

PERSONAL DUST SAMPLING WITH THE CIP-10 FOR A BETTER MEDICAL MANAGEMENT OF THE PNEUMOCONIOSIS RISK IN COAL MINES

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INTRODUCTION

In French coal mines, static sampling is used for regulatory measurements of ambient dust concentrations in workings. In 1983 however, the personal dust sampler CIP-10 became commercially available. This air sampling instrument was designed by CERCHAR ("Centre d'Etudes et Recherches de Charbonnages de France") to measure individual exposures to respirable dust in mining environments.

The CIP-10 is a small (18 x 7 x 2.5 cm) and light (300 g) instrument, conveniently worn by the miners. It can be lodged into a chest pocket or into a chest strap. Wearing the CIP-10 is generally well accepted by the workers. The sampler is operating at a flow rate of 10 l/min and collects the respirable fraction of the dust within a rotary foam. Dust can be ashed or extracted from the foam for laboratory analyses, such as free silica determination. The CIP-10 has enough autonomy to cover a full 8-hour shift. More technical information on the CIP-10 is available elsewhere (Courbon et al, 1988).

Personal sampling greatly modified our existing views on dust exposure in coal mines. Results of a large scale monitoring study of personal exposures to respirable dust in French coal mines have just been reported (Bruyet et al, 1988). Several more specific surveys were carried-out at the request of the

occupational physicians from collieries in Lorraine. They provided other useful informations, examples of which are given in this report.

USEFULNESS OF PERSONAL DUST SAMPLING

Documenting Specific Exposures

In French mines, some goafs must be filled-up, especially in the case of flat working, when heating, water irruption or mining damages are feared. When hydraulic stowing is not possible, pneumatic stowing is sometimes used to fill-up the goafs with shales. The shales are collected in the washing plants, sent back underground with successive tubings, belt-conveyed to the face and sprayed out pneumatically from a stowing machine located in the top road. Since it was often found in the career of pneumoconiotics, this technique was suspected to carry a substantial pneumoconiosis risk.

In February 1984, a survey was carried out in a particular working at Wendel mine to measure personal exposures associated with the pneumatic stowing technique. For a period of 10 days, all workers engaged in the operation and two technicians were equipped with a CIP-10. Measurement results are reported in Tables I and II. Concentrations of respirable dust were in the range 11.2-91.5 mg/m³. Such

Table I
Personal Dust Sampling with the CIP 10
Pneumatic Stowing Technique
Wendel Pit, February 1984

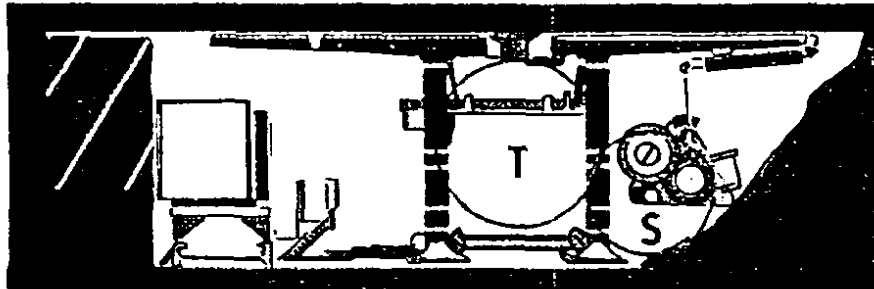
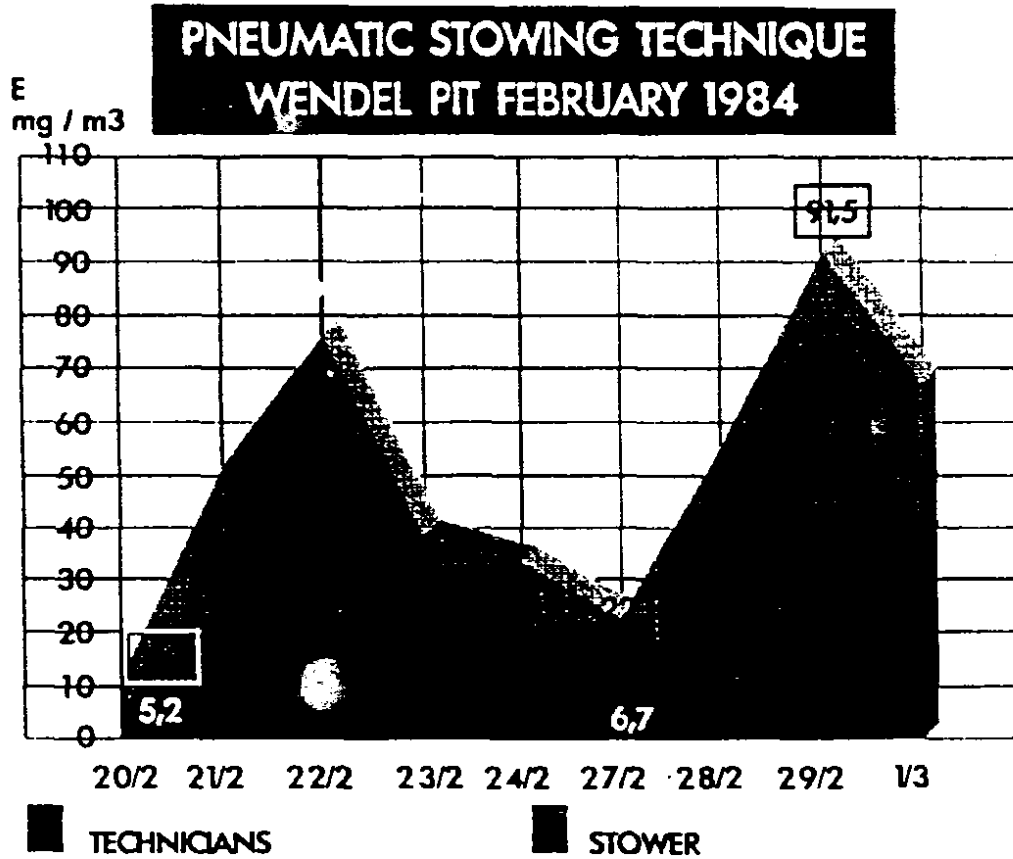
		20/2	21/2	22/2	23/2	24/2	27/2	28/2	29/2	1/3
Pneumatic Stowing Technique	T n°138	3,70	8,00	15,30	9,00	20,10	6,40	7,20	40,00	12,50
	T n°139	6,70	7,40	11,70	8,80	14,10	7,10	6,70	37,50	15,40
	Mean	5,20	7,70	13,50	8,90	17,10	6,70	6,90	38,70	14,00
	S n°140	11,20	52,50	77,70	39,50	33,50	22,10	55,90	91,50	68,50
	Ratio S/T	115%	581%	475%	343%	95%	230%	710%	136%	389%

RESULTS OF RESPIRABLE DUST IN MG/M³

T = Technicians

S = Stower

Table II
Personal Dust Sampling with the CIP 10



RATIO STOWER / TECHNICIANS

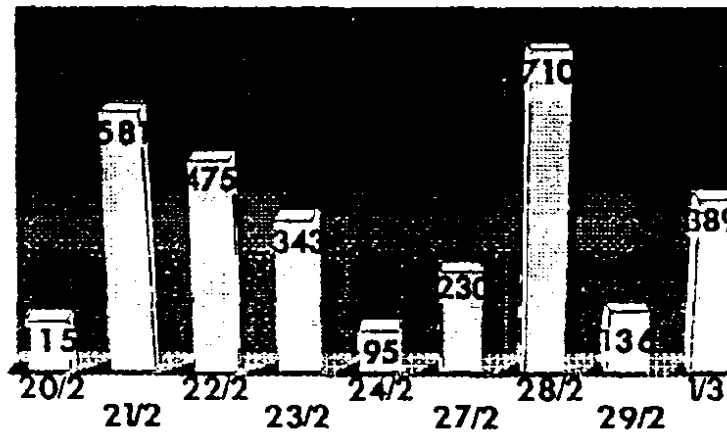
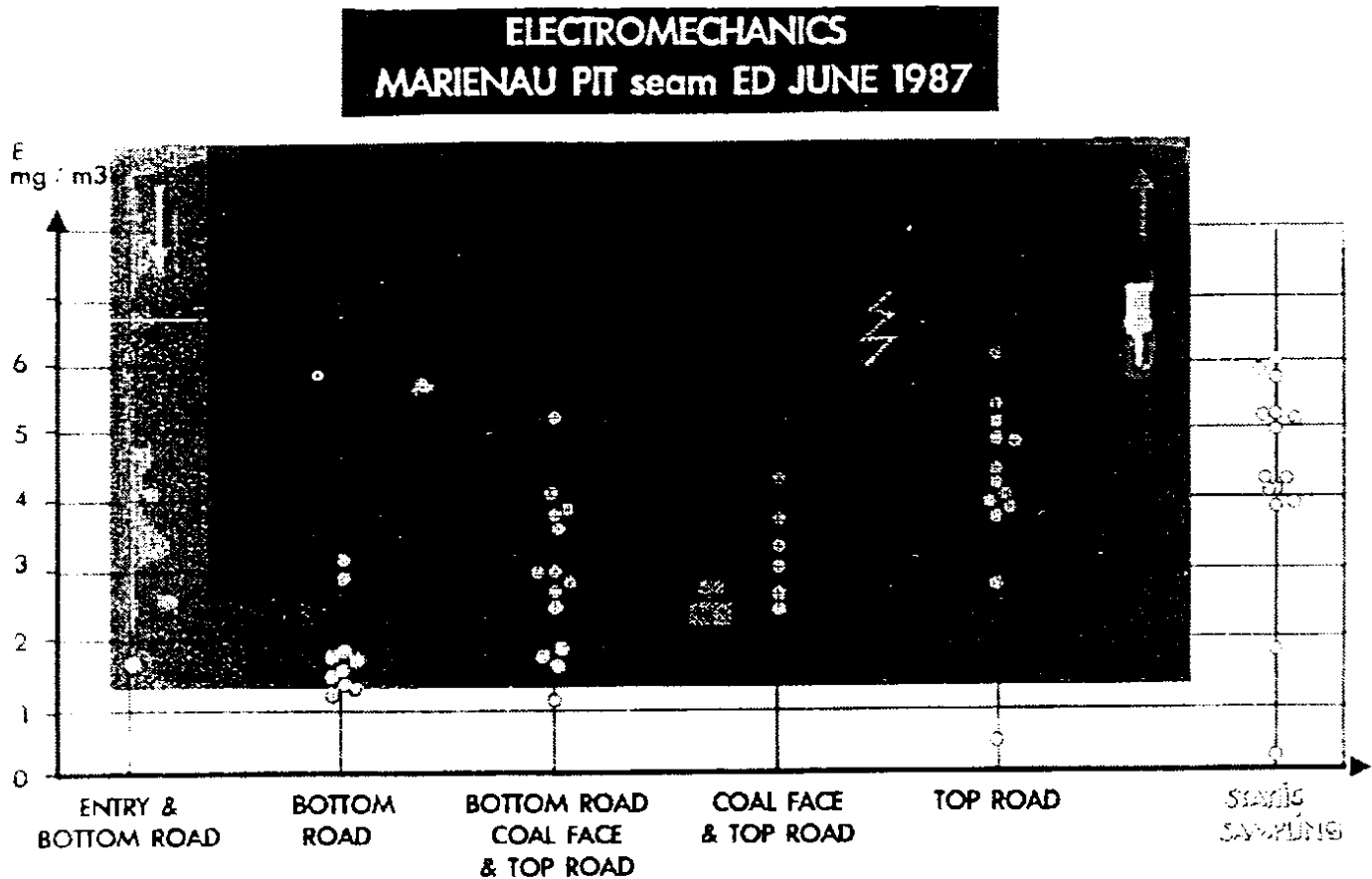


Table IV
Personal Dust Sampling with the CIP 10



DISCUSSION

According to the governmental directives of December 1975, in the French coal mines the concentration of respirable dust is regularly controlled and measured by static ambient sampling in well-defined locations. The respirable dust is collected using the CPM3 air sampling instrument (Fabries et al., 1987). Workings are ranked according to their dustiness. Standard levels are in terms of gravimetric concentration of respirable dust (as collected by the CPM3) in the ambient air. The observed differences in the pneumoconiotic risk among coal fields (Amoudru, 1987) have been taken into account to define standard levels which are specific to each coal field. In Lorraine, the standard level is at 4.5 mg/m³ below 7% free silica, and gradually decreases above 7%. All the workings are regularly classified according to this level.

Also the regulations impose for any worker exposed an annual medical examination and a chest X-ray. At the term of that examination, every year the occupational physician defines for each worker the types of workings in which he can be employed, essentially in function of the data of the chest radiography. So the sound subject (Aptitude 1) will be able to work everywhere (workings ranked O, A, B, C, D, E) and the serious pneumoconiotics (aptitude 5) will only be author-

ized to work in non dusty working places (rank O); in general they are re-allocated in surface jobs.

We know now that there is a heterogeneity of exposures within the workings. This one could have been in the past at the origin of some cases of early and/or severe pneumoconiosis. Re-allocation must also take into account this heterogeneity. Internal procedures are now in place for a better protection of active miners with slight X-ray changes (score 0/1): their exposures are followed to limit under 5 g the annual cumulative inhaled dose according to their work loads.

Another advantage of personal sampling in coal mines is the ability to detect unsuspected high exposures. The surveys among electromechanics and among workers engaged in heading operations beautifully illustrated this point.

Those different studies carried out with the CIP-10 on the indications of the occupational physician have brought useful contributions to the improvement of the technical and medical prevention of pneumoconiosis in our coal mines. The CIP-10 has been found to be a reliable instrument. Personal sampling is considered useful to identify needs for appropriate control measures and to follow cases at risk.

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Table V
Personal Dust Sampling with the CIP 10
Heading Workings
Marienau Pit SDS June 1988

EMPLOYMENT	13/6		14/6		16/6		17/6		20/6	
Overman	iTi.	1,63	iTi.	,59	iTi.	(13,0)	iTi.	1,67	Z3	1,12
Haulager	Z3	(3,10)							Z3	(,92)
Haulager							Z3	1,66	Z3	2,51
"Débloqueur"	Z+	1,88	Z+	2,99	Z+	1,83	Z+	1,61	Z+	3,64
Annexes					Z3	2,68	Z2	1,39	Z3	,50
Piper	Z2	1,40	Z3	2,85	Z3	1,40	Z3	1,66	Z2	(1,15)
Piper	Z2	1,14	Z3	1,27	Z3	2,64	Z3	1,61		
"Resserrage bride"					Z3	2,42				
Divers			Z3	1,74	Z3	1,04	Z3	1,00	Z3	2,81
Divers	Z3	1,67			Z3	1,18	Z3	1,85	Z3	1,04
Hewer	Z2	(,08)	Z2	1,48	Z2	1,13	Z2	1,41	Z2	1,56
Hewer	Z2	1,04	Z1	1,96	Z2	,11	Z1	1,41	Z3	4,26
Hewer	Z2	1,06	Z2	2,57	Z2	1,21	Z2	1,06	Z3	4,35
Hewer	Z2	,93	Z2	1,01	Z2	,80	Z2	(,01)	Z3	3,14
Cutterman	Z1	1,58			Z1	2,52			Z3	3,69
Cutterman	Z1	(,18)	Z1	1,75	Z1	1,34	Z1	1,85	Z3	3,10

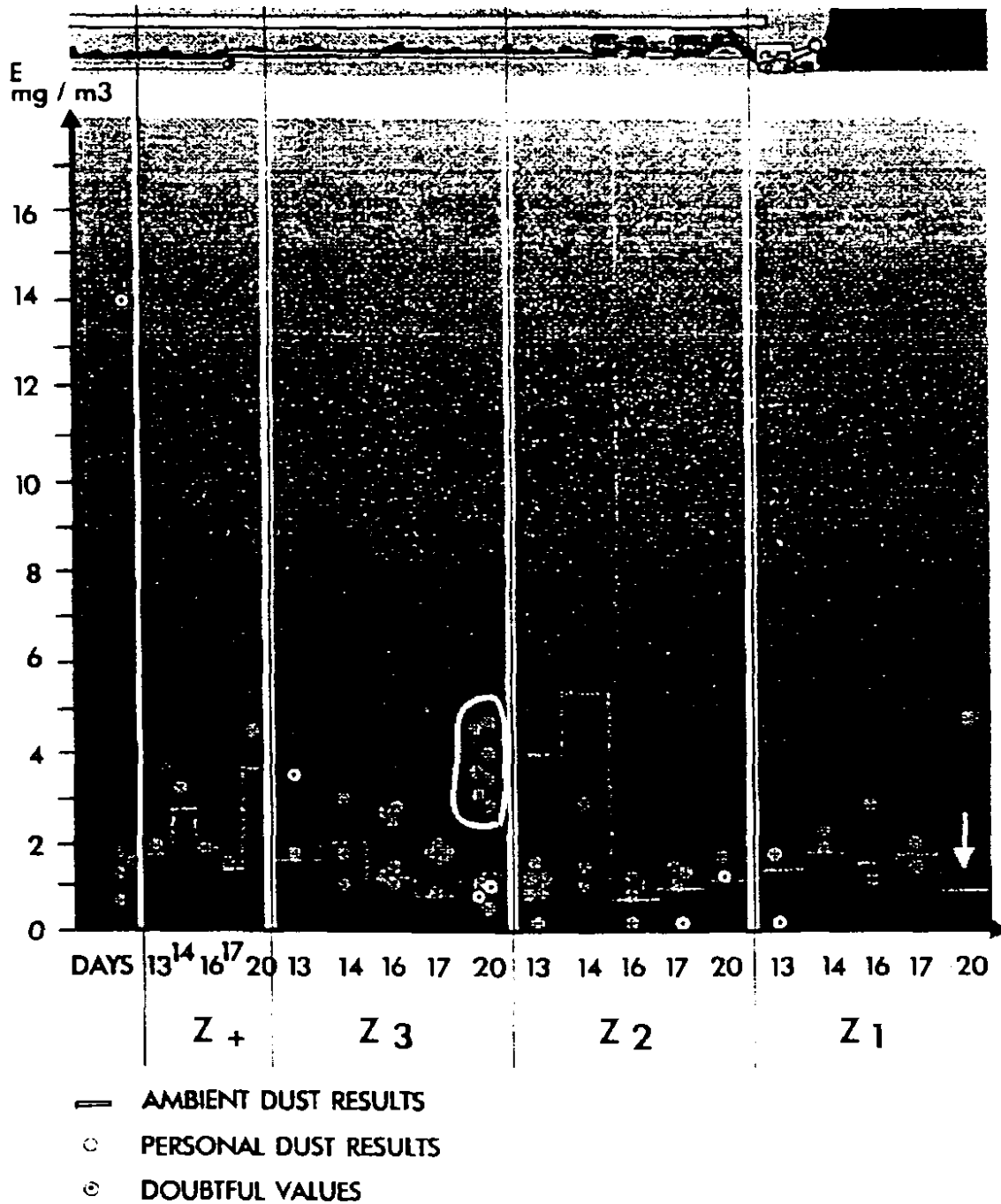
(*) doubtful values

Results of respirable dust in mg/m³

Activity and localisation of workers during the shift

Table VI
Personal Dust Sampling with the CIP 10

HEADING WORKINGS MARIENAU PIT SDS JUNE 1988



REPARTITION ACCORDING TO THE ZONES AND TO THE DAYS

Table VII
Personal Dust Sampling with the CIP 10

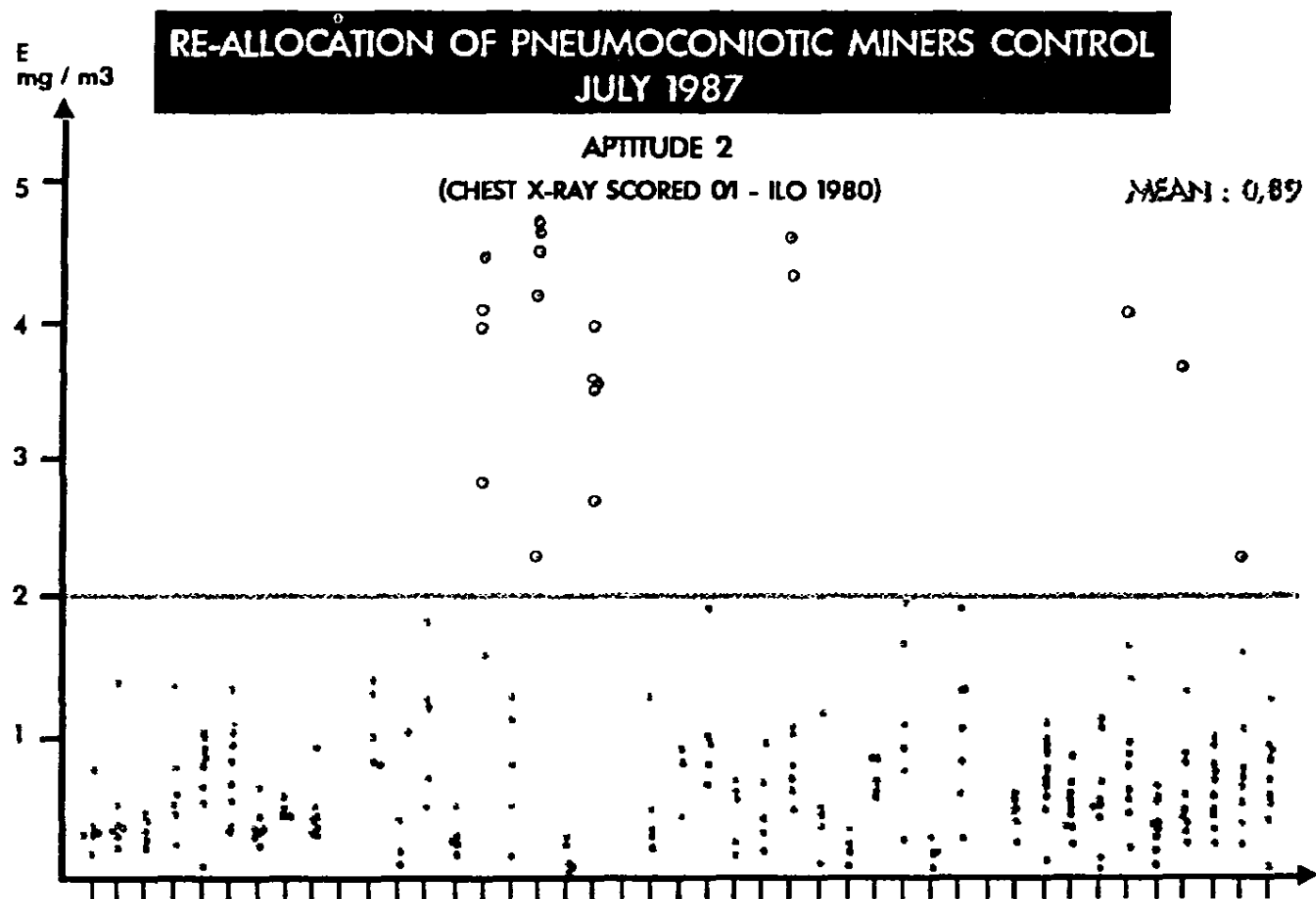
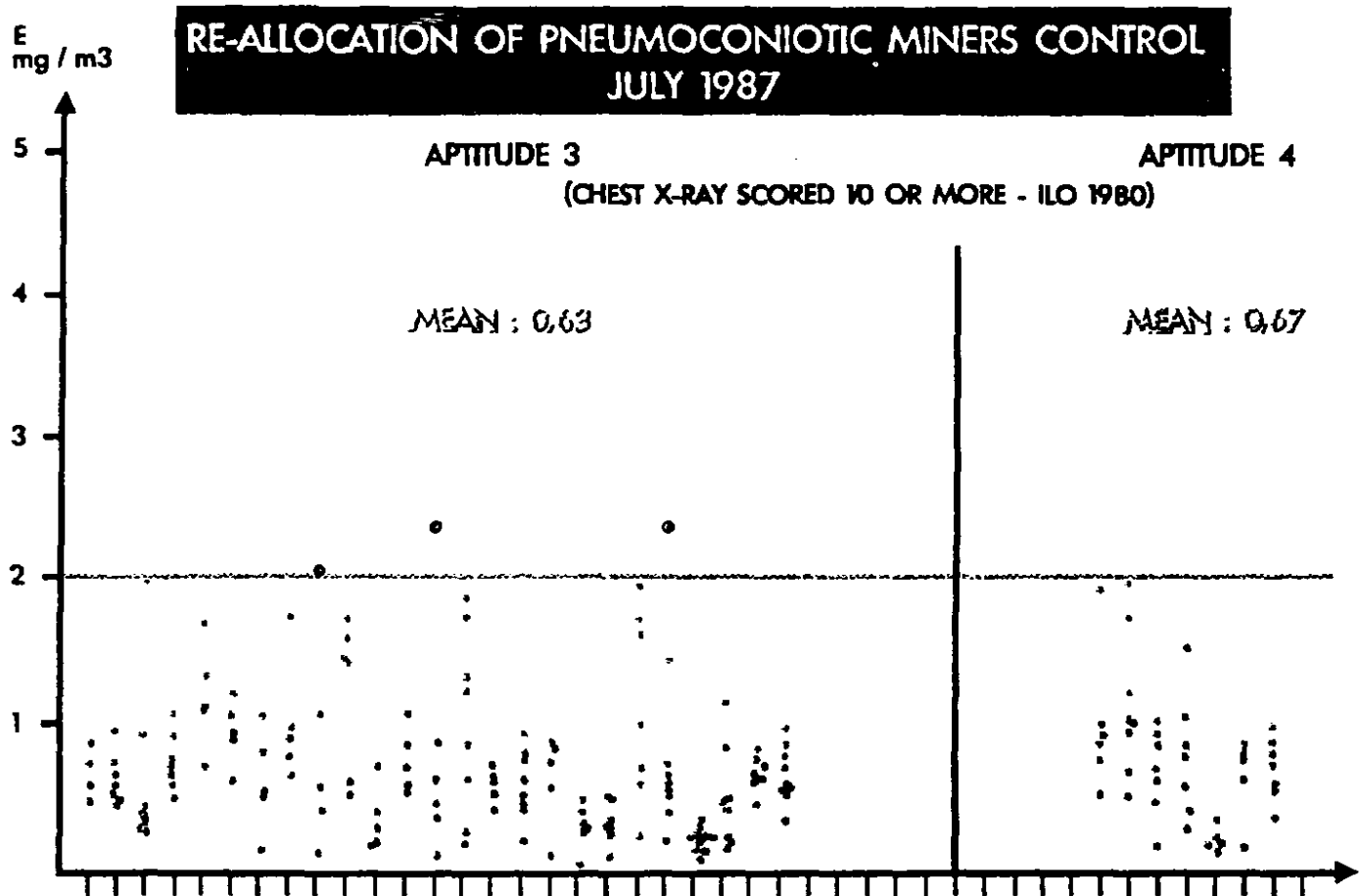
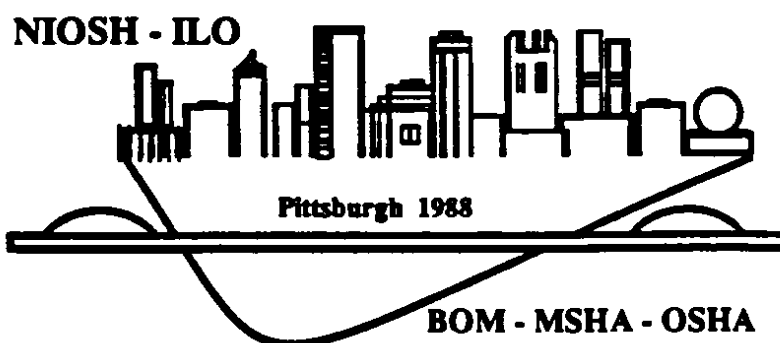


Table VIII
Personal Dust Sampling with the CIP 10



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Transactions de la VIIe Conférence Internationale sur les Pneumoconioses *Tome*
Transacciones de la VIIa Conferencia Internacional sobre las Neumoconiosis *Parte*

II



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