PARAMETRIC STUDY OF THE INFLUENCE OF THE ATMOSPHERIC DIFFUSION PARAMETERS ON THE SHORT AND LONG-TERM EXPOSURE ESTIMATION

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1. INTRODUCTION

In the atmospheric diffusion calculations the diffusion parameters play an important role which has been stressed by different authors. Thus the Pasquill's values for the diffusion parameters are not universal and have been compared (1, 2) with values obtained from the tracer experiments carried out in Jülich, West Germany.

It was found that due to the surface roughness, there is a shift of the maxima of diffusion factors towards the source and their values are usually higher than the Pasquill's values. However, in the practical field of interest, e.g. the emission of radioactive noble gases from routine operation of nuclear power plant or from an accidental release, it is the calculation of cloud gamma doses which is of ultimate interest.

In this report the calculation of cloud gamma doses is carried out with different diffusion parameters in order to study their sensitivity.

The computer code AIREM (3) is applied separately for annual and accidental dose calculations which involve respectively longterm and shortterm dispersion.

2. CALCULATION OF CLOUD GAMMA DOSES

The AIREM code used for the calculation of cloud gamma doses is based on sector averaged Gaussian diffusion equation compatible with wind rose data. This code is primarily written for average annual dose calculations. The code can, however, also be used for calculation of doses from the release of radioactive materials over a shorttime duration. This is verified through the comparison of measured and calculated values which is also reported in another paper to this conference (4).

A release of 100 Ci of Argon-41 at a height of 100 m is here assumed. A finite extent of the cloud is considered because of large gamma energies of Argon-41. This finite cloud model is provided by the computer code EGAD (3). The different vertical diffusion parameters are the experimental values of Pasquill, Brookhaven Laboratory and Jülich (at 50 m and 100 m height).

The annual average dose calculation is on the basis of the Würenlingen meteorological statistics. The annual doses from one major wind sector (SSW) are plotted in Fig. 2. As may be seen, the differences on the doses occur only at larger distances for different diffusion parameters and are insignificant for the purpose of this estimation.

For the shorttime (1 h) release the wind velocity of 2 m/s is considered. The results of the calculations using different diffusion parameters for the different diffusion categories are displayed in Fig. 1.

In case of the diffusion category B there is almost no difference in doses for the Jülich (50 m and 100 m) and Brookhaven sets of parameters.

Pronounced differences are seen for the category C. This is understood from the shortterm diffusion factors for this category shown in Fig. 3. The curve from the Jülich (50 m) parameters is quite different from those with others for the category D.

The diffusion parameters have a little influence on the dose for the category E. For the category F the curves for the Pasquill and Brookhaven parameters are overlapping and show only a little difference with other parameters.

Up to a distance of 5 km the maximum dose difference when using the different diffusion parameters is found to be a factor of 3. However, this lies within the range of the uncertainty of the diffusion model (5) and consideration of different diffusion parameter sets is relatively unimportant to cloud gamma dose calculations.

REFERENCES

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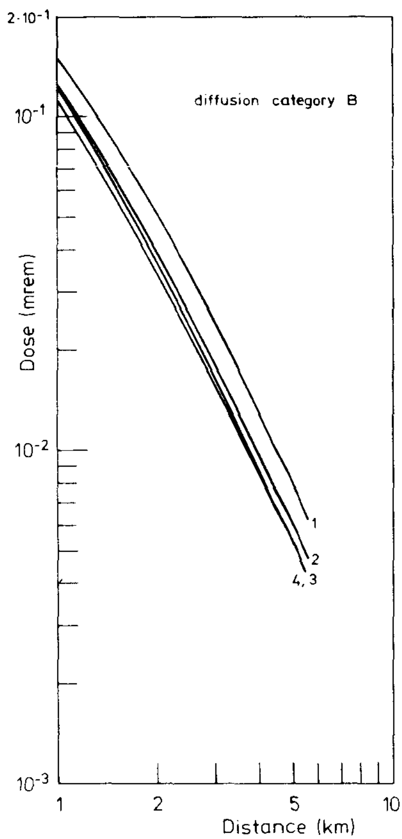


Fig. 1

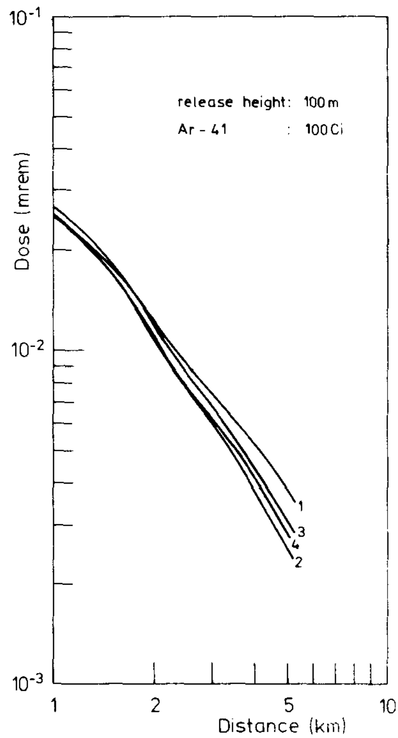


Fig. 2

Annual average dose as a function of the source distance

Curve 1: Pasquill
Curve 2: Jülich (50 m)
Curve 3: Jülich (100 m)
Curve 4: Brookhaven

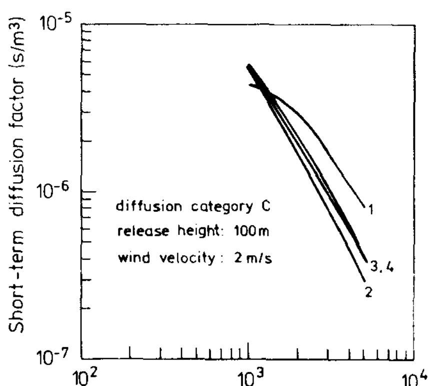
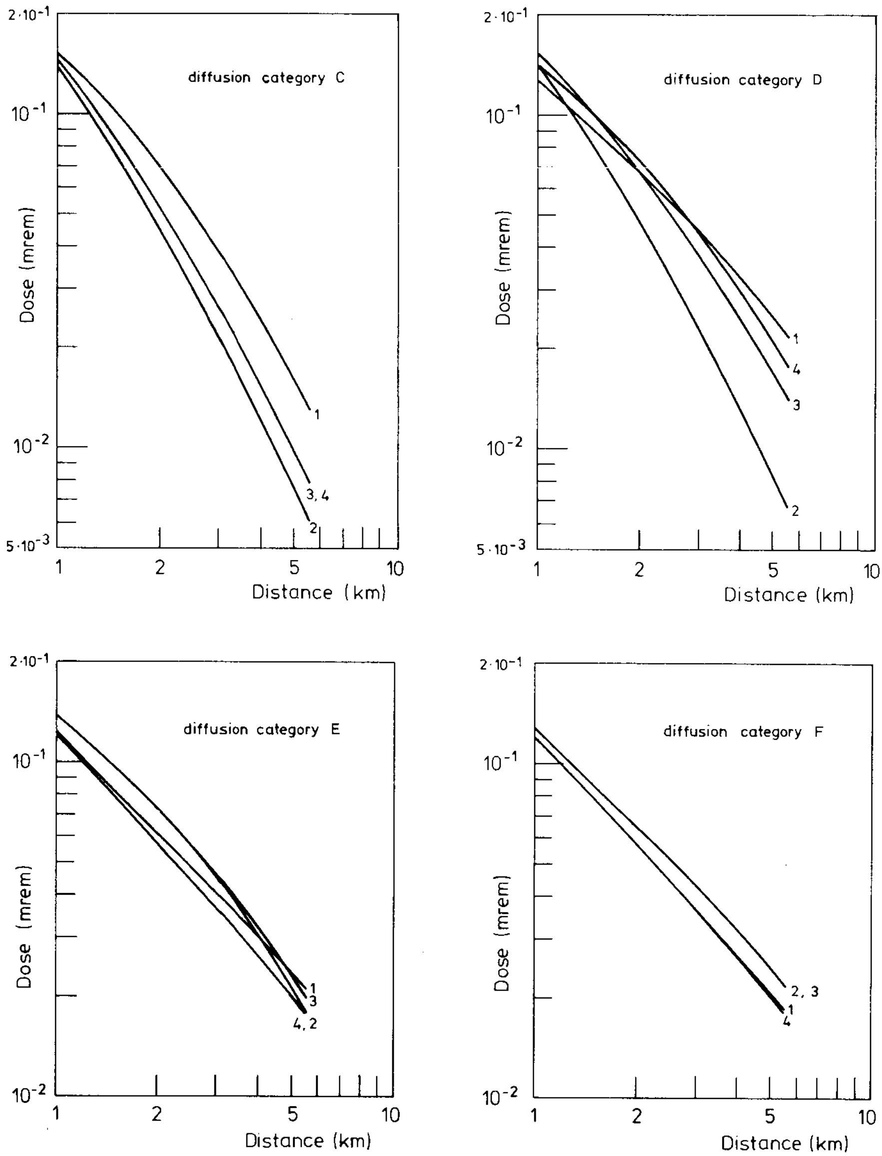


Fig. 3

Short-term diffusion factor as a function of the source distance



Curve 1: Pasquill
Curve 2: Jülich (50 m)
Curve 3: Jülich (100 m)
Curve 4: Brookhaven

Fig. 1

Cloud gamma dose rate for a release height of 100 m and wind velocity of 2 m/s as a function of the source distance for the different diffusion systems calculated for the diffusion categories B-F.