

# Supplementary Materials: Occupational Exposure and Health Impact Assessment of Diisocyanates in Finland

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**Table S1.** Description of occupational study population of the human biomonitoring samples on diisocyanate exposure.

Diisocyanate Metabolite ( <i>n</i> )	Range of Age (a)	Gender	Smoking
MDA ( <i>n</i> = 366)	19–64	98 women 268 men	211 non-smokers 130 smokers 24 not available
TDA ( <i>n</i> = 222)	21–64	62 women 160 men	138 non-smokers 74 smokers 9 not available
HDA ( <i>n</i> = 181)	21–64	52 women 129 men	112 non-smokers 60 smokers 9 not available
IPDA ( <i>n</i> = 155)	21–64	47 women 108 men	100 non-smokers 50 smokers 5 not available

HDA = hexamethylene diamine, IPDA = isophorone diamine, MDA = 4,4'-methylenedianiline, TDA = toluene diamine.

**Table S2.** Human biomonitoring data on diisocyanates for specific sectors from Finnish occupational studies during 2008–2021. Concentrations are given in unit of µg/g creatinine.

Sector	Metabolite (N of Urine Samples)	Urinary Biomonitoring Results (µg/g Creatinine) <sup>1</sup>			
		GM	Median (P50)	P95	Max
Construction	MDA (48) ≥LOQ <i>n</i> = 35 (73%)	0.4	0.4	1.9	3.0
	TDA (8) ≥LOQ <i>n</i> = 0 (0%)	<LOQ	<LOQ	-	<LOQ
	HDA (8) ≥LOQ <i>n</i> = 3 (38%)	1.1	<LOQ	-	124.5
	MDA (54) ≥LOQ <i>n</i> = 10 (19%)	0.3	<LOQ	1.3	17.4
Motor vehicle manufacturing and repair	TDA (40) ≥LOQ <i>n</i> = 4 (10%)	0.2	<LOQ	-	1.2
	HDA (43) ≥LOQ <i>n</i> = 8 (19%)	0.4	<LOQ	13.3	50.3
	MDA (82) ≥LOQ <i>n</i> = 24 (29%)	0.2	<LOQ	1.5	3.9
Manufacturing polyurethane products, polyurethane industry and rigid foam production	TDA (70)	0.2	<LOQ	0.9	8.5

Assemblers of industrial products	≥LOQ <i>n</i> = 11 (16%)				
	HDA (35)	0.5	<LOQ	10.3	13.7
	≥LOQ <i>n</i> = 8 (23%)				
	MDA (177)	0.2	<LOQ	1.2	21.8
	≥LOQ <i>n</i> = 47 (27%)				
	TDA (98)	0.1	<LOQ	0.7	2.7
All biomonitoring samples	≥LOQ <i>n</i> = 8 (8%)				
	HDA (92)	0.2	<LOQ	4.1	77.6
	≥LOQ <i>n</i> = 14 (15%)				
	MDA (366)	0.3	<LOQ	1.5	21.8
	≥LOQ <i>n</i> = 119 (33%)				
	TDA (222)	0.2	<LOQ	0.9	8.5
	≥LOQ <i>n</i> = 25 (11%)				
	HDA (181)	0.3	<LOQ	9.9	124.5
	≥LOQ <i>n</i> = 33 (18%)				
	IPDA (155)	0.1	<LOQ	0.4	9.6
	≥LOQ <i>n</i> = 13 (8%)				

GM = geometric mean, HDA = hexamethylene diamine, IPDA = isophorone diamine, LOQ = limit of quantitation, MDA = 4,4'-methylenedianiline, P = percentile, TDA = toluene diamine. <sup>1</sup>Values below LOQ were replaced with values of LOQ/2.

**Table S3.** Exposure reconstruction of biomonitoring data based on diisocyanate exposure in specific sectors in Finland. The exposure reconstruction was performed using a PBPK model for MDA and TDA, and a regression modelling equation for HDA. All measured median levels were <LOQ, therefore, no reconstructed P50 levels are presented.

Sectors	Diamine	Urinary Biomonitoring (µg DI/L)		
		GM	AM	P95
Construction*	MDA	0.0004	0.34	1.16
Motor vehicle manufacturing and repair*	MDA	0.08	0.78	0.90
	HDA	0.06	3.05	15.4
Manufacture of polyurethane, plastic products or furniture	MDA	0.0005	0.44	1.50
	TDA	0.0001	0.32	0.34
	HDA	0.06	2.57	16.5
Assemblers of industrial products	MDA	0.0003	2.2	0.31
	TDA	$3 \times 10^{-7}$	0.11	0.11
	HDA	$5 \times 10^{-7}$	1.28	4.98

AM = arithmetic mean, GM = geometric mean, HDA = hexamethylene diamine, MDA = 4,4'-methylenedianiline. P = percentile, TDA = toluene diamine. \* Exposure was not reconstructed for TDA and HDA in construction and TDA in the motor vehicle sector due to the low number of total measurements and/or measurements above LOQ.