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**AN EXAMINATION OF RISK OF ACUTE TOXIC INJURY  
FROM DEVICES USING NICOTINE IN OR ON ALUMINA GRANULES**

**Introduction**

The Reynolds product "Premiers" uses alumina granules coated with tobacco extract as a major source of nicotine.

The data from studies of the Reynolds device have been examined as the basis for assessing possible concerns from the use of nicotine-coated alumina granules in novel products. Consideration has been restricted to the possible acute toxic consequences which could arise under some extreme conditions of use, or through accidental exposure via ingestion.

No attempt has been made to review the literature on acute toxicity of nicotine exhaustively. Instead, selected reviews have been taken (1, 2, 3) against which the figures have been examined.

**Assumptions**

The initial examination has been based on the results reported for the nicotine content and delivery of the two variants of the device marketed in the USA: "Premiers" and "Premiers Menthol" (4). The specific data extracted from that report are shown as Table 1.

Additional information which has been noted is that the beads (alumina spheres) in each device weigh approximately 330 mg, are free-flowing and are contained in an aluminium tube occupying a volume of approximately 30 x 4 mm, i.e. under 0.4 cc.

Concern has been restricted to the nicotine available from the device and its acute consequences. Possible risks from the aluminium tube, the alumina spheres and other components of the tobacco extract used have been discounted.

**Potential Nicotine Intake under Normal Use**

By analysis, the total nicotine content of "Premiers" is around 6 mg, with just over one-third provided by the beads. This compares with perhaps 20 mg for a conventional cigarette and substantially larger quantities in cigars and in pipe

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tobaccos. A further comparison is with "Favor", in which there was a nominal loading of 10 mg and a determined content in the aged product of 6.8 mg (Reference 2, Appendix 1).

Two sets of smoking conditions have been applied to "Premiers" - Table 1 - producing a maximum per stick delivery of 0.77 mg nicotine, i.e. well within current commercially acceptable limits for deliveries from conventional tobacco products.

It is difficult to conceive of smoking conditions capable of delivering all of the nicotine from the beads and, even so, this would only augment the delivery from 0.77 to 0.99 mg without some further part being retained on the filter sections.

It is equally difficult to envisage a concern from some "smoking" of the beads section when removed from the device when the total nicotine content is limited to 2 mg.

#### Accidental Ingestion or Inhalation Intake

The assumptions of safe dosage of nicotine to smokers rely heavily on comparison with existing levels of usage. This cannot be used in examining accidental exposure, by whatever route of administration. There are no studies available providing data on totally safe levels of intake for large populations of man, but the limited observations reported make it clear that previously unexposed persons display symptoms at doses one-fifth or less of those tolerated by smokers (1).

The nicotine available from the beads of one "Premiers" is theoretically 2 mg, which compares with the quoted figure for lethal dose to man by oral ingestion in one unit of 60 mg (1). For a very sensitive, previously unexposed to nicotine, member of the population it would be wise to apply a safety figure of 10-fold, still providing a safety factor of three against possible fatal effect.

Realistically it is difficult to envisage accidental exposure of adults in this way, except by deliberate intent or experimentation.

Possible exposure of children or even infants also requires consideration, in terms of both dose and feasibility of the event *per se*.

The average figure quoted for a lethal dose for adults of 60 mg approximates to nearly 1 mg per kg bodyweight. For a child, it would be appropriate to use a safety factor of 10 as a minimum in calculating possible risks, i.e. 0.1 mg/kg, particularly as it must be assumed that a child would not have previously developed any tolerance. Mean weights for European children at different ages (5) have been used to calculate possible doses (Table 2).

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The implication of these figures is to suggest that the beads from one unit could provide a fatal dose of nicotine for an average child up to age 5 and, therefore, for extra-sensitive and under-average weight groups beyond that time.

The independent assessor to ATP (2) considered the risk to children at some length. He relied upon the 1 mg/kg "average" toxic dose as also applying to children. Evidence was produced that extraction of the device would limit intake to about 1.5 mg, whilst admitting the rare possibility of swallowing it and absorbing 5 mg nicotine.

Reliance was then made of the emetic properties of nicotine in mitigating its effects: that would appear dangerous given the occasional reports (3) of both fatal and non-fatal toxicity in children from intake via tobacco products.

The consideration given above has assumed that all of the nicotine in the beads would be absorbed and has not examined the likelihood of the actual event. At first sight it is an extremely unlikely possibility, but the very small volume involved and its form would increase concern of its happening should the container be breached. The beads would be more readily retained in a child's mouth and subsequently swallowed than either filter plugs or tobacco shreds. In the absence of contrary evidence it must be assumed that all the nicotine would be extractable.

### Conclusions

This review of the possible consequences of use of alumina beads impregnated with tobacco extract has identified that, at the level used in "Premiers":

1. They should present no additional risk of acute toxic effects from nicotine, by comparison with conventional tobacco products, to adult smokers.
2. The total available dose of nicotine from the beads should not constitute any major risks to adults from accidental, experimental or mischievous abuse.
3. Although the dose of nicotine contained in the beads is less than that used in "Favor", it could pose a significant risk to children up to 5 years of age on ingestion.
4. The significance of the possible risk to children in part attaches to the small volume of material in which the nicotine is contained. Its relevance depends on views of the ease with which the container holding the beads can be breached, or treatments in liquids of the whole unit would elute its active contents.

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### Recommendations

- A. Used in a smoking device, I can see no reason for objecting to the use of alumina granules containing the level of nicotine found in "Premiers" in respect of acute toxic effects.
- B. If any new device were proposed for marketing relying on this type of technology, it would be important to include consideration of child-proofing the element containing nicotine-alumina beads.
- C. If the bead route is to be followed, actual experimentation is required to show the amount of nicotine eluted from the container and the beads in isolation by drinks and physiological liquids in order for the consequences to be more adequately evaluated.
- D. The concerns would be greatly reduced if the alumina beads or other nicotine source were firmly attached to a larger element of the product. The consequences of intake will almost certainly then be ameliorated particularly in the case of children.
- E. The temptation to increase the nicotine loading of the alumina in any product should be strongly resisted unless or until ample evidence is provided to demonstrate its non-susceptibility to risk of accidental poisoning.

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### References

1. Cohen, A.J. & Roe, F.J.C. "Monograph on the Pharmacology and Toxicology of Nicotine". London: Tobacco Advisory Council. 1981.
2. Ford, D.M. "Toxicology of Nicotine Base". An Assessment for Advanced Tobacco Products. Middletown, N.J.: August 1985.
3. Larson, P.S., Haag, H.B. & Silvette, H. Tobacco: Experimental and Clinical Studies. Baltimore: Williams & Wilkins Co. 1961, 1968, 1971 and 1975.
4. Brown & Williamson Tobacco Corporation. R&D Document "Airbus/499". February 1989.
5. Eveleth, P.B. & Tanner, J.M. "Worldwide Variation in Human Growth". International Biological Programme 8. Cambridge: Cambridge University Press.

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**Table 1 :The Sources of Nicotine in "Premiers"**  
(Data from Reference 4)

(a) Unlit Product

	Nicotine Content (mg)	
	"Premiers"	"Premiers" Menthol
Tobacco	3.57	3.75
Beads	2.08	2.07
Filter	0.42	0.00
Total	6.06	5.82

(b) Mainstream Delivery

Nicotine Content (mg)			
Super	FTC	Super	FTC
0.77	0.3	0.63	0.26

Note: "Super" refers to super-puff smoking conditions of 50 cc puff, 1.5 seconds, 2 puffs per minute, compared with standard FTC conditions of smoking.

**Table 2 :Mean Weights (kg) for European Children**  
(Data from Reference 5)

**Ranges for 21 Countries**

Age (years)	Boys	Girls
1	9.7 - 10.7	9.2 - 10.0
2	11.8 - 13.3	11.2 - 12.8
3	13.0 - 15.6	12.7 - 15.0
4	16.0 - 18.1	15.3 - 17.0
5	17.0 - 19.7	16.7 - 20.0
10	26.9 - 33.8	26.6 - 33.9

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