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MEMORANDUM ON THE CHOICE AND USE OF EXPLOSIMETERS

by

E. H. Coleman

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This note is intended to be a short guide to the choice, use and limitations of portable instruments for detecting flammable gases and measuring their concentration in the atmosphere. More complete information is contained in a published review of the many types available⁽¹⁾ and of tests made at Joint Fire Research Organization⁽²⁾. These portable instruments are expected to operate with a variety of gases. They must be so constructed that they cannot initiate combustion in the atmosphere being tested, the indications should be obtained rapidly, and be comprehensible to the operator, not necessarily a fully trained technician. Should any components fail they should be replaceable easily, and extensive recalibration should not be necessary. It should be possible to check the calibration readily. The instrument should be light and compact, yet sufficiently robust to stand up to reasonable rough handling, as could happen in a restricted space such as a manhole.

Almost any of the properties of gases and vapours can be used to measure its concentration, but the property most widely used in portable instruments is the characteristic property of combustibility. In such instruments the gas is burnt, its concentration is measured by the extent of heating effect, and it is customary for the concentration to be indicated as the percentage of the lower flammable limit. An instrument so calibrated can be used for a number of gases because it so happens that, for many commonly occurring gases and vapours, e.g. petrol vapour, coal gas, sewer gas etc., ~~the heating effects of equal volumes~~ of lower limit mixtures produce similar heating effects. Thus the heating effect of 5.3 per cent of methane, the lower limit mixture, is very similar to that of the corresponding lower limit mixture of hexane (1.3 per cent). The indications of the instrument are thus an indication of the extent of the hazard, i.e. how closely the lower flammable limit is being approached. A high degree of precision is not necessary. The compartment or space being tested may contain pockets in which the concentration differs from that in the main volume, and thus elaborate and extensive sampling at many points is necessary to make an accurate assessment. The accuracy therefore cannot be greater than the thoroughness of sampling.

Although the instruments respond reasonably to a variety of gases and vapours, they do not always respond well to all of them. A lowered response is notable with vapours of many esters and higher alcohols. Therefore before using the instrument where such vapours are expected, an assurance that the instrument is suitable should be obtained from the makers. It is often possible to use a conversion factor.

Many flammable vapours are also toxic, and the toxic limits are frequently much below the flammable limit. In these circumstances special instruments of greater sensitivity are required.

Portable instruments are not usually suitable for continuous monitoring of a particular atmosphere, and there are available several instruments specially designed for the purpose.

References

1. Portable apparatus for detecting flammable gases and vapours. E. H. Coleman, Brit. Chem. Eng. 2 (3) (1957) pp. 143, 202.
2. The performance of some portable explosimeters. E. H. Coleman, Brit. Chem. Eng. (In the Press).