

Annex D. Comparisons of measurements of vapour exposures.

The relationship between a nerve agent vapour dose (measured as concentration and time) and the precise amount of nerve agent absorbed (measured as μg) from being exposed to that dose is¹:

$$\text{Ct} \times W \quad \text{where } W \text{ is the breathing rate (in litres per minute)}$$

This formula assumes that all the vapour inhaled was retained but work at Porton and in the US showed that only a proportion was retained: 96% if inhaled through the nose, 85% if inhaled through the mouth. If that proportion is P then the formula becomes:

$$P \times \text{Ct} \times W$$

For example, the GB vapour exposure level believed at the end of 1950 to be close to the zone of incapacity was 15 mg/min/m^3 . The average breathing rate of men walking around the gas chamber at a steady pace (often the conditions used in chamber experiments) was 29.4 litres per minute². Healthy men were used in the chamber experiments and can therefore be assumed to have inhaled vapour through the nose. 96% of that would have been assumed to be retained³. Using these numbers in the formula yields an absorbed dose of approximately 423 μg .

This formula provides a way of converting absorbed dose to vapour exposure level. This was to prove quite important for later work on the single breath administration of GB vapour. Experimental equipment was developed which allowed a precise quantity of GB, measured in μg , to be vaporised in a container. A man involved in single breath studies would then inhale the contents of this container through a tube in his mouth. Each man in these experiments having his own container. Results obtained by single breath administration of vapour can be compared to earlier work with a vapour exposure in the gas chamber by this formula. As an example the average dose administered to each man in the experiment to measure the amount of retained GB vapour (see above) was 100 μg . That equates to a vapour exposure of about 3.5 mg/min/m^3 , assuming a breathing rate of 29.4 litres/min.

Finally the precise amount of nerve agent absorbed in the body is usually measured per unit body weight (μg per Kg). An average body weight of 70 kg was usually assumed.

¹ WO189/260 Porton Memo 39. Physiological Assessment of the Nerve Gases 2 Aug 50.

² WO189/1017 Porton Technical Paper 702. The single breath administration of Sarin 12 Oct 59.

³ WO189/589 Porton Technical Paper 244. The retention of inhaled GB vapour 11 Jul 51.