

SUMMARY OF RESULTS OF REPEATED VAPOR EXPOSURES TO 50 + 5 P.P.M.ETHYLENE OXIDEMaterial

The ethylene oxide used assayed 97.0-98.0% by wt. by chemical analysis and by mass spectroscopy. Also 2.3% air and 0.7% acetylene by wt. were present by mass spectroscopic analysis.

Analytical Method

The method of analysis employed was somewhat similar to that used by O. F. Lubatti. Determination of Fumigants. XIV. Residual Ethylene Oxide In Wheat. Journal of the Society of Chemical Industry 63, 133-9 (1944). Samples of the chamber atmosphere were absorbed in 25.0 ml. of approximately 0.025 N. H_2SO_4 - $MgBr_2 \cdot 6H_2O$ reagent contained in a 11 in. long (1 3/8 inches internal diameter) porosity B fritted glass absorber at a sampling rate of 1.02-1.1 l./min. for 30-45 min. The reagent contained 600 g. of pure $MgBr_2 \cdot 6H_2O$ in a liter of reagent. The unused H_2SO_4 was titrated with standard N/40 NaOH using a methyl orange-xylene cyanole indicator. The following points had to be taken into consideration in assessing the analytical results:

1. Since the acid reagent would react with any basic vapor arising from the excreta of animals, it was necessary to apply a blank correction. The magnitude of the correction was determined by aerating a 25.0 ml. sample

of the reagent for the same period and at the same rate from a chamber of the same size as the exposure chamber and containing the same number of animals through which just air was passed.

2. The average efficiency of absorption of control samples of ethylene oxide determined in earlier experiments by hooking two absorbers together in series and sampling from a saran bag containing a known concentration of ethylene oxide gas was 92.5%.

To obtain a known concentration of ethylene oxide gas in a saran bag the following procedure was employed. 100 l. of air was introduced into an evacuated saran bag; the air was metered through a wet test meter and dried by passing through a CaCl_2 drying tube. Then by means of a gas burette 51 ml. of ethylene oxide was introduced into the saran bag. The air and ethylene oxide were mixed thoroughly by pressing in and out on the sides of the bag. The measured volume of ethylene oxide gas was corrected to standard conditions of 25°C. and 760 mm. Hg pressure and the theoretical concentration of ethylene oxide calculated (about 500 p.p.m.).

3. Some of the analytical work carried out indicated that the material actually supplied to the chamber from the saran bag reservoir day after day may have been on the average about 87.4% ethylene oxide by wt. the remainder being air except for 0.7% acetylene by wt. Thus

it appeared that some air other than the 2.3% by wt. present in the material from the cylinder found its way into the ethylene oxide reservoir bag presumably by diffusion. Ethylene oxide is also known to be a good solvent.

4. Ethylene oxide is known to polymerize on standing in a cylinder under pressure. On examining the interior of a cylinder after exhausting ethylene oxide gas from it, a white solid is found on the walls.
5. Ethylene oxide is soluble in water in all proportions so it seemed likely that a certain amount might be absorbed by the urine and possibly by the hair of animals exposed in a chamber to ethylene oxide vapor. Also ethylene oxide is known to polymerize readily with the polymerization reaction being catalyzed by iron oxides which would be present in our rusty iron cages. It was conceivable that the polymerization of ethylene oxide might be catalyzed on the walls of the chamber. To allow for anticipated losses of the type described, 10% more ethylene oxide (97.1% by wt.) than the theoretical amount required was arbitrarily added.
6. The average concentration determined by chemical analysis over the entire experimental period (23 samples) correcting for the aerated blank and for the 92.5% average efficiency of absorption of control samples was 49 p.p.m.

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7. It is concluded that the vapor concentration to which the animals were exposed was 50 ± 5 p.p.m. ethylene oxide by calculation and by chemical analysis.

Procedure and Results

Groups of 20 rats, 8 guinea pigs, 2 rabbits and 1 monkey* of each sex plus 10 female mice were given repeated exposures 7 hours a day, 5 days per week to 50 p.p.m. of ethylene oxide vapor for 6 months. Similar matched groups of animals were used as air exposed and as unexposed controls, respectively, except for the monkeys where only unexposed controls were employed.

As judged by growth, mortality, organ wt. data and gross pathology, 50 p.p.m. was without adverse effect on guinea pigs, rabbits, mice and female rats. The growth of the male rats was slightly depressed. Histopathological studies are not yet completed.

* The male monkey died after receiving 22 exposures in 30 days. There was no autopsy but infection was suspected. The female monkey was sacrificed after receiving 38 exposures in 54 days because infection was rampant in the monkey colony.

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