

# MIXED EXPOSURES IN THE WORK ENVIRONMENT : A BILINGUAL WEB TOOL FOR THEIR MANAGEMENT

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## AIM OF THE PROJECT

Develop a toxicological database allowing the identification of possible additive or other interactive effects of mixtures present in the work environment.

## INTRODUCTION

Workers are commonly simultaneously exposed to multiple chemical agents. The Québec Regulation, similarly to the ACGIH® approach prescribes that “where two or more substances are present in the work location and where they have similar effects on the same organs of the human body, the effects of these substances are considered to be additive, unless it is established otherwise” and the formula Rm should be applied.

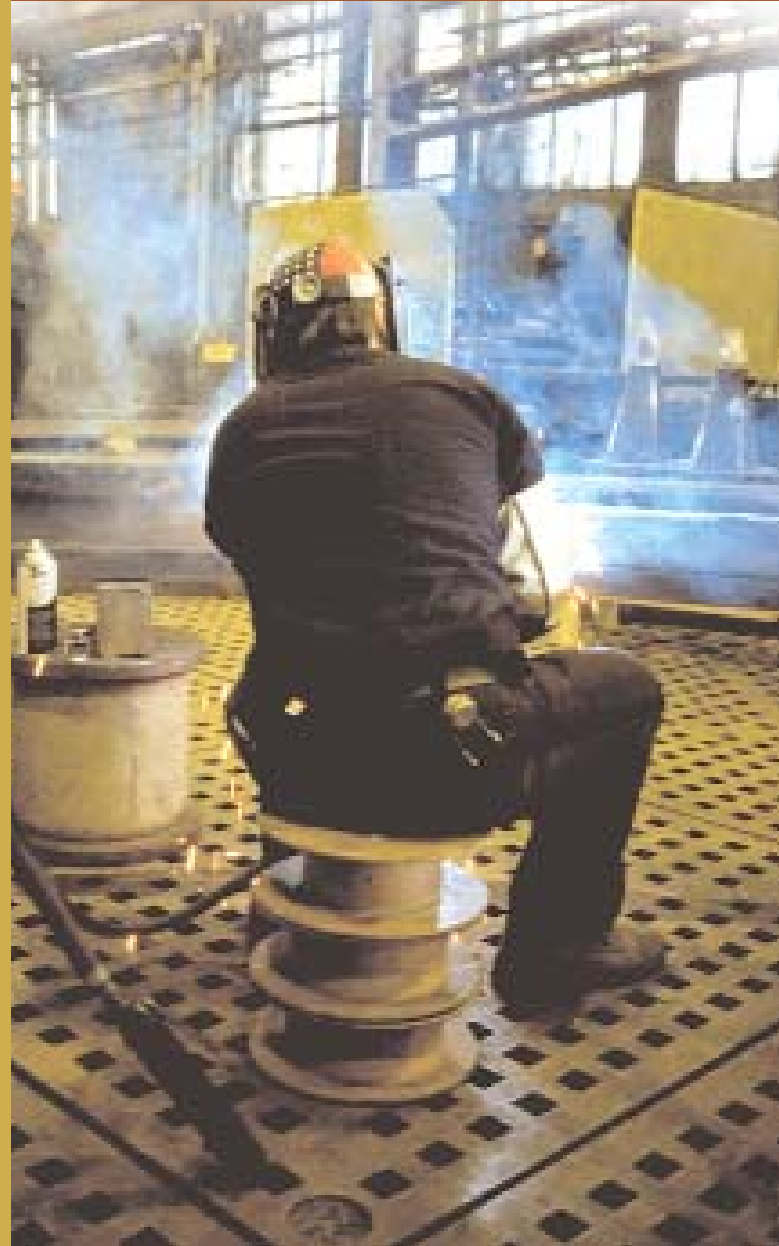
$$Rm = \frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_n}{T_n}$$

If  $Rm > 1$   $\Rightarrow$

The PEL exposure value of the mixture of the substances is exceeded.

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Rm : mixture exposure index, C : measured concentration of a substance at a workplace, T



## PHASE 1

Prediction of potential additivity

Toxicological data for each of the 695 chemical substances of the Quebec Regulation compiled

Secondary literature sources used

82 effect designations grouped in 32 classes of similar toxic effects

The resulting database enables the identification of substances in mixtures for which the formula Rm formula should be applied.

## INTRODUCTION

Identification of possible interactive effects

675 studies evaluated for 209 binary mixtures of 114 substances.

Among 209 binary mixtures:

26 with supraadditivity

3 with infraadditivity

2 mixtures with additivity

178 mixtures, toxicological data were insufficient to make a definitive conclusion.

For the majority of cases where potential additivity was identified in phase 1, there is a lack of supporting toxicological data in the primary literature. In these cases, the results of the first phase will be useful for prevention purposes.

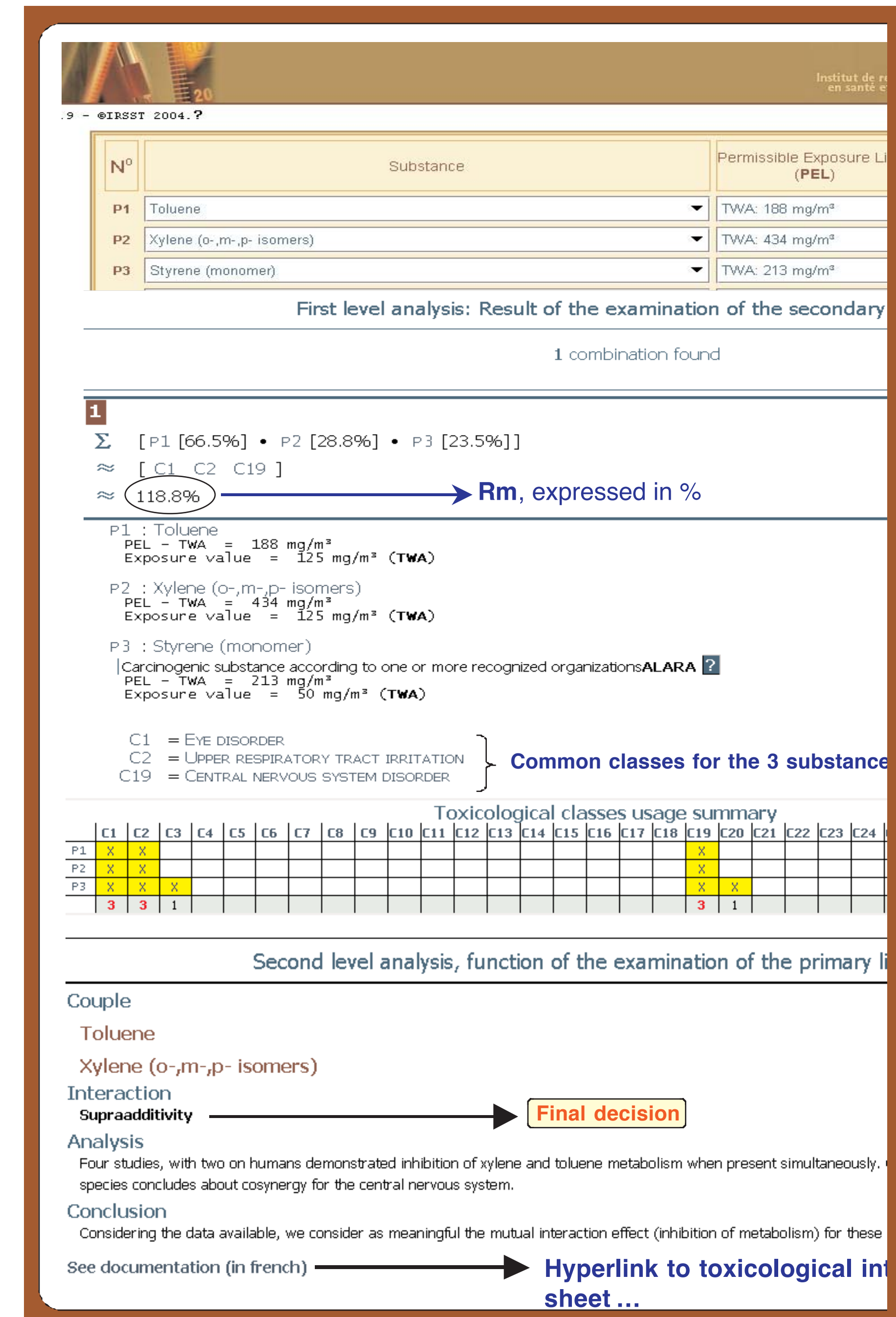
## TOOL

Workers are commonly simultaneously exposed to multiple chemical agents. The Québec Regulation, similarly to the ACGIH® approach prescribes that “where two or more substances are present in the work location and where they have similar effects on the same organs of the human body, the effects of these substances are considered to be additive, unless it is established otherwise” and the formula Rm should be applied.

## SOFTWARES

Relational database: Microsoft® Access 2000

Two consulting tools:  
Java Applet ( developed with Eclipse software)  
Pure Javascript



First level analysis: Result of the examination of the secondary

1 combination found

1

$\Sigma$  [ P1 [66.5%] • P2 [28.8%] • P3 [23.5%] ]  
 $\approx$  [ C1 C2 C19 ]  
 $\approx$  118.8%  $\rightarrow$  Rm, expressed in %

P1 : Toluene  
 PEL - TWA = 188 mg/m<sup>3</sup>  
 Exposure value = 125 mg/m<sup>3</sup> (TWA)

P2 : Xylene (o-,m-,p- isomers)  
 PEL - TWA = 434 mg/m<sup>3</sup>  
 Exposure value = 125 mg/m<sup>3</sup> (TWA)

P3 : Styrene (monomer)  
 [Carcinogenic substance according to one or more recognized organizations ALARA ?]  
 PEL - TWA = 213 mg/m<sup>3</sup>  
 Exposure value = 50 mg/m<sup>3</sup> (TWA)

C1 = EYE DISORDER  
 C2 = UPPER RESPIRATORY TRACT IRRITATION  
 C19 = CENTRAL NERVOUS SYSTEM DISORDER } Common classes for the 3 substances

Toxicological classes usage summary

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24
P1	X	X																	X					
P2	X	X																	X					
P3	X	X	X																X	X				
	3	3	1																3	1				

Second level analysis, function of the examination of the primary literature

Couple

Toluene  
 Xylene (o-,m-,p- isomers)

Interaction  
 Supraadditivity  $\rightarrow$  Final decision

Analysis  
 Four studies, with two on humans demonstrated inhibition of xylene and toluene metabolism when present simultaneously. The study species concludes about cosynergy for the central nervous system.

Conclusion  
 Considering the data available, we consider as meaningful the mutual interaction effect (inhibition of metabolism) for these substances.

See documentation (in french)  $\rightarrow$  Hyperlink to toxicological information sheet ...