







Mean(S.D.) a	nd range of lea	d exposure	勤勞者 납中毒심각
Lead exposure in	es of 13 stude dices Mean (S.D.)	nts Range	「日本」の「日本」の「日本」の「日本」の「日本」の「日本」の「日本」の「日本」の
PBB(ug/dL)	64.9 (15.0)	45.8 - 97.5	
ZPP(ug/dL)	212.3 (44.5)	170 - 324	
ALAU(mg/L)	14.5 (8.8)	4.1 - 35.6	東
HB(g/dL)	12.4 (1.5)	10.1 - 14.6	20 病25 元 病25
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1 1	dus.	PBB(ug/dL)	ZPP(ug/dL)	ALAU(ma/i)	HB(a/dL)	PBA(ma)	m ³) Prev.	
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9.0) 195.2(85.9) 14.1(16.3) 14.0(0.6) 1.3260 33.4 14.2) 238.0(115.7) 14.8(12.0) 15.2(1.0) 1.0867 50.0 11.3) 218.9(160.6) 13.5(7.8) 13.1(1.7) 1.9185 68.0 8.0) 185.2(90.7) 22.6(4.8) 11.8(1.0) 1.1754 80.0		54.4(7.4)	206.6(113.8)	7.5(7.0)	14.1(2.0)	1.0579	40.0	(Second
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Mean (S.D.) indic	and range of es of 66 lead	f lead exposure workers	
Variables	Mean(S.D.)	Range	
PBB(ug/dL)	72.9 (19.0)	35 - 107	
ZPP(ug/dL)	75.8 (98.9)	20 - 589	
ALAU(mg/l)	8.1 (6.5)	0.5 - 25.6	
CPU(ug/l)	263.1(236.8)	28.3 - 825.6	The second second
HB(g/dl)	13.3 (1.8)	8.8 - 16.8	- TRANA SA

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· The main contents of recommendation :

- the necessity of agent-specific (industry type-specific) occupational health services by specialized institutes to take care of lead workers
- the necessity of loosening the environmental standards of workplaces for a short, specified period of time as an interim measure to stimulate employers to comply with air lead standards
- the necessity of a central laboratory to provide laboratory services to local occupational health centers which were not able to measure certain specific analysis such as heavy metals in blood and urine.

Respiratory protection program with biological monitoring of ZPP (1987)

- Intervention study on the effect of respiratory protection with biological monitoring of ZPP to reduce lead exposure of lead workers were carried out in a storage battery factory.
- Maintenance free respirator was chosen for this study.
- This intervention resulted in significant decrease of lead exposure of lead workers in terms of biological indices of lead exposure (ZPP, PBB, ALAU)





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Designation of Institute of Environmental & Occupational Medicine, Soonchunhyang University as an authorized industry-specific occupational health service institute (June, 1988)

- During June to December 1988, 27 lead-using industries (with 4,967 workers) made special contracts to get occupational health services with IEOM at SCHU.
- IEOM thus started to provide the following occupational health services :
 - 1) medical examination of workers
 - 2) biological monitoring
 - 3) exposure assessment in the workplace
 - 4) respiratory protection programs

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Industry (lead) specific group occupational health service (1988-2010)

• The occupational health services provided by the IEOM at SCHU for lead workers in Korea during the last 22 years could be categorized into three phases.

First phase(1988-1993)

An effort was directed at increasing awareness among workers about the hazards of lead exposure with regular health education on an individual or group basis.

Biological monitoring using ZPP measurement was started to evaluate the health status of lead workers. At the same time, a respiratory protection program was introduced to reduce the exposure level of lead workers whose working conditions were not acceptable.



- The success of the field intervention study in 1987 with MFR to reduce ZPP levels of lead workers made a strong impression on other lead industries to use MFR.
- - Thus, a respiratory protection with MFR and



Second phase (1994-1997) Computerized data management system of lead workers was introduce to provide better health information using a personal computer. It was used

during on-going biological monitoring at the site. The decrease of mean blood lead levels during the first phase in some lead industries brought the necessity of blood lead measurement for basic biological monitoring.



- The necessity of blood lead measurement for basic biomarker was well accepted in most lead industries.
- So blood lead measurement was added for basic biological monitoring from 1994 once or twice a year.
- A new monitoring program using blood lead and ZPP together as biomarkers of lead exposure resulted in further decreases of lead absorption in most lead industries under contract



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Third phase (1998-present)

- The new biological monitoring approach using blood lead and ZPP with an respiratory protection program resulted in a considerable decrease of lead absorption among lead workers.
- The reduction of lead exposure levels in terms of ZPP and PBB brought new attention to non-occupational health problems such as cardiovascular disease, liver disease, and other non-occupational conditions.
- In the same time, the IEOM started to provide various lead-related examinations as a part of on-going research activities in collaboration with the Johns Hopkins University School of Hygiene supported by NIEHS
- Bone lead, DMSA-chelatable lead were measured as a part of new lead biomarkers. RBP and NAG were measured as an early renal biomarkers. Polymorphism of lead related genotype (ALAD, VDR) was also studied.





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- The successful prevention of lead poisoning in Korea is a shared accomplishment of lead workers, employers, relevant government agencies, and academic institutes.
- Lead workers followed occupational health regulations by wearing respirators properly for a quite a long time until their working conditions could be improved. Some lead workers still wear their respirators, even in workplaces with safe levels of lead exposure, for double protection against possible lead absorption.
- Employers have invested their limited budgets in the protection of their workers from high lead exposure by providing good respirators during the early stage, developing engineering controls in the workplace, and installing new operational systems to improve productivity and to prevent high lead absorption by workers.

The comprehensive government support through field survey and stipulation of new regulations for the specific group occupational health service. Finally, the continuous concern and passion of academic institutes with their scientific consideration of lead-related health matters played an important role keeping the system running as it developed.

