Clarification and Explanation of the SCF s Opinion of 7 June 1996 on Badge (expressed on 13 June 1997)

Since the Committee expressed its opinion on BADGE on 7 June 1996 (CS/PM/2812-FINAL) **,** a request by the Commission has now been received to provide a more detailed explanation on the following items:

1. The background of the change in the classification from SCF list 4 to list 7, with special emphasis on the mutagenicity data.
2. The characterisation of the identity of the hydrolysis products, which are included in the upper limit of 1 mg/kg of food as a temporary restriction for specific migration of BADGE and its hydrolysis products.

1. The change in the classification from SCF list 4 to list 7, with special emphasis on the mutagenicity data.

RIVM evaluation (Doc. CS/PM/10, February, 1987):

The following studies formed the basis of the first evaluation on BADGE delivered by the WG:

Salmonella reversion assay (Ames test)	Positive	ref. 1
Gene mutations in mouse lymphoma cells	Positive	ref. 2
Chromosomal aberrations in Chinese hamster bone marrow *in vivo*	Negative ?*	ref. 3
Nuclear anomalies in Chinese hamster bone marrow *in vivo*	Negative ?*	ref. 4
Chromosomal aberrations in mouse spermatogonia *in vivo*	Negative	ref. 5
Chromosomal aberrations in mouse spermatogonia *in vivo*	Equivocal	ref. 6
Chromosomal aberrations in mouse spermatocytes *in vivo*	Negative	ref. 7
Dominant lethal test in mouse	Negative	ref. 8

* results negative but the study had a limited experimental design

The data evaluated showed a mutagenic potential *in vitro*, but were inadequate to demonstrate the lack of activity *in vivo*, because of limitations of the studies on somatic cells (ref. 3 and 4). The genotoxic profile was judged to be similar to that displayed by other glycidyl ethers. Therefore, in view of the carcinogenicity of some glycidyl ethers, the substance was classified as a suspected carcinogen (SCF List 4).

First updated evaluation on BADGE (CS/PM/2812-FINAL, June 1996).

For this updated evaluation some additional mutagenicity studies were considered in the technical document prepared by the WG on BADGE (CS/PM/2787).

Test for the induction of unscheduled DNA *synthesis in vitro*, in human white blood cells	Negative	ref. 9
Test for the induction of structural chromosomal aberrations in rat liver cells *in vitro*	Positive	ref. 10
Test for neoplastic transformation *in vitro* in baby hamster kidney cells	Positive	ref. 11
Micronucleus test in female B6D2F1 mice	Negative	ref. 12

Analysis of DNA single strand breaks in rat liver cells after single oral administration	Negative	ref. 13

BADGE was evaluated as mutagenic *in vitro*, and negative in in vivo studies which were again judged as insufficient to demonstrate lack of activity on somatic cells (because of the limited experimental design of ref. 3 and 4, or because the full data were not available for independent evaluation as for ref. 12 and 13, but were only quoted in the form of summaries in a review, ref. 14). Therefore, further *in vivo* studies (chromosomal aberrations in bone marrow and DNA damage in liver) were requested.

Metabolic data provided evidence for extensive and rapid metabolic detoxification, and a more recent DNA binding study showed very low covalent binding to skin DNA after topical application (Steiner et al., Carcinogenesis 13, 969-972, 1992). Accordingly it was expected that the genotoxic activity of BADGE *in vivo* would be weak, or non-existent. Consequently, BADGE was provisionally re-classified in List 7 (SCF opinion 7 June 1996).

Since, the opinion on BADGE of 7 June 1996 the full reports of the studies (ref. 12 and 13) have been made available and were considered by the WG (CS/PM/2967, February 1997). The data showed absence of mutagenic activity in liver and bone marrow *in vivo*.

2. Characterisation of the identity of the hydrolysis products, which are included in the upper limit of 1 mg/kg of food as a temporary restriction for specific migration of BADGE and its hydrolysis products.

In order to reach a view on which hydrolysis products should be included in the upper limit of 1 mg/kg of food as a temporary restriction for BADGE and its hydrolysis products, the following substances have to be considered:

- A: BADGE
- B: monoadduct, in presence of water and acid: 2-[4-(2,3-epoxypropanyloxy) phenyl-2-4-(2,3-dihydroxypropanyloxy)phenyl] propane
- C: diadduct: 2,2-Bis[4-(2,3-dihydroxypropanyl)phenyl]propane
- D: monoadduct of BADGE with HCl
- E: diadduct of BADGE with HCl

Recent and ongoing studies have shown that the following substances can be found in the coatings, foodstuffs and simulants:

- Coating: A, D, E (D, E in some special coatings)
- Foodstuffs: A, B, C (A B C) and D, E (as migrants from special coatings)
- Simulants: A, B, C (A B C)

The Committee noted that in coatings residual amounts of compound A and, depending on the type of coating, also the compounds D and E have been detected. Analyses have shown that these residuals A, D and E may migrate into any type of food whether aquous or fatty. Compound A has been shown to hydrolyse in aqueous foods to B and subsequently to C. However in fatty media compound A is stable. If food contains chloride ions it is theoretically possible that compound A may be transformed into compound D and subsequently E.

The Committee therefore recommends as follows on which substances should be included in the limit for BADGE and its hydrolysis products. There is some experimental evidence that compound C may be of minor toxicological relevance and therefore need not to be considered when assessing compliance of foodstuffs with the SCF group restriction. Consequently, determination of compliance with the SCF group restriction would require that only the sum of A and B be considered in the case of examination of foodstuffs. However in the case of examination of food contact materials by aqueous food simulants, the sum of A, B and C should be determined because in this case more A and B would be converted to C as compared to the situation in foodstuffs.

The compounds D and E in foodstuffs are of concern because of their structural analogy to the genotoxic monochloropropanediol (MCPD). The Committee will address this issue as soon as it has confirmation of their presence and their levels in food.

References

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