ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

RAW MUSHROOMS: CONSUMER ADVICE

1. Following the finding of *Salmonella* Kedougou in raw mushrooms from Northern Ireland in 2001, the Food Standards Agency (FSA) issued advice to consumers to wash mushrooms and to peel and cook them before use. In the light of work undertaken by the industry since this incident the Agency is seeking advice from Members on whether the FSA's advice to consumers to "peel and cook" mushrooms before use should now be withdrawn.

Background

2. In March 2001, Wyre Borough Council informed the Agency about an outbreak associated with a buffet for a group of schoolteachers on 26-27 February. Testing of stool samples had identified the causative agent as *E. coli* O:88. As part of the investigation, Environmental Health Officers sampled a range of foods prepared for the buffet. They also sampled raw mushrooms that had been delivered before the buffet but were not served and *Salmonella* Kedougou was found in the mushrooms by Preston PHL.

3. The mushrooms were supplied by a wholesaler in Preston who received supplies via a distributor for two mushroom growers in Northern Ireland and a marketer in Republic of Ireland. However it was not possible to identify a specific source for the contaminated mushrooms at that stage and further testing was undertaken. Testing of mushrooms from the wholesaler in Preston found *Salmonella* contamination in mushrooms from three different suppliers. This provided evidence that there was a wider problem and pointed to a link between the suppliers or growers, such as the sourcing of raw materials for mushroom cultivation.

Cultivation of mushrooms

4. The white *Agaricus bisporus* mushroom accounts for 95% of the market. Mushroom compost is produced by composting chopped straw and poultry manure with the addition of water and gypsum. After composting, the compost is pasteurised and supplied to the mushroom grower usually in plastic bags, blocks or as bulk compost. These are typically placed out in insulated polythene tunnels.

5. Mushroom spawn (seed) is added and when the fungal mycelium has grown through the compost, a deep layer of casing material (limed peat) is placed on top to induce the formation of fruiting bodies or mushrooms. About a week later, harvesting of the mushrooms commences and this continues for

four to six weeks. After cropping, the spent compost/casing is removed to make way for the next crop.

Source of the contamination

6. Following finding of mushrooms contaminated with *Salmonella* Kedougou, FSA Northern Ireland followed up investigations at growers and distributers linked to the positive isolations in Preston. Positive samples were obtained from mushrooms, casing and compost.

7. Attention then focused on the compost and casing supplied to mushroom growers. *Salmonella* Kedougou was found in casing from various suppliers suggesting that one of the casing ingredients was the source of the problem. Further investigation identified sugar beet lime, from sugar manufacture in the Republic of Ireland, as the source of *Salmonella* Kedougou.

Advice to consumers

8. A meeting with all interested parties, including the Mushroom Growers Association and the compost and casing industry, was held in April 2001. Following this meeting, a press release was issued by the Food Standards Agency (Annex A) and the Food Safety Authority of Ireland (Annex B) advising the public to wash, peel and cook mushrooms before consuming them. Some retailers also put notices in their stores making consumers aware of the FSA's advice, which is still in force.

Further Action

9. A decision was also taken that mushroom casing would not be manufactured with sugar beet lime until such time that the casing manufacturing industry could provide evidence that casing material was free from pathogens.

10. A code of practice for mushroom casing production in Northern Ireland and the Republic of Ireland was produced to standardise its production and to minimise the recurrence of this type of incident (Annex C). The respective Departments of Agriculture monitored testing at casing manufacturers and found no *Salmonella* positive samples.

11. Tests were also carried out at 20 mushroom growing farms in England, Wales and Scotland in the months following this incident. Mushrooms, compost, sugar beet lime, casing or peat were sampled and no *Salmonella* positive samples were found.

12. Since this incident, casing suppliers, mushroom growers and retailers have included *Salmonella* as part of their routine testing. Information has been provided by the Mushroom Growers Association on testing of casing, compost, peat and mushrooms over the last 2-3 years and the results are summarised in Annex D.

13. **The Agency is content that consumers should be advised to wash mushrooms before consuming them, as this is consistent with its advice**

in relation to salad vegetables. The Committee is invited to give its views on whether or not the additional advice to peel and cook mushrooms can now be removed.

Secretariat
September 2003

Annex A

FSA Press Release
Food Standards Agency Acts on *Salmonella* in mushrooms
Thursday, 12 April 2001

A rare type of *Salmonella*, that is an uncommon cause of illness in humans, has been found in some mushrooms in the UK.

The potential problem was confirmed late last month, after testing of catering and wholesale mushrooms sampled by environmental health officers in Lancashire. They discovered the presence of *Salmonella* Kedougou, which has in the past been associated with turkey meat and tripe. The extent of the problem is not yet known but it has been found in mushrooms from some - but not all – growers in Northern Ireland. Investigations are continuing to identify any other affected growers and suppliers of compost and casing throughout the UK.

The Food Standards Agency is co-ordinating further investigations with the Mushroom Growers industry - and suppliers of the medium used to grow the mushrooms - to pinpoint the source and extent of the problem. Preliminary findings indicate that the most likely source may be the casing, a layer of organic material added on top of the compost to promote mushroom fruiting.

Mushroom growers and suppliers of compost and casings that are potentially implicated in this incident are being advised of test results on their products and requested not to sell their products until the problem has been resolved.

There have been only three reported cases in the UK this year associated with this bacterium. None of the reported cases was associated with eating mushrooms, nor was the type of *Salmonella* Kedougou the same as the one found in the mushrooms.

Although most mushrooms are cooked, they are also widely eaten raw in salads or dips. Like other salad vegetables, they may become contaminated by bacteria from the soil or other media in which they are grown.

The Food Standards Agency advises that vegetables and salads should be washed carefully to remove any soil and dirt which can carry bacteria and other organisms, making sure that any soil is also washed from hands, kitchen surfaces and equipment. Consumers are advised to peel their washed mushrooms, in order to minimise any risks from bacteria. Mushrooms for use in salads may be cooked, then allowed to cool before serving.

BACKGROUND NOTE

There are about 2,400 different types of *Salmonella*. The Public Health Laboratory Service reported14,844 isolates (provisional figures) of *Salmonella* from humans in England and Wales last year, of which only 20 or so were *Salmonella* Kedougou. This particular strain was first isolated in Africa in 1970. Total numbers of human infections in the last four years are as follows :

1998 – 18
1999 – 13
2000 – 20
2001 - 3 (to date)

The Food Standards Agency Northern Ireland has so far taken between 110 and 120 samples of mushrooms, complete with their compost and casing. Of the 22 positive results so far obtained, 14 relate to the casing, 4 to the compost, and only 4 to the mushrooms themselves.

According to the Mushroom Growers' Association, approximately 300 million pounds in weight of mushrooms are consumed each year in the UK.

Annex B

Food Safety Authority of Ireland Press Release.

Food Safety Authority of Ireland advises consumers to cook mushrooms

Thursday, 12 April 2001

Following testing of catering and wholesale mushrooms in Preston, Lancashire, UK a number of samples of raw mushrooms tested positive for Salmonella kedougou. In light of this, as a precautionary measure the Food Safety Authority of Ireland (FSAI) is advising consumers and commercial caterers that until further notice it is advisable to cook all mushrooms before eating/serving, as cooking kills all Salmonella.

Salmonella kedougou is an uncommon strain of Salmonella and the last reported case in humans in Ireland was in 1997. To date, no illness has been reported in the UK and it is not known whether the contamination is associated with UK produced or imported mushrooms. An investigation is now underway in the UK and Northern Ireland to establish the source of the contamination. It is too early to pinpoint the source and the FSAI is working closely in this investigation with the Food Standards Agency in Northern Ireland and the UK.

There is no evidence that any mushrooms produced in the Republic of Ireland are contaminated; however, this precaution is in place until the investigation is complete. The FSAI is co-ordinating the investigation in the Republic of Ireland with mushroom growers and suppliers of the material that is used to grow the mushrooms.

The FSAI intends to keep consumers informed of any developments on this issue.

Annex C

Code of Practice for mushroom casing production in Ireland : Stage 1 (of 3). Bord Glas. March 2002.

Annex D

Salmonella Testing

All Negative unless otherwise stated.

Mushroom Grower A

	Mushroom	Casing	Compost
Feb 03	9	3	3
Jan 03	5	3	3
Nov 02	7	3	3
Jun 02	6	0	0
May 02	9	3	3
Mar 02	2	1	1
Dec 01	9	4	4
Oct 01	10	4	4
Sept 01	0	5	5
Jun 01	11	5	5
May 01	18	6	6 tested negative from 7 samples*
Apr 01	3	5	3

*: One sample tested positive for *Salmonella* Typhimurium, Compost discarded

Mushroom Grower B

	Salmonella Testing
	Compost/Casing
Jun 03	2
May 03	5
Apr 03	4
Mar 03	5
Feb 03	3
Jan 03	4
Dec 02	3
Nov 02	5
Oct 02	4
Sep 02	4
Aug 02	5
Jul 02	9
Jun 02	7
May 02	4
Apr 02	34
Apr 02	32
Mar 02	32
Feb 02	14
Jan 02	64
Dec 01	53
Nov 01	61
Oct 01	72
Sep 01	49
Aug 01	65
Jul 02	126
Jun 01	48

Casing Manufacturer A

	Casing/Peat
Jul 03	10
Jun 03	25
May 03	20
Apr 03	25
Mar 03	31
Feb 03	20
Jan 03	25
Dec 02	15
Nov 02	23
Oct 02	15
Sep 02	29
Aug 02	40
Jul 02	11
Jun 02	28
May 02	22
Apr 02	32
Mar 02	32
Feb 02	14
Jan 02	64
Dec 01	53
Nov 01	61
Oct 01	72
Sep 01	49
Aug 01	65
Jul 01	126
Jun 01	48

Casing Manufacturer B

	Casing/Peat	Sugar Beet Lime	Water
Jun 03	1	0	0
May 03	2	0	0
Apr 03	1	0	0
Mar 03	1	0	0
Jan 03	1	0	0
Dec 02	1	0	0
Nov 02	1	0	0
Sep 02	1	0	0
Aug 02	1	0	0
Jul 02	1	0	0
Jun 02	1	0	0
Apr 02	4	2	0
Mar 02	7	1	1
Feb 02	7	1	1
Jan 02	7	1	1
Oct 01	4	1	1
Sep 01	4	1	0
Aug 01	3	1	1
Jul 01	3	0	0
Jun 01	2	0	0
May 01	2	0	0
Apr 01	1	1	1