Description of an Aerosol Calculator

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INTRODUCTION

A set of spreadsheets was developed in Microsoft Excel® to perform calculations related to aerosol research. The spreadsheets have been checked and corrected, thanks to feedback from users, and have been in use for about 20 years. Six spreadsheets are included as part of the Aerosol Calculator package: AeroCalc (modules calculating various parameters), 2Drect (potential field in rectangular coordinates), 2Daxial (potential field in radial coordinates), sizedis (lognormal size distribution), 2Dsizeds (two dimensional size distribution), and probit (probit plot of size distributions). The operation and usage of each of these spreadsheets has a brief explanation with appropriate references.

DESCRIPTION

The AeroCalc spreadsheet is perhaps the most useful because it contains over 100 modules that calculate useful aerosol related parameters, such as settling velocity, losses in tubing and bends, and coagulation. The equations are taken from two principal references (Hinds 2000; Baron and Willeke 2001) or from indicated journal articles, so a description of each module's source and applicability is available. In AeroCalc, there are two equivalent worksheets that are set up in SI and cgs units, as well as an index of the modules. Some of the calculations require iteration of the spreadsheet calculation; this function has to be turned on for these functions to work properly (under Tools; Options or Preferences; Calculation). Each module is set up as an independent calculation, with input parameters described, along with appropriate units. Modules can be expanded and linked so that complex calculations can be carried out easily and results calculated and plotted for selected ranges of input parameters. Some examples of calculations include a potential field, the transmission efficiency of a 1 cm sampling line consisting of an inlet and three separate tubes separated by two bends (Figure 1), and the inlet efficiency of the personal asbestos sampler.

The 2Drect and 2Daxial spreadsheets allow calculation of potential fields, e.g., electrostatic fields, with arbitrary boundary conditions.

The sizedis spreadsheet allows calculation of size distributions with the input of median diameter, geometric standard deviation, and number of particles. In addition, the inhalable, thoracic, respirable, and PM-10 fraction definitions are included and can be applied to the calculated size distributions.

The 2Dsizeds spreadsheet calculates two dimensional distributions, as for fibers, with input of the two median dimensions, the corresponding geometric standard deviations and the correlation between the two dimensions.

Finally, the probit spreadsheet takes a user supplied distribution and plots it as a function of diameter and probits. This graphical display of a size distribution produces a linear plot for a lognormal distribution.

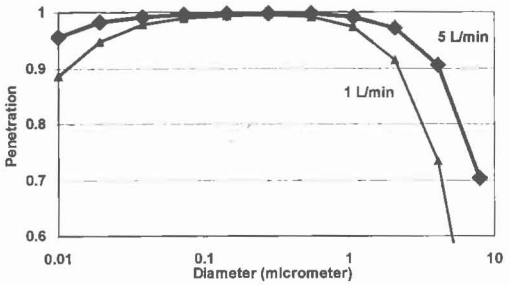

Figure 1. Example of penetration efficiency curves for a 1 cm diameter sampling line. The calculation was performed by linking modules for each component into a single spreadsheet.

CONCLUSIONS

The Aerosol Calculator spreadsheets have been useful not only as an aid to performing aerosol research, but also in learning and understanding aerosol properties. The Aerosol Calculator package (rev. 10/12/01) is available as freeware on the web from www.bgiusa.com.

REFERENCES

Baron, P. A. and Willeke, K., Eds. (2001) *Aerosol Measurement: Principles, Techniques and Applications*. New York.Wiley-Interscience.

Hinds, W. (1999). *Aerosol Technology*. New York. Wiley-Interscience.

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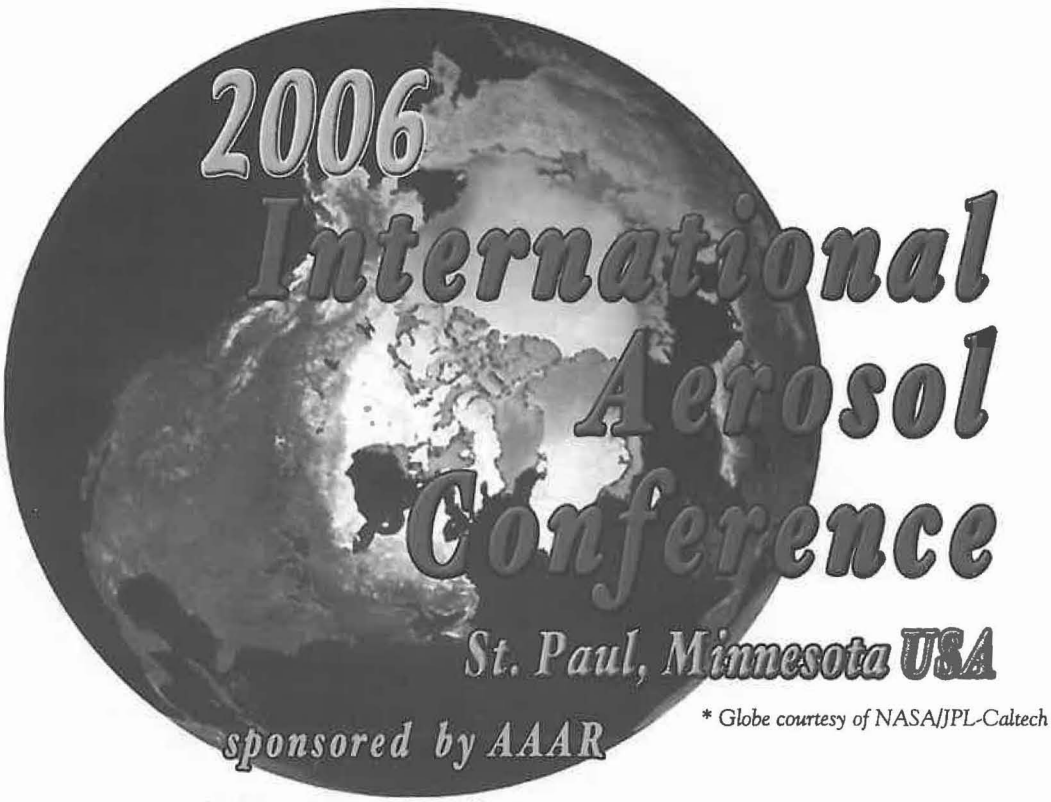

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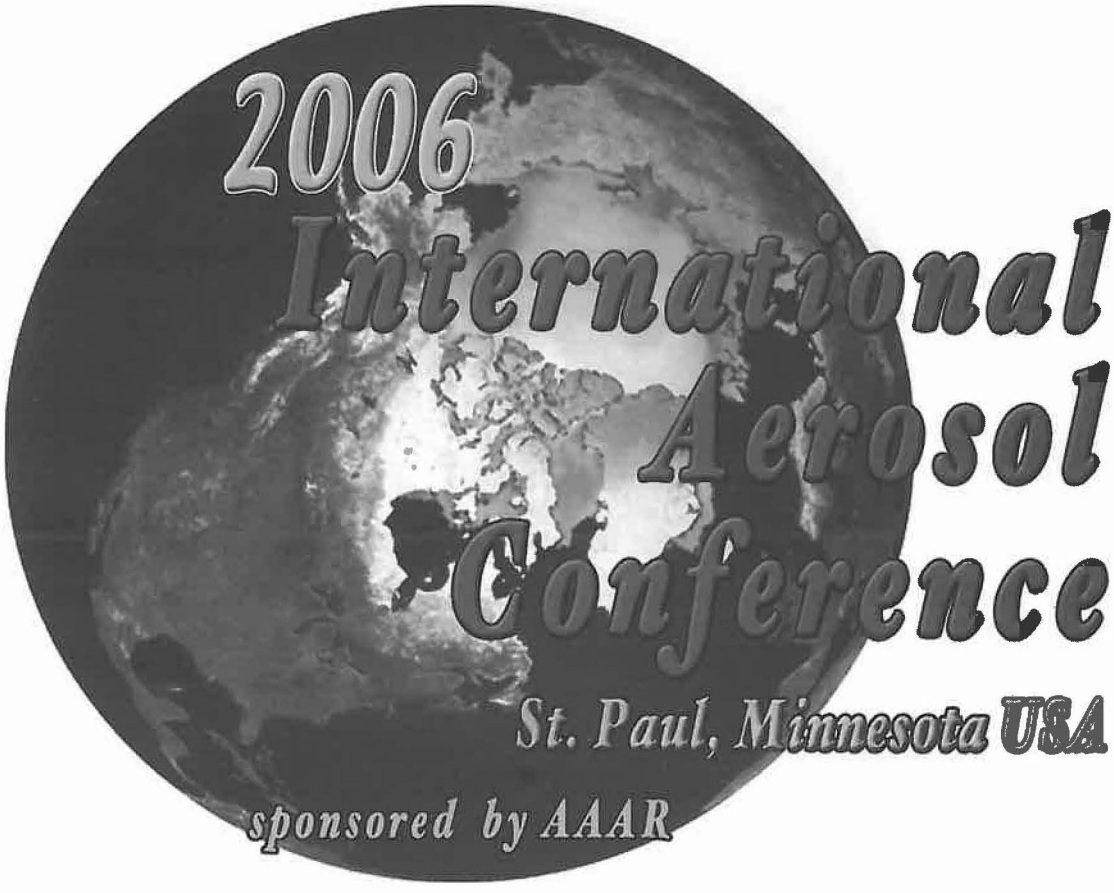

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