

The Concept of Toxicants Rating in China

Jiong Liang Zhou*

School of Public Health, Sun Yet Sen University of Medical Science, Guangzhou, 510089, P.R.China

ABSTRACT: As the preliminary data collection for further chemical risk assessment, toxicants rating works is now rather extensively implemented in China. It consists of two parts, i.e., rating of the hazard level of the exposed toxicant and that of the toxicant's profession. In the first part, the rating are based on six criteria, i.e., acute toxicity, incidence of acute poisoning, prevalence of chronic poisoning, consequence of chronic poisoning, carcinogenicity and MAC level. Four hazardous levels are to be classified as extreme, high, medium, mild. In the second part, three determinants as weighted coefficients are taken into account, i.e., toxicant's hazard level, exposure time and folds of MAC surpassing. Eventually, the index of classification C by which the work with toxic hazard can be classified is able to be calculated and assessed. Several comments were discussed and new recommendations were demonstrated.

Key Words: Toxicant rating hazard level weighted coefficient index of classification

I. INTRODUCTION

Due to the fact that chemical hazard is still one of the important hazards among Chinese industrial enterprises, especially acute chemical poisoning has become a prominent problem in those joint-venture enterprises recently, toxicants rating in china is in urgent need. It is not only able to provide bases for occupational hazard controls and priority setting, but also collect valuable data for risk assessment.

Toxicant rating is rather complicated, since it has to deal with diversity of toxic chemicals and a lot of confounding factors. However, as a kind of preliminary work for hazard identification in the process of risk assessment, to work out an applicable criterion for toxicants rating is worthy to be considered.

In china, the toxicants rating works have begun since 80's of the 20th century. It has been promoted by the x-Ministry of Labor and Ministry of Public Health, designed and developed by a lot of experts

in Chinese academy of Preventive Medicine. It consists of two parts. Firstly, rating of the hazard level of the exposed toxicant; Secondly, rating of the hazard level of the toxicant's profession. These two parts are communicated and supplemented with each other.

II. RATING OF THE HAZARD LEVEL OF THE EXPOSED TOXICANT

1. Principles

The rating should be based on six criteria, i.e. acute toxicity, incidence of acute poisoning, prevalence of chronic poisoning, consequence of chronic poisoning, carcinogenicity and MAC level. For each criterion, 4 levels are to be classified. i.e. I (extreme hazardous), II (high hazardous), III (medium hazardous) and IV (mild hazardous).

The detailed classification contents are as follows:

(1) Acute toxicity

Level	I	II	III	IV
LC ₅₀ (mg/M ³) by inhalation	<200	200-	2000-	>2000
LD ₅₀ (mg/kg) per cutaneous	<100	100-	500-	>2500
Ld ₅₀ (mg/kg) per Os	<25	25-	500-	>5000

Based on the lowest value shown in the animal experiment.

*To whom correspondence should be addressed

(2) Incidence of acute poisoning

Level	I	II	III	IV
Incidence	easy occurrence bad consequence	Possible occurrence consequence not bad	occurrence by chance	no occurrence some acute effects

In level I, be special aware of fatal case and disable case.

(3) Prevalence of chronic poisoning

Level	I	II	III	IV
Prevalence	high prevalence (5%)	low prevalence (5%) or high symptoms occurrence rate (20%)	chance occurrence or low symptom occurrence rate (10%)	no occurrence some chronic effects

If absence of prevalence data, symptom occurrence rate or indice detecting rate may be used instead.

(4) Consequence of chronic poisoning

Level	I	II	III	IV
Consequence after exposure stoppage	Progressive or incurable	basically curable	recovery, no severe consequence	automatic recovery, no undesirable consequence

In addition, the consequence may also be determined by animal experiment in term of the nature of lesion (progressive, irreversible, reversible) and pathophysiological feature of target organ (repairable, regenerative, functional reserve capacity).

(5) Carcinogenicity

Level	I	II	III	IV
Carcinogenicity	human carcinogen	suspicious human carcinogen	animal carcinogen	no carcinogenicity

Based on IARC data.

(6) MAC level

Level	I	II	III	IV
MAC (mg/M ³)	<0.1	0.1	1.0	>10

The MAC is based on TJ 36-79(Hygienic standard of Industrial enterprises design).

2. Some special considerations during rating

(1) For above mentioned six criteria, comprehensive analysis, full evaluation and majority principle should be introduced;

(2) In case of those toxicants with prominent hazardous features, extraordinary treatment should be needed;

(3) In case of multi-exposure to several toxicants, the classification should be based on the highest hazardous one;

(4) For the toxicant with its workplace concentration usually under the MAC, and the prevalence rate of chronic poisoning or the symptoms occurrence rate

Hazardous level	Toxicants
I (extreme)	Hg, benzene, As
II (high)	TNT, CS ₂ , H ₂ S
III (medium)	Xylene, Toluene, Methanol
IV (mild)	Gasoline, Ammonia, Acetone

This criterion has been authorized by the National Standard Bureau as GB5044-85 in 1985.

lower than the corresponding values mentioned above, it may be considered to classify it one level lower.

3. A checklist for some usual toxicants

According to the above criteria, the classification of 56 usual toxicants has been worked out and enlisted to facilitate the rating work.

III. RATING OF THE HAZARD LEVEL OF THE TOXICANT'S PROFESSION

Based on GB5044-85, the hazard level of toxicant's profession can be rated by taking three determinants.

The three determinant's are as follow:

- D- Weighted coefficient of toxicant's hazard level
- L- Weighted coefficient of exposure time
- B- Folds of toxicant's concentration exceeding MAC

D can be firstly determined by taking advantage of GB5044-85

L can be calculated on the basis of exposure time

Hazard level of exposed toxicant	D
I	8
II	4
III	2
IV	1

(classified by GB5044-85)

B can be calculated on the basis of folds of the

Exposure time (hr)	L
≤ 2	1
2~5	2
>5	3

workplace air toxicant concentration surpassing MAC.

$B = Mc/Ms^{-1}$, where

Mc-average concentration of toxicant by measurement (mg/M^3)

Ms-MAC of that toxicant (mg/M^3)

Finally, the Index of classification C can be calculated by the formula $C = D * L * B$

In case of existence of multi-toxicants in the air, it

Index range	Classification of work with toxic hazard	
$C \leq 0$	Grade 0	(safe)
$0 < C \leq 6$	Grade 1	(mild hazardous)
$6 < C \leq 24$	Grade 2	(medium hazardous)
$24 < C \leq 96$	Grade 3	(high hazardous)
$C > 96$	Grade 4	(extreme hazardous)

has to classifying them respectively, then take the most severe grade for classification, but needs to record the other toxicants grade ranges during classification. This classification criterion has also been approved as National Standard (GB12331-90) in 1990.

IV. COMMENTS

Since then, in our country, extensive surveys had

been carried out for classification of works with toxic hazard nation-wide. It was proved to be really helpful for priority setting in practices of labor safety and occupational health and for serving as a part of hazard identification to facilitate the further risk assessment.

However, it is still so preliminary, some obvious shortages had been shown:

1. whatever $B < 0$, it would be just classified as Grade 0.
2. An unified measurement guideline for GB12311-90 seems to be in urgent need, especially for sampling method, measurement devices, choice of mean (arithmetic, geometric or medium), use of T.W.A. etc.
3. Lack of approach to assess the joint action of toxicants.
4. No enough items in the toxicant checklist (only 56) in GB5044-85 for convenient application.
5. The present classification is by my mean accurate nor universal, it needs better revision and further development.

REFERENCES

- Ministry of Public Health, P.R.C. (1979): Hygiene Standard of industrial enterprises design (TJ36-79).
- National Standard Bureau (1985): Classification of Occupational Toxicants (GB5044-85).
- National Standard Bureau (1990): Classification of Work Toxicants (GB12331-90).
- Huang Shu Jun (1999): Comments on the National Standard "classification of work toxicants". Chinese J. Of Occupational medicine, **12**(2), 81.