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RENOLIT ITALIA S.r.l.

VIA URUGUAY, 85

PADUA

ENVIRONMENTAL INVESTIGATION

ASSESSMENT OF WORKPLACE EXPOSURE

TO AIRBORNE CONTAMINANTS

DECEMBER 2014

Indagini ambientali: acqua, aria, rumore, rifiuti, amianto, igiene industriale — Analisi chimiche Industriali - Consulenze

ECORICERCHE s.r.l. - Via Col di Grado, 15 int. A - 36061 Bassano del Grappa (VI) - Tel. (0424) 500722 - Fax (0424) 500708
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1. *PRELIMINARY CONSIDERATIONS*

On 5th December 2014 a series of tests were carried out at the **C.P.I.P.E. – Centro Provinciale di Istruzione Professionale Edile** situated at Via Basilicata, 10 – Padua, to determine the level of airborne contaminants present.

The **RENOLIT** Group is the international leader in the production of high-quality plastic film and related products for technical applications.

The investigation was requested by **RENOLIT ITALIA S.r.l.** in order to assess exposure to airborne contaminants during the **hot welding** of PVC membranes.

The methods adopted in carrying out the tests and the results obtained for the sampling station are described below.

2. *METHODS*

2.1. Choice of the contaminants and the sampling station

The contaminants were chosen on the basis of the safety data sheets of the products used in the work cycle. These contaminants are indicated here below:

- *Volatile organic substances;*
- *Vinyl chloride monomer.*

The sampling station was agreed upon with the company's manager. The investigation was conducted under standard working conditions.

2.2. Methods for testing the contaminants considered

- *Determination of volatile organic substances - OSHA 07 (2000) method;*
- *Determination of vinyl chloride monomer - NIOSH 1007 (1994) method.*

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During the course of the tests, the atmospheric pressure and average ambient temperature were measured. The inflow of the samplers used was regulated at the start of the tests and checked at the end of the tests using a rotameter. The sampling times and conditions are indicated, for each analysis, in the test report annexes. The samples were analysed at the *Ecoricerche S.r.l.* test laboratory directed by Dott. R. Demeneghi.

*3. **NORMATIVE REFERENCES***

The investigation is part of the programme for assessing the exposure of workers to airborne contaminants in accordance with the **Decreto Legislativo n. 81** of 9th April 2008 supplemented by the **Decreto Legislativo n. 106/2009** (CONSOLIDATION ACT ON HEALTH AND SAFETY AT WORK).

The Consolidation act regulates all situations in which hazardous substances are present and used at the workplace, grouping under a single title (title IX) the provisions (previously present under several titles of the Decreto Legislativo n. 626/1994) regulating workers' exposure to an additional risk, due to the presence of chemical substances (Chapter I), carcinogens and mutagens (Chapter II) and asbestos (Chapter III), laying down specific rules and related sanctioning regulations.

In particular, Chapter 1, following the path paved by Dlgs 626/1994, has specials regulations for all the working activities that use or involve the presence of chemical substances, assigning the employer and the persons that assist him (company doctor, Health and Safety officer, managers and supervisors) the task of assessing the risks actually present at the company and, on the basis of investigations and monitoring, taking the measures necessary to eliminate or minimize the health hazard for workers exposed to these substances.

Chapter II comprises and confirms the entire regulatory framework set out in Title VII of the Decreto Legislativo 626/1994, as amended by the Decreti legislativi 66/2000 (implementing Council Directive 97/42/EC and 99/38/EC, which amend Directive 90/394/EEC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work) and 25/2002 (implementing Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemicals at work).

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3.1. Reference parameters

As far as the working environment is concerned, Italy has adopted limits for some contaminants through the Decreto Legislativo n. 81 of 9th April 2008, as amended and supplemented, indicated in annexes XXXVIII and XLIII. For other contaminants, use is made of the reference limits recommended by the A.C.G.I.H. (American Conference of Governmental Industrial Hygienists), defined as T.L.V. and having the following meaning:

TLV-TWA – time-weighted average: weighted mean concentration in time, ***over a working day of eight hours and a total of 40 hours per week,*** to which nearly all workers may be exposed repeatedly, day after day, without suffering any negative effects.

TLV-STEL – short-term exposure limit: concentration at which the workers can be exposed continuously for a short period of time, providing the daily TLV-TWA limit is not exceeded without any of the following symptoms occurring: 1) irritation, 2) chronic or irreversible tissue alteration, 3) narcosis of a sufficient degree to increase the risk of accidents, interfere with the ability to escape or actually reduce working efficiency.

The ***STEL/C*** is actually defined as the average exposure level weighted over a period of 15 minutes that must never be exceeded during the working day, even if the weighted average over 8 hours is less than the T.L.V.

These exposure limit values are updated and published once a year by the A.C.G.I.H., with revisions that depend on the medical and scientific knowledge acquired on the size of the risk posed by the contaminant.

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For the comparison with the limit value, reference can be made to a risk index RI defined as the ratio between the contaminant and the specific limit as indicated in the Linee Guida Regionali (chemical risk at the workplace, Region of Veneto) and UNI EN 689 (guidance for the assessment exposure by inhalation to chemical agents).

An RI of more than 1 indicates that the limit has been exceeded.

For RI values of 0.1 or less, or RI values of 0.25 or less when measured during three different work shifts at the same workstation, the risk of exposure to chemicals is considered low for safety and negligible for the health of workers at the workplace and no periodic measurements are necessary. If any changes are made to the production cycle, the substances used or the reference limits (stricter), the risk assessment must be repeated.

For RI values of less than 1 and more than 0.1 (in a single measurement), the exposure to hazardous chemicals is considered a chemical risk not "low for safety and negligent for the health of workers" and so appropriate protective and preventive measures must be taken to safeguard the health of workers by applying articles 221 to 232 of Chapter I, protection against chemicals, Title IX of the aforesaid legislative decree, by subjecting them to periodic health surveillance visits, normally once a year but with a frequency that depends on the risk assessment and the results obtained in time.

If the operation to be tested lasts for less than the reference eight hours, the time-weighted average is obtained by weighing the duration and the concentration measured during the working activity under examination, with the remaining duration and concentration (that is, measured while the activity under investigation is not in progress). If the value measured is already lower than 1/10 of the limit value, it is not necessary to calculate the exposure over the 8 hours.

[1] *Low risk for safety: risk for safety at the workplace or part of it* in which only slightly hazardous agents are present and in which the local operating conditions such that the risk of an incident occurring is limited and, even if such an event were to occur, the probability of the effects of the incident spreading is to be considered low *negligible risk for health* risk posed by occupational exposure the average level of which is comparable to the average risk to which the general population is exposed.

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There is also a sum total limit for a mixture of components having similar toxicological effects. When two or more harmful substances that act on the same organ system of the body are present at the same time, the combined effects rather than those of the single components should be taken into consideration. Unless proved otherwise, the effects of the harmful substances present must be considered additive if the results on health and the target organs or system are the same.

In other words, if the sum of the contaminant/limit value fractions exceeds one, the limit for the mixture must be considered as exceeded. For values of less than one, the aforesaid risks are applicable.

The environmental investigation was conducted in compliance with the provisions laid down in the Decreto Legislativo n. 81/2008, article 225, paragraph 2: *"periodically and whenever conditions that may influence exposure are modified, the employer measures the agents that may pose a health hazard ... with particular reference to the exposure limit values and for representative periods in terms of time and space".*

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4. ASSESSMENT OF OCCUPATIONAL EXPOSURE

REGIONAL GUIDELINES LEGISLATIVE DECREE NO. .81/2008 AND UNI EN 689 STANDARD

4.1. SHEET 1— Thermal welding — Test report no. 103065

Company: RENOLIT ITALIA S.r.l.

Test site: C.P.I.P.E. Via Basilicata, 10 - Padua
Activity to be investigated: thermal welding

Sampling date: 5th December 2014

Production process: hot welding of PVC membranes.

Activity carried out by the worker: cutting of PVC membranes, thermal welding of PVC membranes, gluing of the membranes to metal by spreading glue onto both the membrane and the metal (contact glue). The joints are filled with liquid PVC (PVC dissolved in tetrahydrofurane — 80% solvent and 20% PVC). The tetrahydrofurane is a solvent also used to clean tools.

Workstation configuration: work bench.

Air extraction system: none.

Time spent in the work area: on average 3 hours a day welding and gluing.

Raw materials used during the investigation: PVC membranes, nitrile rubber for gluing. 50 g of liquid PVC and 150 g of nitrile glue were used during the sampling process.

Identification of contaminants present: volatile organic substances and vinyl chloride monomer.

LIMIT VALUES

Volatile organic substances: Risk index <1 (sum total limit Σ of the contaminant/TLV-TWA limit value ratios for a mixture of substances having similar toxicological effects)

Vinyl chloride monomer: Dlgs n. 81/2008 7.77 mg/m^3

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SHEET 1 Hot welding – Test report no. 103065

RESULTS OBTAINED

Test report no.	*Reference workstation*	*Value measured*	*Risk index RI*
103065	    Air in the working area of Mr. Gilbert Cerbara, teacher on the training courses on the application of PVC membranes.	Volatile organic substances as Σ contaminant/limit value ratio R.I. 0.083	0.083 8.3% of limit
		Vinyl chloride monomer <0.17 *mg/m³*	<0.17/7.7=<0.022 <2.2% of limit

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SHEET 1 — Hot welding – Test report no. 103065

EVALUATION OF THE RESULTS

The measured value of the volatile organic substances expressed as the sum total of the contaminant/limit value ratios was found to be less than 10% of the limit value assigned with a consequent chemical exposure risk considered **low for safety and negligible for the health of workers at the workplace.**

The vinyl chloride monomer value was found to be lower than the instrument detection limit of the method of analysis used.

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We remain at your disposal for any further enquiries.

Best regards.

Physical test engineer	Chemical test engineer and Laboratory director
Dott. Agostino Zannoni	Dott. Rosario Demeneghi

Annexe: Test report no. 103065

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Customer
RENOLIT ITALIA S.r.l.
Via Uruguay, 85
35127 PADOVA

TEST REPORT *N° 103065*

Bassano del Grappa, 30/12/2014

SAMPLE DATA

Description	Air in the area where Mr. Gilbert Cerbara works, teacher on training courses for application of PVC membranes
Manufacturer	**C.P.I.P.E. - Centro Provinciale di Istruzione Professionale Edile** **Via Basilicata, 10 - PADOVA**
Process characteristics	Thermal welding of PVC
Samples taken by	Ecoricerche srl - Stefano Pellanda
TEST REQUESTED	Test for airborne contaminants in work environment
DATE OF TESTS	Samples taken on 05/12/2014 — End of test date: 22/12/2014

TESTS AND RESULTS

Volatile organic substances — Test method OSHA 07 2000

Tests	Result mg/m3	Leg. D. no. 81/2008 mg/m3 (8 hours)	Leg. D.no. 81/2008 mg/m3 (15 min)	TLV-TWA mg/m3	STEL/C mg/m3	*Result* TLV - TWA
n-Pentane	**0.37**	2000		1771	-	<0.001
n-Hexane	**0.072**	72		176	-	<0.001
n-Heptane	**<0.023**	2085		1639	2049	<0.001
Acetone	**20.4**	1210		1187	1781	0.017
Methyl acetate	**<0.068**			606	757	<0.001
Tetrahydrofurane	**3.2**	150	300	147	295	0.022
Ethyl acetate	**<0.054**			1441	-	<0.001
Methyl alcohol	**<0.051**	260		262	328	<0.001
Isopropyl acetate	**<0.049**			418	836	<0.001
Methyl ethyl ketone	**24.6**	600	900	590	885	0.042
Methyl ethyl ketone	**<0.023**				-	
Isopropyl alcohol	**<0.043**			492	983	<0.001
Ethyl alcohol	**<0.056**				1884	
Benzene	**<0.033**	3,25		1,6	8	<0.021
Methyl isobutyl ketone	**<0.022**			82	307	<0.001
Isobutyl acetate	**<0.023**			713	2049	<0.001

Preservation of the sample at the end of the tests: the sample was destroyed at the end of the tests. *Form*. RSW-02 rev. 0 del 31/1/2012

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Test	Result mg/m3	Leg. D. 81/2008 mg/m3 (8 hours)	Leg. D.no. 81/2008 mg/m3 (15 min)	TLV-TWA mg/m3	STEL/C mg/m3	*Result* TLV - TWA
n-propyl alcohol	**<0.027**			**246**	**-**	<0.001
Toluene	**0.18**	192		75.4	-	0.002
Butyl acetate	**<0.023**			713	950	<0.001
Isobutyl alcohol	**<0.026**			152	-	<0.001
1-methoxy-2-propanol	**<0.060**	375	568	184	368	<0.001
Ethylbenzene	**<0.024**	442	884	87	-	<0.001
Xylenes	**<0.029**	221	442	434	651	<0.001
2-methoxyethanol	**<0.070**			0.31	-	<0.226
Isoamyl alcohol	**<0.021**			361	451	<0.001
Cyclopentane	**<0.026**			1721	-	<0.001
2-ethoxyethanol	**<0.050**	8		18.4	-	<0.003
1-methoxy-2-propylacetate	**<0.043**				-	
Styrene	**<0.027**			85	170	<0.001
2-ethoxyethyl acetate	**<0.048**	11		27	-	<0.002
Cyclohexanone	**<0.026**	40.8	81.6	80	201	<0.001
N,N-dimethylformamide	**<0.068**	15	30	30	-	<0.002
Diacetone alcohol	**<0.054**			238	-	<0.001
2-Butoxyethanol	**<0.028**	98	246	97	-	<0.001
2-Butoxyethyl acetate	**<0.048**	133	333	131	-	<0.001
non ACCREDIA accredited tests						
Other organic substances expressed as heptane	**0.12**			1639	2049	<0.001
Sum total (Result/TLV-TWA)						0.083

Sampling conditions **Vinyl chloride monomer**

Type of sample	*personal*	*Start of sampling time*	*10:12*
Sampling flow	*0.1 Um*	*Volume sampled (at 1 atm and 20* °C)	12 *litres*
Sampling time	*60 minutes*	*Mean ambient temperature*	*18* °C
Atmospheric pressure	*101 kPa*		

Test/Method	Result mg/m3	Leg. D. 81/2008 mg/m3 (8 hours)	Leg. D.no. 81/2008 mg/m3 (15 min)	TLV-TWA mg/m3	*Result* TLV - TWA	STEL/C mg/m3
Vinyl chloride monomer	**<0.17**	7.77		2.6	<0.065	**-**
NIOSH 1007 1994 Not accredited by ACCREDIA						

Sampling conditions **Vinyl chloride monomer**

Type of sample	*personal*	*Start of sampling time*	*10:12*
Sampling flow	*0.1 l/m*	*Volume sampled (at 1 atm and 20* °C)	*6 litres*
Sampling time	*60 minutes*	*Mean ambient temperature*	*18* °C
Atmospheric pressure	*101 kPa*		

Preservation of the sample at the end of the tests: the sample was destroyed at the end of the tests. Form. RSW-02 rev. 0 of 31/1/2012

UNI CEI EN ISO/IEC 17025 accredited laboratory

TEST REPORT no. *103065*

Notes:

The limit values refer to the national legislation (Leg. D. no. 81 of 9/04/2008, annexes XXXVIII and XLIII, as amended and supplemented).
TLV-TWA: threshold limit value, time-weighted average (8 hours/day and 40 hours/week).
TLV-STEL: threshold limit value — short-term exposure limit.
TLV-C: threshold limit value that must never be exceeded during work exposure.
The TLV-TWA, TLV-STEL and TLV-C values were taken from the supplement of volume 4, no. 2 - 2013 of the Giornale degli Igienisti Industriali (Journal of Industrial Hygienists).
n.t.: not in table.

Physical test engineer

Dott. Agostino Zannoni
[signed]

Chemical test engineer
and Laboratory director
Dott. Rosario Demeneghi
[signed]