

Comments on ITC Report No 153

The Assessment of Alveolar CO Concentrations as an Indicator
of Smoke Inhalation.

2/12/77

I don't understand this endorsement
N.M.

To start on a trivial point, the method shows the amount of RETENTION of CO rather than inhalation. The results obtained by this method seem very reasonable and all go in the expected directions in a logical way. It is unfortunate that Montreal have not had a benchtop IR method available to them (such as that reported by Rawstone) as the analysis of the samples by GLC is slow and tedious. With an IR method the throughput of samples could be increased enormously, with very little loss of accuracy.

We have found, using our Quill Parsons IR CO analyser, that when it is tuned to its most sensitive but

107469784

uncalibrated setting, that it is slightly sensitive to CO_2 . We
 therefore added soda-lime and calcium chloride traps to remove
 the CO_2 and water. Since ^{exhalate is saturated} ~~the air is saturated~~ with water
 vapour it was expected that some would condense in the
 measurement cell, and with possible deleterious effects.

I prefer the Montreal method of collecting samples to
 that of Rowhani. The 4 exhalations and 3 inhalations into a
 metabolic bag used by ERF and PSD is much simpler and
 quicker than Rowhani's. Rowhani used a long tube with
 breathing valves and a mark so that the tidal exhalate
 was sampled from the tube. To set up and control
 the valves from pressure switches would not be simple. Essentially
 a valve must open to admit exhalate to the tube, whilst a

107469785

volume class that admits room air to the face mask. The volume measure during inhalation. Although we never attempted to set up such a volume system, I did use a long sample tube with controlled breathing - in through nose and out through mouth. Results obtained in this way were compared with sample collected into a rebreather bag. Differences were generally slight. It was assumed that it is difficult to collect tidal exhalate in a bag because the temptation exists to breathe in slightly more deeply and breathe out more deeply when blowing up a bag. Any excursion into inhalation volume will have a diluting effect on the sample. The rebreathing technique used by Montreal should minimize any dilution effects due to initial "over breathing".

107469786

The Montreal have used each subject as his own control, which is the very practical way to proceed in such a test. They have found the the usual large differences both within a subject and between subjects which we have learned to expect in human studies. Because of these variations and differences it is clearly necessary to work to an experimental design when comparing cigarette brands. Many replicates (days) need to be measured. There is one point which needs clarification - How do you measure the CO level half an hour before smoking, when the subjects are smoking ad-habituation? The only way is to depend smokers for 1/2 hour so that the resting level is measured 30 minutes after a cigarette - a cigarette is smoked (3-10 minutes) the "after

107469787

5
body measurement is taken 3 minutes later followed by
enforced abstinence for the next 30 minutes etc.

A further use of this technique could be an
index used to measure the irritation of tobacco smoke.

- It is assumed that more irritant smokes are less likely to
be inhaled than "milder" smokes. The technique would need to
be modified slightly to use more subjects with possibly fewer
replicates as a survey would yield more information in this
case.

The relationship between CO in exhaled air and the
COHb level in the blood has been established broadly and
the equation quoted by Ransome is probably a useful
generalization. Specifically, it was applied to individuals

107469788

subjects, some marked deviations could be expected. The
 retention of CO or any other material must depend on the
 lung morphology and physiology. The retention of CO will
 also depend on the concentration of Hb in the blood, the volume
 of blood and the loading-unloading dissociation curve of the Hb.
 To improve the precision of the equation for individual subjects
 it would be necessary to perform a ^{battery of} ~~single~~ lung function tests
 and an extensive haematological examination before each test on each
 subject. Since this is not practical as direct COHb measurement
 is precluded by present company policy it is necessary to use
 a representative number of subjects so that assumptions made
 by Rawson's equation are valid. It should, therefore, be
 remembered that the technique is ~~over~~ a summary technique

107469789

and therefore statistically misleading when applied to small numbers of subjects and replicates. It is possible that the presence of other tobacco smoke components could influence the absorption and retention of CO. Such interactive effects could enhance or reduce the absorption. It can be seen from

(156153)

Table 1 that De Munnier menthol smokers attained higher levels than all other smokers except the Pall Mall smokers. This may be an interactive effect or that the irritation was lower on these brands, and the depths of inhalation and residence times of the smoke in the lungs longer.

In summary the technique described ^{above} and 176 are to be considered as an elegant and useful addition to the tests available to monitor smoking behaviour. Such a test

107469790

provides enough information to make breathing pattern measurement obsolete as it is a direct measure of what has happened rather than providing clues to what might or should happen.

I recommend that we purchase a more sensitive IR CO detector and use the technique in future behavior tests where appropriate. Logistically it will be difficult to fit in as our present techniques and experimental designs have been such that we can measure the smoking patterns once per day for 12 subjects. The use of this CO analysis method means that perhaps 2 subjects per day are monitored on 6 occasions each throughout the day. Subsequent duplication of the smoking patterns would allow us to increase the CO delivery provided to the smokers. A comparison of the calculated

107469791