of TSEs in pigs, poultry and fish, and mathematical modelling of the propagation dynamics resulting from intra species recycling.

3.3 On the question "At what stage (incidence level) would this be detectable*?", the SSC concludes*:

The stage or incidence level at which the incidence of transmissible spongiform encephalopathies would be detectable can presently not be determined. It would be influenced by a range of factors, in particular the long incubation time of these diseases in relation to the normal life span of the animals, the intensity of the surveillance and the absence of pre-clinical diagnosis, the clinical presentation in the observed species and feeding practices. All these factors are likely to differ significantly between different species and populations concerned.

However, considering primarily the long incubation time of theses diseases, it is very likely that a newly emerging feed-borne animal TSE would be detected at a (rather late) stage when significant numbers of equally fed animals would have been exposed, as learnt from the development of the BSE epidemic.

3.4. Conclusions

The SSC, in considering the possible consequences, concludes as follows:

A. So far no scientific evidence exists to demonstrate the natural occurrence of TSE in farmed pigs, poultry and fish, which may create a basis for an intra-species progression of a TSE infection due to intra-species recycling.

B. Given the limitations of the surveillance in certain areas, and the length of the incubation time in relation to the normal (=economic or commercial) life span of the animals, it can not be excluded that cases occur and that, perhaps

more important, an undetected pool of infectivity is build up.

C. Because of these two preceding points, the SSC wants to underline that in scientific terms absence of evidence is neitherevidence of absence nor of presence of a risk. However, it is impossible to exclude, on the basis of the available evidence, that TSEs are already present (albeit undetected) in non-ruminant farmed animals, in particular not if there is reason to assume that these species have been (and might still be) exposed to BSE-contaminated feed (produced from ruminants).

D. Recycling of animal material, in general, will increase the risk that cases occur or undetected infectivity pools develop,in particular if potentially BSE (TSE) contaminated material is recycled to ruminants or (possibly) susceptible non-ruminants.

E. Intra-species recycling will, due to the absence of a species barrier, increase the risk further.

F. If recycling, and in particular intra-species recycling, of animal material to farmed animals can not be avoided, all measures that reduce the recycled infectivity would reduce the risk.

G. Measures that reduce the recycled infectivity include [6] :

- exposing the recycled animal material to a treatment by 133°/20'/3b or equivalent conditions,

- excluding those tissues known to carry the highest infectious load (SRM [7]),

- excluding [8] fallen stock from the production of feed,

- stop feeding pig, poultry or fish potentially contaminated feed a sufficiently long period of time before slaughter in order to reduce the risk of recycling infectivity via the gut-content.

H. It has to be understood that

- the possible measures would not be able to reach a zero risk should infectivity enter the recycling loop, and

- that due to the long incubation time of this type of disease a significant risk would have build up before an incidence becomes visible (as has been seen in the case of BSE in the UK).

I. The SSC considers R&D in the field of surveillance and (pre-clinical) diagnostic of TSEs and the experimental transmission of TSEs to farmed (non-ruminant) animals to be of highest priority.

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- Safety of Tallow, 27/3/98
- Safety of Dicalcium Phosphate precipitated from ruminant bones and used as an animal feed, 26/6/98
- Safety of Hydrolysed Proteins produced from bovine hides, 23/10/98
- Safety of Organic Fertilizers derived from mammalian animals, 25/9/98
- Risk of Infection of Sheep and Goats with the Bovine Spongiform Encephalopathy agent, 25/9/98
- "Fallen Stock": The risks of non conventional transmissible agents, conventional infectious agents or other hazards such as toxic substances entering the human food or animal feed chains via raw material from fallen stock and dead animals (including also: ruminants, pigs, poultry, fish, wild/exotic/zoo animals, fur animals, cats, laboratory animals and fish) or via condemned materials, 23/7/99

Reports of Working Groups

- Report on the safety of meat and bone meal derived from mammalian animals fed to non-ruminant food-producing farm animals, 25/9/98
- Report on the possible vertical transmission of Bovine Spongiform Encephalopathy (BSE),19/3/99.

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[1] Intra-species recycling of fur animals is discussed in the SSC opinion on "Fallen stock", adopted on 24-25.06.99

[2] There are recent reports of scrapie being transmitted to sheep and goats in Italy with a vaccination being implicated as the means by which the animals became infected. The vaccine was prepared from homogenised sheep materials including central nervous system tissues. This issue should be addressed separately, but given the high efficiency of certain ways of transmission of TSEs (e.g., by the parenteral route), it is appropriate to recommend extreme prudence and not extrapolate the conclusions of the working group to other ways of intra-species recycling, for example via pharmaceutical products, vaccines, etc.

[3] Opinion of the SSC on: "The risks of non conventional transmissible agents, conventional infectious agents or other hazards such as toxic substances entering the human food or animal feed chains via raw material from fallen stock and dead animals (including also: ruminants, pigs, poultry, fish, wild/exotic/zoo animals, fur animals, cats, laboratory animals and fish) or via condemned materials". Adopted by the SSC on 25 June 1999.

[4] FAIR5-CT97-3308 entitled "Separation, identification and characterisation of the normal and abnormal isoforms of prion protein from normal and experimentally infected fish" has started on 1/3/1998 for three years, with the objectives: (i) characterization of the normal isoforms of fish PrP and its coding nucleotide sequence; (ii) attempt to transmit experimentally TSE material from ovine and bovine to fish; (iii) setting up of a sensitive and specific diagnostic test for PrP detection in fish tissues, (iv) the evaluation of the uptake and binding of normal fish PrP.

[5] For details see report of the working group, published on the Internet as a separate document.

[6] See also the various opinions of the SSC on the safety of products.

[7] Disease and species dependent, at current only defined for BSE and cattle and cattle, sheep and goats.

[8] For detailed recommendation s see the "Fallen Stock" opinion of the SSC, July 1999.