MAXIMUM ALLOWABLE CONCENTRATIONS OF DUST

by Dr. F. Hartogensis,
Head Air Pollution in Industry Division, Resarch Institute for Public Health Engineering T.N.O. (1)

From the proceedings of the

2nd INTERNATIONAL SYMPOSIUM ON MAXIMUM ALLOWABLE CONCENTRATIONS OF TOXIC SUBSTANCES IN INDUSTRIAL ENVIRONMENTS

PARIS — 1-6 APRIL 1963

Pages 133 to 136

INSTITUT NATIONAL DE SECURITE
9, avenue Montaigne — PARIS

MAXIMUM ALLOWABLE CONCENTRATIONS OF DUST

by Dr. F. Hartogensis,

Head Air Pollution in Industry Division, Resarch Institute for Public Health Engineering T.N.O. (1)

1) The concentration of a toxic gas or vapour in the air on a given place and at a given time can be expressed by a simple figure, and this figure is usually independant of the method of determination. This is not at all valid for the concentration of dust. Especially the number of dust particles can differ a factor of 10 or 15 if the method of determination or of counting is different. The weight of the dust per m^3 of air is less dependent of the method of determination, although there exists an influence of the air velocity. These facts have been clearly demonstrated by a combined investigation, organised by the European Community for Coal and Steel and published in the german periodical " Staub " (Band 23, nr. 1, Januar 1963, p. 1).

It is often suggested that the different expressions for dustconcentrations, for instance weight of dust and number of particles in a m^3 of air, will be proportional, or at least that there will be a good correlation between them ; in several cases it was possible to prove a correlation of this kind between two different expressions. I want to report here on a study where such correlation seems to be missing.

2) We studied the occurrence of a siliceous dust, together with another institute, on 160 different places under similar conditions. The methods used included two different filtermethods, the Hamilton or long running thermal precipitator and the tyndalloscope. All samples on a given place were taken quite near each other and during the same time. The results were judged according to four different systems of judgment, all of these described in the literature and used in some part of Europe, and according to a system used by our institute. The standards, used in these systems were :

a) The weight of the dust per m^3 of air, in combination with the ashcontent. The limit was set at 16 mg/m^3 et 100 % ash, and moved according to a given curve to 80 mg/m^3 at 10 % ash. The sampling occurred iso-kinetic.

b) The reading of the tyndalloscope, also in combination with the ashcontent. The limit was at an angle of 8° at 12 % ash, and 6° at 50 %, also according to a given curve.

c) The number of particles between 0.5 and 5 micron per cm^3 of air as counted in light field, multiplied by the percentage of silica and

(1) Contribution for the 2nd Symposium on Maximum Allowable Concentrations in Industry, Paris, April 1 - 6, 1963.
Publication nr. 197, Research Institute for Public Health Engineering T.N.O.

divided by 100. The limit for this product was set at 500 according to the french " indice coniotique " = 5.

d) The number of particles, counted in light field, between 1 and 5 micron. Limit : 850 particles per cm^3 of air.

e) Our own system, using the number of acid-insoluble particles as counted in dark field. The limit was set, quite arbitrary, at 2000 acid-insoluble particles per cm^3 of air.

A situation was judged as " good " or " bad " according to each system of judgment. I will remark here, that it is not my purpose to discuss the exact value of the limits mentioned here, but merely the differences caused by using different standards.

The correlation between these systems is shown in the diagrams 1 and 2, where the first mentioned standard, the weight of the dust in combination with the ashcontent, is compared with the other standards, and in diagram 3, where our standard is compared with the " indice coniotique ". In all diagrams we see, that a rather high percentage of the places is " good " according to both systems. This is not very interesting ; the dustcontent of the air in a livingroom will be judged as " good " by all reasonable systems. But at the working place where there might be doubt whether the situation is " good " or " bad " we do not find any good correlation. So, for instance, in figure 3 there are 14 places that are perhaps " bad " ; two of these are " bad " according to both systems, but 12 are " good " according to one and " bad " according to the other system. In figure 1 we see that the standard : less than 850 particles between 1 and 5 micron is a heavy standard ; it gives 46 "bad" places and the other standard, the weight of the dust, only 16. But not with standing this fact there are 6 places that are judged as « good » by the first-mentioned standard and as " bad " by the other.

The same fact : no correlation between different expressions for the dustcontent of the air, is illustrated in figure 4, in which we give the weight of the silica, present in particles smaller than 3 micron, and the number of silica particles per cm^3 of air, in the same foundry on five different days. The number of silica particles is here calculated in a rather complicated way, based on the number of acid-insoluble particles. We do not see any correlation. And we may ask, which situation is more dangerous, that of the first or that of the fifth day.

3) If we want to have a maximum allowable concentration of dust we find here a situation that is to some extent analogous to that. mentioned by Dr. Zielhuis and me for the medical aspects. We have first to make a choice, which standard we want to use, e.g. weight of dust under 5 micron or number of particles. And afterwards we have to decide where, in the system that we want to use, the limit ought to be. Both decisions ask for much more knowledge of the relation between the dust that a man breathes and the influence of this dust on his wellbeing than we have up to now. I do think that it is our duty to acquire this knowledge. And for the time being each country can use its own system until there is more evidence that one of the different systems is more reliable than others.

weight of dust	tyndalloscope			number particles .5 - 5 µm			total
	good	bad	unknown	good	bad	unknown	
good	126	3	12	95	36	10	141
bad	12	2	2	6	10	-	16
unknown	2	-	1	2	–	1	3
total	140	5	15	103	46	11	160

Figure 1.

weight of dust	indice coniotique			number acid resisting particles			total
	good	bad	unknown	good	bad	unknown	
good	107	5	29	110	10	21	141
bad	15	1	-	11	3	2	16
unknown	-	-	3	2	-	1	3
total	122	6	32	123	13	24	160

Figure 2.

number acid resisting part.	indice coniotique			
	good	bad	unknown	total
good	103	3	17	123
bad	9	2	2	13
unknown	10	1	13	24
total	122	6	32	160

Figure 3.

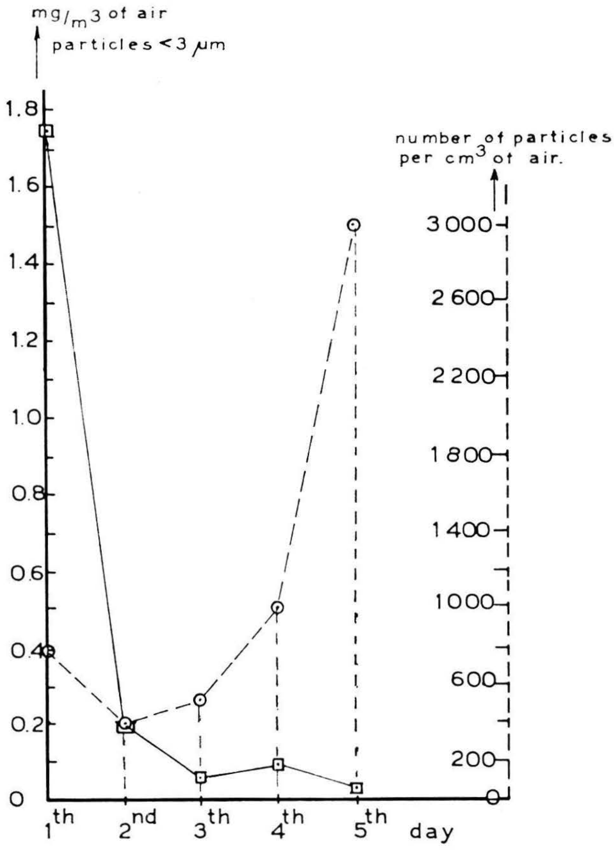

Figure 4. Silicadust in a foundry.

LITERATURE

American Conference Governmental Industrial Hygienists. Threshold limit values, 1962. Detroit Michigan.

Mc Faarland, R.A. J.I. Niven and M. H. Halperin. — Visual thresholds as an index of physiological imbalance caused by anoxia, carbon monoxide and low blood sugar. Proc. ninth international Congress industr. Med., p. 519. London, 1948.

Klimkova-Deutschova, E. — Neurologische Befunde in der Plastikindustrie bei Styrol Arbeitern. Arch. Gewerbepath. Gewerbehyg., 19 (1962) 35.

Ryazanov, V.A. — Sensory physiology as basis for air quality standards ; the approach used in the Soviet Union. Arch. environm. Hlth., 5 (1962) 480.

*
**