

## SERUM HEAVY METAL LEVELS OF RESIDENTS IN THE VICINITY OF A PETROCHEMICAL COMPLEX IN TAIWAN

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### Introduction

Because of the application of a large number of chemicals and the complex manufacturing process, the impact of petrochemical industry on environmental pollution and related health effects was concerned. Among these petrochemical-related air pollutants, the emissive heavy metal was one kind of important chemicals because of its toxicity in humans and persistency in environment. In central Taiwan, a petrochemical complex that includes oil refineries, naphtha cracking and coal-fired power plants was considered as a locally major emission source of metal pollutants. However, few studies investigated the effects of heavy metal pollutions on the inhabitants living in the vicinity of this kind of industrial area. Therefore, this study conducted a biological monitoring study to investigate the effect of heavy metal pollutants on inhabitants around this petrochemical complex.

### Methods

Our study area included 10 townships with similar socioeconomic factors between 0 and 30 km from the No. 6 Naphtha Cracking Complex, located in Mailiao Township in Yunling County with an area of 2,603 ha, the largest petrochemical complex in Taiwan, is the main source of industrial emissions of our study area. Taishi and Mailiao townships which were within 10 km radius of the complex were classified as high exposure (HE) area. Other 8 townships which were farther than 10 km radius of the complex were classified as low exposure (LE) area. Then, all study subjects were asked to participate in health examination, questionnaire survey, and serum sample collection to be recruited in this study. After excluding the subjects who did not live in these areas more than five years, this study totally recruited 200 study subjects, including 100 from HE and 100 from LE.

Six metals were detected in these serum samples, including V, Cr, Cu, As, Sr, and Tl. To analyze these six metals, the serum samples were first diluted by 10-fold with diluent containing 0.01 mol/L of ammonium hydroxide solution, 10 ml/L Triton X-100, and 0.0002 mol/L EDTA (Case et al., 2001). All diluted serum samples were filtered with a 0.45- $\mu$ m filter and then analyzed by inductively coupled plasma mass spectrometry (ICP-MS) with an Agilent 7500c system (Agilent, Santa Clara, United States). To ensure the precision of the analysis, spikes were examined to make sure the measurement stability. Certified reference materials (CRM), were analyzed to assess accuracy. If the metal levels in certain blood samples were below the method detection limit (MDL), half of the MDL for the specific metal was allocated to these samples.

## Results

Table 1. Demographic characteristics between HE and LE groups.

Groups Variables	HE (N=100)	LE (N=100)	p-value*
Age, mean $\pm$ SD	49.35 $\pm$ 22.91	49.15 $\pm$ 22.84	0.9497
Gender, n (%)			
Male	21(34.43)	21(29.17)	0.5155
Female	40(65.57)	51(70.83)	
Smoking, n (%)			
No	95(95.00)	94(94.00)	0.7695
Yes	5(5.00)	6(6.00)	
Alcohol drinking, n (%)			
No	90(90.00)	92(92.00)	0.6054
Yes	10(10.00)	8(8.00)	
Betel nut chewing, n (%)			
No	96(96.00)	97(97.00)	1.0000
Yes	4(4.00)	3(3.00)	

\*Comparison of continue variable by Student's t-test; comparison of discrete variables by Chi-square test with fisher's exact test.

Table 2. Multiple regression models for predictors of serum metal levels ( $\mu\text{g/L}$ ) of study subjects (N=200).\*

Is Variables	Meta					
	V	Cr	Cu	As	Sr	Tl
	$\beta$	$\beta$	$\beta$	$\beta$	$\beta$	$\beta$
Group	0.073	0.304	0.118 <sup>¥</sup>	0.242 <sup>¥</sup>	0.119 <sup>¥</sup>	0.020
Gender	0.009	-0.926 <sup>\$</sup>	-0.128 <sup>¥</sup>	-0.056	0.187 <sup>\$</sup>	0.038
Age (years)	-0.001	0.008	0.001	0.011 <sup>\$</sup>	-0.009 <sup>\$</sup>	-0.006 <sup>¥</sup>
Education						
High school	-0.061	0.633	0.034	0.159	-0.058	0.114
University	-0.118	1.218 <sup>¥</sup>	0.009	0.304	-0.246 <sup>\$</sup>	0.037
Smoking	0.007	-0.400	-0.092	0.184	-0.114	-0.046
Drinking	-0.083	0.662	-0.017	0.116	-0.001	0.093
Betel chewing	0.106	1.098	0.046	0.104	-0.084	0.342
Tap water	0.009	-0.155	-0.057	0.008	-0.014	-0.054)
Seafood	0.065	0.5000	0.027	0.288	0.163	0.116

\*Reference group: group-LE, gender-female, education-elementary school, smoking-no, drinking-no, betel chewing-no, tap water-no, and seafood-no. ¥p-value<0.05 ; \$p-value<0.01.

## Conclusion

This biological monitoring study showed the potential effects of emitted metal pollutants from a petrochemical complex, including Cu, As, and Sr, on the residents nearby.

## References

Case CP, Ellis L, Turner JC, Fairman B, (2001). Development of a routine method for the determination of trace metals in whole blood by magnetic sector inductively coupled plasma mass spectrometry with particular relevance to patients with total hip and knee arthroplasty. Clin Chem., 47, 275–280.