

The amounts of PM and nicotine (per filter pad, with each pad collecting the smoke of five cigarettes, as described later), being measured either absolutely or relatively, are minuscule. They are weight determined from each filter pad to the nearest 0.1 milligram.

A gram is about one twenty-eighth of an ounce. A milligram is one-thousandth of a gram. Put another way, a milligram is  $\frac{1}{2500}$  of an ounce. The weighing of the filter pad, which collects PM from five machine-smoked cigarettes, to 0.1 milligram, is a determination to one ten-thousandth of a gram.

To visualize the quantities and the possible weight differences sought to be determined, one might consider a milligram to be equivalent to a barely visible particle of sugar which when dissolved in a quart of water—could not be tasted. A like comparison of a tenth of a milligram to an ounce would be to compare the apparent size of a period sign on a page of the Federal Register to the entire page.

#### What Is Not Being Measured?

The Ogt Method in fact does not, and cannot, measure either all of the particulate matter (PM), or the total nicotine, from any cigarette. It measures only the PM and nicotine in the volume of smoke pulled through a machine on the standardized method. It does not measure the PM or nicotine in all of the smoke that any cigarette might produce when totally smoked under any and all conditions.

The Ogt Method does not measure the volume of smoke—or the PM or nicotine in the volume of smoke—that any human being will draw from smoking any particular cigarette. Each smoking characteristic is leveled or averaged out by the standard method.

No two human smokers smoke in the same way. No individual smoker always smokes in the same fashion. The speed at which one smokes varies both among smokers, and usually also varies with the same individual under different circumstances even within the same day. Some take long puffs (or draws); some take short puffs. That variation affects the PM quantity in the smoke generated.

Even with the same type of cigarette, individual smokers take a different number of puffs per cigarette depending upon the circumstances. When concentrating, or talking, the number of puffs is usually less. When listening, or required to listen, to another person talking, the number of puffs per

cigarette, as well as the duration of each puff, usually increases. Smoking rates while reading a book may differ from smoking rates while viewing a television program. The number of puffs and puff duration (as well as butt length) will vary according to emotional state. Some smokers customarily put their cigarette down in an ashtray where they burn between puffs; other smokers constantly hold cigarettes in their mouths; others hold them between their fingers.

As to butt length to which individuals smoke various types of cigarettes, as will be seen the average is over 80 millimeters, except where the filter prevents smoking down to that length, or where the rapidity of smoking generates a high heat zone or a change in taste, and causes the smoker to discard the cigarette. But, here again, there are no constants, and there is no relationship between standardized machine smoking of cigarettes and the volume of smoke which any smoker will get in smoking down to any selected butt length. About all that is known is that tobacco itself has some filter effect.

The Ogg Method does not and cannot measure these many variations in human smoking habits. It does not measure PM or nicotine in the smoke generated while the cigarette is not being puffed. It does not measure all of the PM or nicotine in any cigarette, but only that in the smoke drawn in the standardized machine smoking according to the prescribed method.

These basic standardizations are well understood by all technologists in talking about any testing method.

#### Standardization Required And Embedded In The Ogg Method

Because of the minute quantities of PM present in smoke and the difficulties in impounding it on a filter pad and measuring these minute levels, the Ogg Method, or indeed any other scientific testing method, must attempt to reduce all possible variations that will substantially affect the determinations of PM and nicotine.

No standardization of technique can eliminate human error or ineptitude. No method designed can remedy the limitations in a testing method derived from the available equipment, the precision possible in its use, or its inability to secure reproducible results.

What the Ogg Method does standardize are a few of the factors—puff frequency, puff duration, and the puff volume through the filter pad—that affect the burning rate and the amount of PM and nicotine deposited.