

This article was downloaded by: [185.55.64.226]

On: 16 March 2015, At: 10:48

Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



International Journal of Occupational Safety and Ergonomics

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tose20>

Occupational Exposure to Physical Agents: The New Italian Database for Risk Assessment and Control

Pietro Nataletti^a, Andrea Bogi^b, Massimo Borra^a, Domenico Gioia^b, Rosaria Falsaperla^a, Enrico Marchetti^a, Andrea Militello^a, Omar Nicolini^b, Paolo Rossi^a, Floriana Sacco^a, Nicola Stacchini^b & Iole Pinto^b

^a Department of Occupational Hygiene, National Workers' Compensation Authority (INAIL), Rome, Italy

^b Local Health Service, Siena, Italy

Published online: 08 Jan 2015.



[Click for updates](#)

To cite this article: Pietro Nataletti, Andrea Bogi, Massimo Borra, Domenico Gioia, Rosaria Falsaperla, Enrico Marchetti, Andrea Militello, Omar Nicolini, Paolo Rossi, Floriana Sacco, Nicola Stacchini & Iole Pinto (2014) Occupational Exposure to Physical Agents: The New Italian Database for Risk Assessment and Control, *International Journal of Occupational Safety and Ergonomics*, 20:3, 407-420

To link to this article: <http://dx.doi.org/10.1080/10803548.2014.11077065>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Occupational Exposure to Physical Agents: The New Italian Database for Risk Assessment and Control

Pietro Nataletti

Department of Occupational Hygiene, National Workers' Compensation Authority (INAIL),
Rome, Italy

Andrea Bogi

Local Health Service, Siena, Italy

Massimo Borra

Department of Occupational Hygiene, National Workers' Compensation Authority (INAIL),
Rome, Italy

Domenico Gioia

Local Health Service, Siena, Italy

Rosaria Falsaperla

Enrico Marchetti

Andrea Militello

Department of Occupational Hygiene, National Workers' Compensation Authority (INAIL),
Rome, Italy

Omar Nicolini

Local Health Service, Modena, Italy

Paolo Rossi

Floriana Sacco

Department of Occupational Hygiene, National Workers' Compensation Authority (INAIL),
Rome, Italy

Nicola Stacchini

Iole Pinto

Local Health Service, Siena, Italy

We would like to acknowledge the helpful and competent contribution to the EMF section of the portal from Nicola Zoppetti from IFAC CNR (Florence Italy).

The database has been supported and funded by the Italian Health Ministry, through contract CCM 12/08.

Correspondence should be sent to Pietro Nataletti, INAIL, Via Fontana Candida 1, 00040 Monte Porzio Catone, Italy. E-mail: p.nataletti@inail.it.

This article presents the new Italian database of physical agents, which is available at <http://www.portaleagentifisici.it>. It supports in risk assessment employers who have to comply with Italy's Legislative Decree 81/2008 (transposing into law European Union Directives 2003/10/EC, 2002/44/EC, 2004/40/EC and 2006/25/EC). The database currently contains measurements and declared European Community (EC) values from over 2540 machines; in particular, the database hosts data on mechanical vibration from over 1430 hand-held power tools (e.g., pneumatic and electric hammers, chainsaws, grinders, drills, sanders and saws) and from over 1020 whole-body machines (e.g., buses, fork lifts and wheel tractors). The database is continuously updated as soon as new experimental and declared data are acquired.

noise vibration electromagnetic fields artificial optical radiation risk assessment
database of physical agents

1. INTRODUCTION

Despite a decline in the proportion of the workforce employed in traditional, physically demanding sectors, e.g., manufacturing, construction, agriculture and mining, some physical risks such as mechanical vibration and noise are still prevalent. In 2010, ~22% of Italian workers, i.e., over 5 million people, were exposed to potentially harmful mechanical vibration and noise at the workplace for at least a quarter of their working time. Moreover, the trend showed a slight flat behaviour across Eurofound's surveys since 1990 [1].

Regarding mechanical vibration, there is strong epidemiological evidence of a relationship between occupational exposure to hand–arm vibration (HAV) and a number of health effects and injuries referred to as the HAV syndrome [2]. There is also epidemiological evidence of a relationship between occupational exposure to whole-body vibration (WBV) and a number of health effects and injuries of the spine. Hence, the Italian Workers' Compensation Authority (INAIL) recognizes and compensates vascular, neurological and musculoskeletal disorders of the hand–arm system, the carpal tunnel syndrome and diseases of intervertebral discs. At present, physical agents rank first in compensation for occupational diseases in Italy.

Publication of European Union (EU) Directives 2002/44/EC [3], 2003/10/EC [4], 2004/40/EC¹ [5] and 2006/25/EC [6] resulted in the Italian government bringing them into force with Legislative Decree 81/2008 [7]. Thus, for the first time, Italy has a regulation specifically dedicated to occupational exposure to physical agents at work. According to Legislative Decree 81/2008, employers have to implement a programme of prevention and reduction measures in the workplace. In particular, they need to assess the levels of physical agents to which workers are exposed and, if necessary, measure these levels with specific apparatus and appropriate methodologies. On the basis of the results, employers should determine what measures to take: informing and training workers, ensuring health surveillance, making provisions aimed at avoiding or reducing exposure, or providing personal protective equipment (PPE).

Even though physical agents are traditional risk factors, in Italy there are still no competent services and technicians able to measure and assess the levels of physical agents to which workers are exposed. Hence, Legislative Decree 81/2008 [7] allows employers to use manufacturers' data on emission and national databases established by the former National Institute of Occupational Prevention and Safety (ISPESL)² as sources of information of the magnitude of vibration [8].

¹ Directive 2004/40/EC has since been replaced by Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC. OJ. 2013;L179:1–21. Retrieved July 21, 2014, from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:179:0001:0021:EN:PDF>.

² now part of the INAIL

This article presents the new database of physical agents, a centralized Italian database, which supports Legislative Decree 81/2008 [7] and replaces a database on mechanical vibration [8]. This database (supported jointly by the Tuscany Region and the Ministry of Health) was started in 2008 by three Italian partners: the INAIL and the local health services of Siena and Modena. It fulfils the following requirements:

- data are presented in a clear, understandable and useful way;
- it is easily accessible;
- measurement data pass through quality control before insertion;
- data are based on measurements conducted in accordance with standards of the European Committee for Standardization (CEN) or International Organization for Standardization (ISO);
- new data are quickly accessible;

- corrections and additions are easy to make;
- it is easy to manage and maintain.

2. DATABASE CONTENT

To be used throughout the EU, the portal has been translated into English; this is the version this article presents.

The database currently contains measured data (collected by the INAIL, the local health services of Siena and Modena, and some public and private companies) and declared European Community (EC) values relative to over 2540 machines. The greater part of the database regards mechanical vibration: it hosts over 1430 hand-held power tools (e.g., pneumatic and electric hammers, chainsaws, grinders, drills, sanders and saws) and over 1020 whole-body machines (e.g., buses, fork lifts and wheel tractors). The database has four menus: noise, vibration (HAV

N° OF MACHINES IN THE DATABASE 2.468 - MEASURES IN THE DATABASE 7.692

Welcome to the Physical Agents Portal

Please, note that the portal is under construction and can be used for information purposes only.

The Physical Agents Portal (PAF) has been realised by the Prevention Department - Physical Agents Laboratory of the "USL 7 Siena" Health Agency in the frame of the "Targeted Plan for Risks arising from Physical Agents" approved by the Tuscany Region Committee Decree No. 5888 of 1 December 2008. The Portal has been developed in collaboration with INAIL (Italian Workers' Compensation Authority) and the Modena USL Health Agency in the framework of the Project of the Ministry of Health and of CCM (National Centre for disease prevention and control) "Risk arising from exposure to physical agents in working environments: development and adjustment of databases for supporting risk assessment and interventions for prevention in all working sectors" in order to provide an information tool which could direct the Security Managers and the Prevention Operators to a correct response for prevention and protection from PHYSICAL AGENTS. The user should look through the documents contained in the "Guide for using the Database" for each single Physical Agent in order to use the related data in the proper way. We decline any liability arising from an improper use of the data and information contained in the Databases and in the Portal.

WHOLE BODY VIBRATIONS

HAND-ARM VIBRATION

NOISE

NATURAL OPTICAL RADIATION

ARTIFICIAL OPTICAL RADIATION

ELECTROMAGNETIC FIELDS

Home
Noise
Hand-Arm Vibration
Whole-Body Vibration
Electromagnetic Fields
Artificial Optical Radiation
Natural Optical Radiation
Legislation and Guidelines
Contacts
Who we are
Newsletter
Documentation for Data Delivery
Educational Materials

INAIL
Regione Toscana
Diritti Valori Innovazione
Sostenibilità
SS1 Azienda USL 7 Siena
Servizio Sanitario della Toscana
SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA
Azienda
Unità Sanitaria Locale di Modena

WHO WE ARE TERMS OF USE CONTACTS BACKOFFICE LOADING TIME: 0.18 S.

Figure 1. Home page of the Italian database of physical agents.

and WBV), electromagnetic fields (EMF), and natural and artificial optical radiation (AOR). After entering the home page (Figure 1), users are directed to the main menus of each physical agent.

Once a physical agent has been selected, a list of items appears: risk description, guide to using the database, the database, assessment procedure, legislation, exposure calculator, prevention and protection measures, and documentation. The guide explains how the database should be used; this is important as assessing physical agents with databases is difficult, with measurement remaining the reference method. The guide also helps users to properly use manufacturers' declared emission values to determine admissible daily exposure to physical agents established by the relevant directives.

2.1. Noise

The main feature of the noise section is the proposal of a standardized procedure for risk assessment of noise exposure, in compliance with the requirements of Legislative Decree 81/2008 for small and medium enterprises (SMEs) employing up to 10 workers [7], which account for 90% of all enterprises in Italy. It is possible to calculate online the level of personal exposure to noise, L_{ex} (dB(A)), set by Directive 2003/10/EC [4], using data input into the database by the Territorial Joint Committee for the Prevention, Hygiene and Work Environment of Turin and Province³ or data collected by the company.

2.2. Vibration

The section on vibration of the portal contains a wealth of information and data. It includes an earlier vibration database set up by the ISPESL and Italian regions, quoting all previously measured and declared vibration data, and adding recently collected new data. Figure 2 shows the HAV menu.

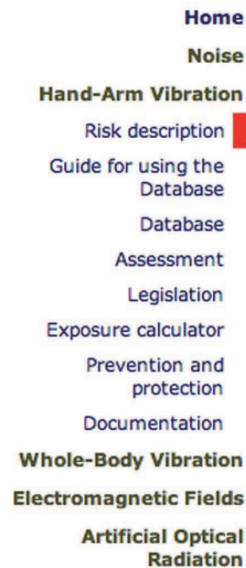


Figure 2. Menu of the hand–arm vibration database.

A brief description of risk is followed by a guide on using the database, which leads users to assessing daily exposure to mechanical vibration resulting from using hand-held power tools and hand-guided machines. The guide helps users to correctly use the manufacturer's declared values reported in manuals, in accordance with Directives 98/37/EC [9] and 2006/42/EC [10]. In the former case, recommendations given in Technical Report No. CEN/TR 15350:2013 [11] hold: the total value of vibration can be estimated with the aid of the correction factor c to be multiplied by the declared vibration data. In the latter case, users are told to add to the declared total value a_{hv} , the uncertainty factor k , obtained in accordance with the new CEN ISO standards released to comply with the requirements set by Directive 2006/42/EC [10, 12] and 12 standards No. EN ISO 28927⁴ published in 2009–2012.

The tool list can be browsed page by page (Figure 3a). Each page reports a list of tools identified by the constructor, model, tool category and power supply. Users can also search the tool database using a number of filters (brand, model, type and power); further, they can also do an advanced

³ <http://www.cpt.to.it>

⁴ Hand-held portable power tools—test methods for evaluation of vibration emission.

PAF > HAND-ARM VIBRATION > DATABASE

Hand-Arm Vibration Database

ADVANCED SEARCH

Brand: All
 Model:
 Type: All
 Power: All
 Weighing less than: Kg

SEARCH

1 2 3 4 5 6 7 Next

- GRIZZLI AMON**
Type: Industrial vacuum cleaner Power: Electric 220V-380V
- AIR TOOLS 4000**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- AIRMARTIN MW-S128V1**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- ATLAS COPCO EPICHR 42/B**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- ATLAS COPCO LMS 17 - HR13**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- ATLAS COPCO LMS 22 - HR13**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- ATLAS COPCO LMS 37 - HR13**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- ATLAS COPCO LMS 87 - HR20**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- ATLAS COPCO LMS 84 - GR 25/B**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic
- ATLAS COPCO LUM 21 HR23 - U**
Type: Wrenches and screwdrivers (straight, pistolgrip an...) Power: Pneumatic

WHO WE ARE TERMS OF USE CONTACTS BACKOFFICE LOADING TIME: 0.337 S.

Figure 3a. Sample browse page of the hand–arm vibration database.

PAF > HAND-ARM VIBRATION > DATABASE

Machine technical sheet

Brand: AIRMARTIN
Model: MW-S128V1
 electric screwdriver
 Built in 2007
 Weight: 1.94 Kg
 Power: pneumatic
 Anti-vibration devices: not present

Values declared in accordance to the standard **UNI EN ISO 8662-7:1999**
 (x 1,5 Tightening belts)

CONDITIONS	MATERIAL	ACCESSORY	VALUE	g _{1/3}
NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	3.52	m/s ²

(1) Additive coefficient

Field measurements (Click to view the field measurements)

WORK ACTIVITY: BOLTING, UNBOLTING
WORKED MATERIAL: Metal bolts and nuts
ACCESSORY: Wrench insert
SECTOR: Motor vehicle industry

Reference person: Iole Pinto - Nicola Stacchini AUSL 7 Siena - Laboratorio Agenti Fisici (i.olepinto@7.zoscana.it)
 Location: Poggibonsi (SI) on 2007-05-24
 Features of the accessory: wrench belt NOTES: nuts and bolts clamping
 Conditions of measurement

Values related to the vibration worst case handle (Posterior)

A _{hv} (Mean)	A ₃₂ (Mean)	A ₃₃ (Mean)	A _{hv sum}
4.5	2.8	3.9	6.6
Standard deviation	Standard deviation	Standard deviation	Standard deviation x 1.645:
0.44	0.96	0.47	1.45
Mean + Standard deviation:	Mean + Standard deviation:	Mean + Standard deviation:	A _{hv sum} + (Dev. std. x 1.645):
4.9	3.8	4.4	8.1

WORK ACTIVITY: BOLTING, UNBOLTING
WORKED MATERIAL: Metal bolts and nuts
ACCESSORY: Wrench insert
SECTOR: Motor vehicle industry

WHO WE ARE TERMS OF USE CONTACTS BACKOFFICE LOADING TIME: 0.113 S.

Figure 3b. Details of a tool.

search, requiring the database to search for all tools that emit a specific measured or declared value. This feature implements the law that allows the employer to select tools that produce lower exposure.

Once a tool has been found, clicking on the photograph opens a technical sheet with a complete set of data including declared EC values and values measured in the field (Figure 3b). The declared value includes the correction factor c or k , in accordance with the relevant CEN ISO standard; the measured values are complete with the extended uncertainty given by 1.65 times the standard deviation of the measures.

At the end, the guide directs users to anti-vibration gloves, PPE that reduces exposure to HAV. These gloves, which have to be CE (Conformité Européenne) marked and certified in accordance with Standard No. EN ISO 10819:2013 [13], show values of effective reduc-

tion measured in the field ranging from 10% for percussion tools to 60% for some rotating tools.

WBV has a menu like the one for HAV; it leads to a number of browse pages like those in Figures 4a–4b.

2.3. EMF

The database of sources of EMF contains measured data relative to over 60 sources. It is currently under development to

- guarantee easy retrieval of exposure values related to electromagnetic radiation produced by common industrial, health and research machinery, equipment and sources, to promote as far as possible the implementation of interventions aimed at reducing and preventing risk still in the course of risk assessment, without having to recourse to measures that are often expensive and complex;

The screenshot displays the 'Whole-Body vibration Database' website. At the top, there is a navigation bar with the PAF logo and the text 'PAF > WHOLE-BODY VIBRATION > DATABASE'. Below this is a search section titled 'Whole-Body vibration Database' with an 'ADVANCED SEARCH' button. The search filters include: Brand (All), Model (empty), Type (All), and Power (All). A 'SEARCH' button is located below the filters. Below the search bar is a pagination control showing '1 2 3 4 5 6 7 Next'. The main content area displays a list of search results, each with a small image of a truck and text describing the model and power source. The results include: IVECO Fiat Iveco 2,8 id TD (Ambulance, Internal combustion diesel engine); ASTRA 3 Assi H&D 64-65 (Truck mixer, Internal combustion diesel engine); ASTRA BM 19 (Truck mixer, Internal combustion diesel engine); F.LLI DIECI N2400 (Truck mixer, Internal combustion diesel engine); FIORI DB 244 (Truck mixer, Internal combustion diesel engine); FIORI DB 250S (Truck mixer, Internal combustion diesel engine); FIORI DB150 (Truck mixer, Internal combustion diesel engine); IVECO 3 ABSI - 330 (Truck mixer, Internal combustion diesel engine); MERCEDES-BENZ 4141 (Truck mixer, Internal combustion diesel engine); and ASTRA BM 5430 (Tank truck, Internal combustion diesel engine). A 'Next' button is located at the bottom right of the results list. On the left side, there is a vertical navigation menu with links to Home, Noise, Hand-Arm Vibration, Whole-Body Vibration, Risk description, Guide for using the Database, Database, Assessment, Legislation, Exposure calculator, Prevention and protection, Documentation, Electromagnetic Fields, Artificial Optical Radiation, Natural Optical Radiation, Legislation and Guidelines, Contacts, Who we are, Newsletter, Documentation for Data Delivery, and Educational Materials. On the right side, there are logos for 'Regione Toscana' and 'INAIL', along with text for 'Servizio Sanitario Regionale' and 'Unità Sanitarie Locali di Modena'. At the bottom, there is a footer with links for 'WHO WE ARE', 'TERMS OF USE', 'CONTACTS', 'BACKOFFICE', and 'LOADING TIME: 0.299 S.'.

Figure 4a. Sample browse page of the whole-body vibration database.

PAF > WHOLE-BODY VIBRATION > DATABASE

Machine technical sheet

Brand: Pazzaglia SpA - Casalguidi (PT)
Model: Sirio 4x4 MD 190
Type: Ride on mowers
 Weight: 435 Kg
 Power: 16.3 Kw
 Power: Internal combustion diesel engine
 Anti-vibration devices: present

Values declared in accordance to the standard **not available**

CONDITIONS	MATERIAL	k ⁽¹⁾
NOT ASSESSED	2.5 m/s ²	

(1) Additive coefficient:

Field measurements (Click to view the field measurements)

WORK ACTIVITY: GRASS CUTTING
 Features of the work activity (in ITALIAN): ground milling
SECTOR: Growing of crops
ACCESSORY: Harrow **1.2 m/s²**

Reference:
 Location: Agliana
 on 2009-07-08
 Ground / road type: packed dirt ground
 Ground / road conditions: Adequate conditions
 Speed of progress (IN ITALIAN): slow
 Armrests: absent

SEAT
 Seat type: di serie
 Seat brand: not available
 Seat model: not available
 Seat suspension type: not available
 Potential adjustments of the seat: not available

Conditions of measurement

A _{wx} (Mean):	A _{wy} (Mean)	A _{wz} (Mean)	A _{wv} max
0.7 m/s ²	0.3 m/s ²	0.8 m/s ²	1 m/s ²
dev. std. x 1,645: 0.23 m/s ²	dev. std. x 1,645: 0.02 m/s ²	dev. std. x 1,645: 0.15 m/s ²	dev. std. x 1,645: 0.29 m/s ²
Mean x dev. std. x 1,645): 0.9 m/s ²	Mean x dev. std. x 1,645): 0.4 m/s ²	Mean x dev. std. x 1,645): 1 m/s ²	A _{wv} max (dev. std. x 1,645): 1.2 m/s ²

WHO WE ARE TERMS OF USE CONTACTS BACKOFFICE LOADING TIME: 0.176 S.

Figure 4b. Details of a machine.

- allow employers and their consultants to identify, when purchasing new machinery, machines or sources that reduce the risk of exposure to EMF to a minimum.

The EMF database is arranged to report exactly during assessment the features of both the machinery under evaluation and the sources mounted inside. For each piece of machinery or apparatus present in the database, two types of data are provided. Data related to

- proper identification of machinery or apparatus;
- sources or applicators to which the measures in the portal refer. It must be noted that it can happen that the same equipment or machinery has different applicators mounted inside. In this case, it is necessary to look for data related to the applicator of interest.

The database can also contain pdf documents associated with specific machinery. These documents are related to analytical data on field assessments and efficient changes made in machinery to reduce workers' exposure. Protection measures to be put into place under specifically indicated operating conditions are also reported for each piece of machinery (Figure 5).

Once a tool has been found, by clicking on an active photograph, users open a technical sheet with a complete set of values measured in field (Figures 6a–6c).

The last two columns in Figure 6b show the magnitude of the field measured in terms of percentages of the action values for workers [5] and of the reference levels for general public exposure established in the ICNIRP guidelines [14, 15]. These values make it possible to distinguish two zones: 1 (yellow) and 2 (red) [16]. When the

Figure 5. Sample search page of the electromagnetic field database.

value of exposure is under the action levels for workers, there is no zone 2. Otherwise, the extension of zone 2 is defined starting at the centre of the applicator. The same procedure is followed to define zone 1 (in the case in Figure 6b, this must be done 2.25 m from the machinery).

Figure 6c shows an example of an exposure evaluation report. The safety distances from the source are evaluated for increasing values of load current on the basis of the reference levels in the ICNIRP guidelines [14, 15, 17].

2.4. Optical Radiation

A database of AOR sources is the main feature of this section. At present, it contains measured data relative to over 40 sources. It is currently under development to

- guarantee easy retrieval of exposure values related to optical radiation produced by common industrial, health and research machinery, equipment and sources, to promote as far as possible the implementation of interventions aimed at reducing and preventing risk, still in the course of risk assessment, without having to recourse to measures that are often expensive and complex [18, 19];

- allow employers and their consultants to identify, when purchasing new machinery, machines or sources that reduce the risk of exposure to optical radiation to a minimum.

For each piece of machinery or apparatus present in the database, two types of data are provided:

- on proper identification of machinery or apparatus;
- on sources or lamps that machinery or apparatus contains.

Then, the specific AOR source mounted inside the apparatus, to which the measures reported in the portal refer, is characterized. It must be noted that it can happen that the same equipment or machinery has different lamps mounted inside. The database reports exactly the features of both the machinery under evaluation and the sources mounted inside when performing the assessment (Figure 7).

For each piece of machinery, the following specific results concerning the machinery or source are provided:

- relevant spectral emissions, e.g., infrared and blue light;

Machine technical sheet

Brand: KEMPPi
 Model: KEMPOWELD PRO 4200
Type: Arc welders
 Power: 18 Kw
 Power: Electric 220V-380V
 Reference standard: CEI EN 50444
 Required protection measures:
 1. Delimit Zone 1: Exposure values above the reference levels for general public
 2. Delimit Zone 2: Exposure values above the action levels for workers
 3. The access to the Restricted Access zone is forbidden to persons carrying pacemakers and/or implanted electric devices



Field measurements (Click to view the field measurements)


KEMPPi Power Cable
 SECTOR: Metal carpentry

Figure 6a. Sample details of a machine: electromagnetic fields.

Field measurements (Click to view the field measurements)

KEMPPi Power Cable
 SECTOR: Metal carpentry

Reference person:
[IFAC CNR Nicola Zoppetti \(nicola.zoppetti@gmail.com\)](mailto:nicola.zoppetti@gmail.com)



SIZE AND SHAPE OF THE APPLICATOR [m]

X 0.02
 Y 0.4
 Z 0.02

SHAPE
 Cylindrical

Measuring point	Reference	Distance Perpendicular [cm]	Distance Parallel [cm]	Height from ground [cm]	Frequency dominant [Hz]	Field Electric [V/m]	Field Magnetic [µT]	Power [W]	Action level Workers* [%]	Action level Population* [%]
P1 applicer	-	20	0	-	-	-	-	-	280	-

*The values reported in the two last columns as percent of ICNIRP reference levels refer to the electrical field or to the magnetic field, depending on which of the two resulted to be the most relevant from the exposure point of view.

1.15 m Zone 2 is the area where the exposure levels exceed the action levels set for in the Directive 2004/40/EC for workers

2.25 m Zone 1 is the area within which the exposure levels exceed the reference levels for the population but are less than or equal to the action values for workers set for in the Directive 2004/40 EC

Note
 Typical operating parameters (380 A)


 [A report is available for this measure](#)

Figure 6b. Details of a report of electromagnetic field measurements.

I [A]	Distances respect weld time (KEMPPi) (Wire EN50444)									
	100	200	300	400	500	600	700	800	900	1000
1998 workers	0.3	0.65	0.95	1.15	1.25	1.35	1.45	1.5	1.6	1.65
1998 population	1.25	1.65	1.9	2.25	2.5	2.75	2.95	3.15	3.3	3.45
2010 workers	0.1	0.1	0.15	0.25	0.3	0.35	0.4	0.5	0.55	0.65
2010 population	0.2	0.45	0.7	0.9	1.05	1.15	1.25	1.3	1.4	1.45

Figure 6c. Details of an exposure evaluation report.

Artificial Optical Radiations Database

Brand

Model

Type
Infrared heaters (5)

Power

Protection measures
All

1






	Type: Infrared heaters STAR PROGETTI - Helios Infrared Waterproof Power: Electric 220V-380V
	Type: Infrared heaters Varmatec - Varma infrared Power: Electric 220V-380V
	Type: Infrared heaters CERRUTI - lucequadra Power: Electric 220V-380V
	Type: Infrared heaters Vortice Elettrosociali S.p.A. - Thermologika Soleil Power: Electric 220V-380V
	Type: Infrared heaters Varmatec - Varma Infrared Water Resistant Power: Electric 220V-380V

Figure 7. Sample search page of the artificial optical radiation database.

- hazard distance over which exposure to the AOR emitted by machinery is not harmful according to the ICNIRP risk criteria [18, 20];
- protection measures to be adopted in specific cases; these are divided into
 - determination of controlled area;
 - behavioural modes, e.g., avoiding having the source in the field of view at workstations located closer to the source than the hazard distance;
 - modes and criteria of using PPE.

The analytical results of the irradiance and radiance measures performed at different distances and conditions of the use of the apparatus are then reported in terms of

- distance from the source;
- maximum permissible exposure time of an unprotected subject's eyes or skin. This time

does not exceed exposure limit values and considers the level of exposure at specific locations (Figures 8a–8b).

Further, this section also provides two guiding procedures: one for assessing risk associated with light-emitting diode (LED) sources for general lighting, the other for calculating PPE for welding as a function of the distance from the source.

3. INTERNET

The database is available at <http://www.portaleagentifisici.it>. Over 10000 users per month have consulted the database since it was published on November 1, 2011. There are other international noise and vibration databases on the Internet, too: Sweden's <http://www.vibration.db.umu.se>⁵; Germany's <http://www.las-bb.de/Karla>; USA's <http://wwwn.cdc.gov/niosh-sound-vibration>; and

⁵ originally hosted at Sweden's National Institute for Working Life

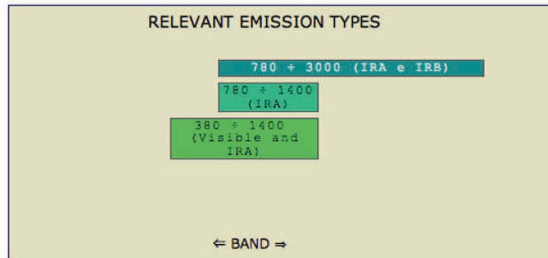
Machine technical sheet



Brand: Vortice Elettrosociali S.p.A.
 Model: Thermologika Soleil
 Type: Infrared heaters
 Power: 1.5 Kw
 Power: Electric 220V-380V
 Reference standard: CEI EN 62471
 Classification according to standard IEC-EN 62471 / IEC-EN 60825-1: not available
 Category according to standard EN12198-1 not available



SOURCE TECHNICAL SHEET
 Type: incandescent lamp n
 Emission: continuous
 N. of lighting bodies: 1
 Brand: not available
 Model: not available
 Classification according to standard IEC-EN 62471 / IEC-EN 60825-1: not available
 Reference standard: not available



Main protection measures to implement for safety purposes:

- 1. Avoid having the source in the field of vision

Field measurements (Click to view the field measurements)

TYPE OF MEASUREMENT: DIRECT SECTOR: Restaurants, work canteens and cafés
 ORIGINAL LAMPS: Yes GEOMETRY OF THE MEASUREMENT: generic position 145 cm

TYPE OF MEASUREMENT: DIRECT SECTOR: Restaurants, work canteens and cafés
 ORIGINAL LAMPS: Yes GEOMETRY OF THE MEASUREMENT: worker position 145 cm

Figure 8a. Details of an artificial optical radiation source.

Field measurements (Click to view the field measurements)

TYPE OF MEASUREMENT: DIRECT SECTOR: Restaurants, work canteens and cafés
 ORIGINAL LAMPS: Yes GEOMETRY OF THE MEASUREMENT: generic position 145 cm

TYPE OF MEASUREMENT: DIRECT SECTOR: Restaurants, work canteens and cafés
 ORIGINAL LAMPS: Yes GEOMETRY OF THE MEASUREMENT: worker position 145 cm

Reference person:
 AUSL 7 Siena – Laboratorio Agenti Fisici Andrea Bogi (a.bogi@usl7.toscana.it)

Rif.D.lgs 81/08	SPECTRAL RANGE	TARGET ORGANS	RESULT	Val.
a	E ₅ (Ultraviolet)	Eyes and skin	insignificant	
b	E _{UVA} (Ultraviolet A)	Eyes	insignificant	
c,d	L _B (Blue light, extended source)	Eyes	insignificant	
e,f	E _g (Blue light, small source)	Eyes	not applicable	
	L _{AFA} (Blue light, extended source, aphakic individuals)	Eyes	not applicable	
	E _{AFA} (Blue light, small source, aphakic individuals)	Eyes	not applicable	
g,h,i	L _R (Visible and Infrared A)	Eyes	insignificant	
j,k,l	L _R (Infrared A)	Eyes	from 20% + 50% of limit	13800 W m ⁻² m ⁻²
m,n	E _{IR} (Infrared A + Infrared B)	Eyes	Greater than VLE	340W m ⁻²
o	E _{skin} (Visible + Infrared A + Infrared B)	Skin	insignificant	340 W m ⁻²

SENSOR-SOURCE DISTANCE: 145 cm

MAXIMUM EXPOSURE TIME: 197 seconds

Figure 8b. Details of artificial optical radiation measurements.

Downloaded by [185.55.64.226] at 10:48 16 March 2015

Europe's http://ec.europa.eu/enterprise/sectors/mechanical/noise-outdoor-equipment/database/index_en.htm.

4. CONCLUSIONS

The database this paper presents is a single Italian database of physical agents representative of all the main tools and machines used in the various working environments. This Physical Agents Portal includes an earlier vibration database.

The goal was to implement the database with as many existing tools, machines and sources as possible, and to update it with the rapidly changing market. That is why agreements have been signed with some Italian public and private institutes that operate in specific sectors (construction, boating, transportation, etc.) and the INAIL, which also measures exposure to physical agents for research and compensation purposes. Thus, employers can perform systematic and statistically representative measurements of the levels of physical agents to which their workers are exposed and introduce those measurements into the national database (the only database Italian law allows to be used in risk assessment). A severe measurement protocol has been established to fulfil this purpose, together with a format for data entry. Periodic round robin tests will be run by all participants to ensure the same quality levels and metrological standardization of data delivered to the database by the various subjects.

The aim of the database is also to advise employers in purchasing equipment and machinery that produce the lowest possible level of physical agents transmitted to the workers, in compliance with Directives 2002/44/EC [3], 2003/10/EC [4], 2004/40/EC [5] and 2006/25/EC [6]. In fact, among the technical and organizational measures intended to reduce to a minimum exposure to physical agents and the attendant risks, the employer should consider in particular "the choice of appropriate work equipment of appropriate ergonomic design and, taking account of the work to be done, producing the least possible vibration" (p. 3) [3].

The Italian Government's decision to allow employers to use a centralized database for

assessing risk posed by vibration, regardless of the size of company, and to use a standardized procedure for the general assessment of all risks in SMEs, has created an intense debate in Italy, as risk assessment is a difficult and delicate task to be carried out by competent services or technicians, by means of a careful evaluation of workers' exposure to all risks at the workplace.

The new database is intended to become the centralized Italian database, which supports Legislative Decree 81/2008 [7] in assessing and controlling risk posed by physical agents. That is why programmes are being developed then published in the AOR section of the database; they make it possible to calculate exposure and characteristics of PPE for the eye in different exposure scenarios and for different types of sources or processes widely used in industry, e.g., in welding and melting machines, and laser equipment [21].

Moreover, some online calculation tools will be published for assessing photobiological risk associated with various types of lamps and lamp systems, starting from the database of lighting (with values of colour temperature and illuminance provided by manufacturers). Algorithms that predict EMF emitted by various types of machinery at different distances and operating parameters are also being developed.

REFERENCES

1. Eurofound. Fifth European Working Conditions Survey. Luxembourg: Publications Office of the European Union; 2012. Retrieved July 21, 2014, from: <http://www.eurofound.europa.eu/publications/htmlfiles/ef1182.htm>.
2. Bovenzi M. Health effects of mechanical vibration. *G Ital Med Lav Ergon*. 2005; 27(1):58–64.
3. Directive 2002/44/EC of the European Parliament and of the Council of 25 June 2002 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration) (sixteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC). OJ. 2002;

- L177:13–9. Retrieved July 21, 2014, from: http://eur-lex.europa.eu/resource.html?uri=cellar:546a09c0-3ad1-4c07-bcd5-9c3dae6b1668.0004.02/DOC_1&format=PDF.
4. Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise) (seventeenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC). OJ. 2003;L42:38–44. Retrieved July 21, 2014, from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:042:0038:0044:EN:PDF>.
 5. Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) OJ. 2004;L184:1–9. Retrieved July 21, 2014, from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:184:0001:0009:EN:PDF>.
 6. Directive 2006/25/EC of the European Parliament and of the Council of 5 April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC). OJ. 2006;L114:38–59. Retrieved July 21, 2014, from: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006L0025&from=EN>.
 7. Decreto Legislativo 9 aprile 2008, n. 81 “Attuazione dell’articolo 1 della legge 3 agosto 2007, n. 123, in materia di tutela della salute e della sicurezza nei luoghi di lavoro” [Legislative Decree April 9, 2008, No. 81 “Implementation of Article 1 of the Law of 3 August 2007 n. 123, concerning the protection of health and safety in the workplace”]. *Gazzetta Ufficiale della Repubblica Italiana*. 2008;(101 Suppl 108/L):1–354.
 8. Nataletti P, Marchetti E, Lunghi A, Pinto I, Stacchini N, Santini F. Occupational exposure to mechanical vibration: the Italian database for risk assessment. *International Journal of Occupational Safety and Ergonomics (JOSE)*. 2008;14(4):379–86. Retrieved July 21, 2014, from: <http://www.ciop.pl/27979>.
 9. Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery. OJ. 1998;L207:1–46. Retrieved July 21, 2014, from: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31998L0037&from=EN>.
 10. Directive 2006/42/EC of the European Parliament and of the Council 17 May 2006 on machinery, and amending Directive 95/16/EC (recast). OJ. 2006;L157:24–86. Retrieved July 21, 2014, from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:157:0024:0086:en:PDF>.
 11. European Committee for Standardization (CEN). *Mechanical vibration—guideline for the assessment of exposure to hand-transmitted vibration using available information including that provided by manufacturers of machinery (Technical Report No. CEN/TR 15350:2013)*. Brussels, Belgium: CEN; 2013.
 12. European Committee for Standardization (CEN). *Mechanical vibration—hand-held and hand-guided machinery—principles for evaluation of vibration emission (Standard No. EN ISO 20643:2008)*. Brussels, Belgium: CEN; 2008.
 13. European Committee for Standardization (CEN). *Mechanical vibration and shock—hand–arm vibration—measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand (Standard No. EN ISO 10819:2013)*. Brussels, Belgium: CEN; 2013.
 14. International Commission on Non-Ionizing Radiation Protection (ICNIRP). *Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)*. *Health Phys*. 1998;74(4):494–522.
 15. International Commission on Non-Ionizing Radiation Protection (ICNIRP). *Guidance on determining compliance of exposure to pulsed fields and complex non-sinusoidal*

- waveforms below 100 kHz with ICNIRP guidelines. *Health Phys.* 2003;84(3):383–7.
16. European Committee for Electrotechnical Standardization (CENELEC). Procedure for the assessment of the exposure of the workers to electromagnetic fields (Standard No. EN 50499:2008). Brussels, Belgium: CENELEC; 2011.
 17. International Commission on Non-Ionizing Radiation Protection. Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). *Health Phys.* 2010;99(6):818–36.
 18. Guidelines on limits of exposure to broadband incoherent optical radiation (0.38 to 3 μm). International Commission on Non-Ionizing Radiation Protection. *Health Phys.* 1997;73(3):539–5.
 19. European Commission. Non-binding guide to the artificial optical radiation Directive 2006/25/EC “Artificial optical radiation”. Luxembourg: Publications Office of the European Union, 2011. Retrieved July 21, 2014, from: http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=KE3010384.
 20. European Committee for Electrotechnical Standardization (CENELEC). Measurement and assessment of personal exposures to incoherent optical radiation—part 2: visible and infrared radiation emitted by artificial sources in the workplace (Standard No. EN 14255-2:2005). Brussels, Belgium: CENELEC; 2005.
 21. Vecchia P, Hietanen M, Stuck BE, van Deventer E, Niu S, editors. Protecting workers from ultraviolet radiation (ICNIRP 14/2007). Oberschleissheim, Germany: International Commission on Non-Ionizing Radiation Protection; 2007. Retrieved July 21, 2014, from: http://www.who.int/uv/publications/Protecting_Workers_UV_pub.pdf.