SCIENCE

AT WORK FOR OCCUPATIONAL HEALTH AND SAFETY

ACTIVITY REPORT
2012

irsst

DECLARATION OF DATA RELIABILITY

I declare that I have every reason to believe that the observable facts and measurable data presented in this activity report accurately reflect the situation as at December 31, 2012. This information falls under my responsibility as president and CEO of the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST). I hereby attest to its accuracy and the reliability of the controls relating thereto.

The indicators retained are used to assess the Institute's production over the course of the year.

Recommended by the members of the IRSST's Scientific Advisory Board and approved by its Board of Directors, the 2012 activity report faithfully describes the Institute's mission, vision, and principal achievements.

MARIE LARUE
PRESIDENT AND CEO

TABLE OF CONTENTS

MARIE LARUE

PRESIDENT AND CEO

MESSAGE FROM THE PRESIDENT AND CEO

MARIE LARUE

At the organizational level, in 2012, the IRSST bore the mark of the new administrative structure announced at the end of 2011. The implementation of the new structure influenced the Institute's agenda and shaped the work of all its divisions and departments. Inevitably, when we look back and take stock, the perceptions of an action-filled year can vary from one person and perspective to another. As witnessed, experienced, and assessed from my vantage point, 2012 has given me many reasons to affirm that through their accomplishments, our personnel largely attained the goals set forth in the IRSST's three mission statements.

ONE: Our personnel contributed to the prevention of occupational injuries and rehabilitation of affected workers, not only through research but also in a host of other ways. Our evidence-based data and vast knowledge supported and improved the prevention of work-related injuries. This data and knowledge came from our own studies, which were all peer-reviewed from the research protocol stage through to the final results and met the requirements of our scientific policy. The knowledge was there, readily accessible, and simply waiting to be used. From this standpoint and the sustainable development perspective, the production of five-year indicators and the very first portrait of Québec workers' exposure to chemical substances and to circumstances with delayed effects over time provide prime examples of a major contribution to the advancement of knowledge. This contribution was useful for, among other things, establishing the action priorities of researchers, preventionists, and decision makers.

TWO: The personnel of the Communications and Knowledge Transfer Division brought the results of studies conducted by our scientific staff within reach of lay readers and ensured their dissemination. Working with our partners, they maximized the results' impact by transferring them in a variety of ways. Numerous examples of their accomplishments could be cited. Accessible and extremely helpful, the staff proudly did their part to ensure that the IRSST played its intended role by putting their expertise to work for the entire Québec labour force: from fishermen in Gaspé and miners in Abitibi to agents working in a Québec City emergency call centre and Montréal metro operators, not to mention their respective employers. As a scientific reference centre, the Institute also continued to stand out. Whether by organizing national or international meetings, including a Café Scientifique, or by launching a video series on **www.irsst.tv**, the Institute capitalized on each advance in knowledge that furthered the accomplishment of its mission. The IRSST and its personnel—because, after all, it is people who make organizations—had a broader outreach than ever before.

THREE: Our laboratory technicians and scientists offered—I would again venture to say, more than ever before—the specialized services and expertise needed to support the activities of the public prevention and occupational health and safety (OHS) network. The year 2012 was truly the year for our laboratories. In addition to their production and their new analytical methods, they distinguished themselves on numerous occasions. Their expertise was required and appreciated during the legionellosis outbreak in Québec City and the investigation into air quality in Montréal's elementary schools. And better still, our laboratories, which already calibrate industrial hygiene instruments for Québec's prevention network, were put in charge of the same task for the Government of Canada, clear testimony that their reputation extends beyond Québec's borders.

In terms of stewardship, in 2012, the internal audit team followed up on its recommendations regarding research project management and concluded "that generally speaking, all the IRSST's planned actions had been taken." At the same time, the new management model for this scientific work was successfully tested, enabling us to increase our team efficiency and improve planning, follow-up, and project quality.

During that time, canvassing activities, calls for proposals, and tighter management also strengthened our external research portfolio. I have said it before and will say it again: the network of external researchers we have built over more than 30 years constitutes an invaluable asset for advancing OHS knowledge. However, consolidating this network requires an infusion of new blood that cannot be guaranteed by the IRSST's Graduate Studies Scholarship Program alone. Additional initiatives to groom the next generation of researchers were therefore launched in 2012.

Integrity, ethics, efficiency, relevance, and accountability pervaded the year's discourse, including the discussions with our governing bodies, ultimately to enhance the plan for the five-year research program, among other things.

All told, the future looks bright. The Board of Directors has granted us the means we need to continue our mission. We will have a five-year plan to clearly guide our research efforts and address the needs of the prevention-inspection network. With these resources in hand, we are committed to contributing, through research, to the prevention of occupational injuries and rehabilitation of affected workers in accordance with the mission to which we all subscribe.

2012 SCIENCE IN NUMBERS

PRODUCTION, PROJECTS AND ACTIVITIES

41 COMPLETED PROJECTS

21 PROJECTS BEING DEVELOPED

172 ACTIVE **PROJECTS AND ACTIVITIES**

37 PROJECTS **BEGAN**

22 JOINT
8 EXTERNAL
7 INTERNAL

73 PROJECTS **IN PROGRESS**

7,886 **HOURS WERE SPENT ON THE CALIBRATION, MAINTENANCE, AND REPAIR OF DIRECT-READING AND SAMPLING INSTRUMENTS**

78.4% **DEDICATED TO THE OHS AND PREVENTION-INSPECTION NETWORK**

THIS NUMBER REPRESENTS AN INCREASE OF **3%** OVER THE PREVIOUS YEAR

200 **PARTNER ORGANIZATIONS** WERE INVOLVED IN ACTIVE PROJECTS

218 **EXTERNAL RESEARCHERS** FROM **32** UNIVERSITIES AND **23** RESEARCH CENTRES FORMED PART OF THE IRSST'S NETWORK OF RESEARCH COLLABORATORS

40 **SCHOLARSHIPS WERE AWARDED,** FOR A TOTAL OF **$401,784**

14 NATIONAL AND INTERNATIONAL **STANDARDS COMMITTEES**

47 **EXTERNAL COMMITTEES INCLUDED AT LEAST ONE IRSST REPRESENTATIVE**

13 **COMMITTEES OF THE CSST** AND ITS NETWORK, INCLUDING REGULATORY COMMITTEES

20 **OTHER** LOCAL, NATIONAL, AND INTERNATIONAL **COMMITTEES**

69,670 **ENVIRONMENTAL, TOXICOLOGICAL, AND MICROBIOLOGICAL ANALYSES WERE PERFORMED**

75.6% **WERE FOR PARTNERS IN THE PREVENTION-INSPECTION NETWORK:** THE CSST, THE LOCAL HEALTH AND SOCIAL SERVICES NETWORK DEVELOPMENT AGENCIES, AND JOINT SECTOR-BASED ASSOCIATIONS

THE TOTAL NUMBER OF ANALYSES DROPPED BY **4.2%** COMPARED TO 2011

101 **NEW REQUESTS FOR EXPERTISE WERE RECEIVED**

2012 SCIENCE IN NUMBERS

OUTREACH, PUBLICATIONS AND COMMUNICATIONS

25 **SIMPLIFIED ARTICLES IN *PRÉVENTION AU TRAVAIL*,** THE MAGAZINE PUBLISHED BY THE CSST AND THE IRSST

65 **OTHER PRESENTATIONS GIVEN BY IRSST PERSONNEL** OR IRSST-FUNDED RESEARCHERS AT SCIENTIFIC CONFERENCES OR EVENTS ORGANIZED BY PARTNERS

49 **RESEARCH REPORTS,** TECHNICAL FACT SHEETS, AND GUIDES PUBLISHED BY THE IRSST

54 PUBLICATIONS

5 **LABORATORY METHODS**

5% **INCREASE IN TRAFFIC TO THE IRSST'S WEB SITES**

DATA COMPILED BY GOOGLE ANALYTICS

19,000 **SUBSCRIBERS TO *INFO IRSST*, THE INSTITUTE'S ELECTRONIC NEWSLETTER**

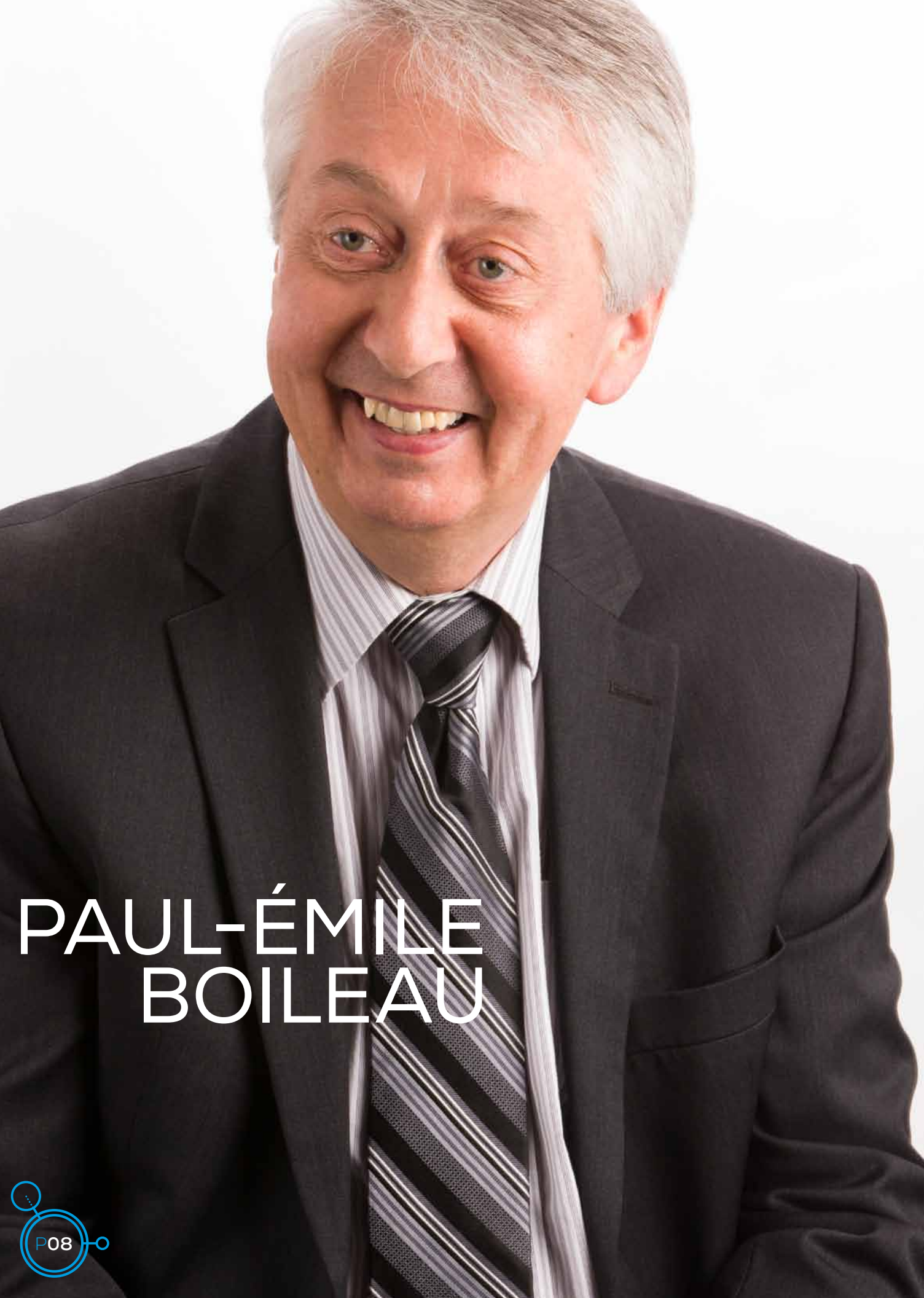
27 **JOURNAL ARTICLES**

108 SCIENTIFIC PEER-REVIEWED PUBLICATIONS

RELATED TO PROJECTS CARRIED OUT OR FUNDED BY THE IRSST

7 **OTHER PUBLICATIONS,** SUCH AS BOOK CHAPTERS, MASTER'S THESES, AND DOCTORAL DISSERTATIONS

74 **ARTICLES PUBLISHED IN CONFERENCE PROCEEDINGS**



PAUL-ÉMILE BOILEAU

FUTURE DIRECTIONS OF SCIENCE

PAUL-ÉMILE BOILEAU PhD, SCIENTIFIC DIRECTOR

In 2012, the end of a cycle led us to outline a new plan—this time, covering five years—that will guide the IRSST's activities for the years 2013–2017. This ambitious project drew from many sources and monopolized the human resources of the Scientific Division throughout the year. The new plan reflects the results of intensive consultations with the CSST, joint sector-based associations, and employer and trade-union associations, not to mention the researchers themselves, who keep abreast of the trends and knowledge development needs in the field of OHS. This plan is also based on international research-field mappings and on five-year statistical indicator profiles of compensated occupational injuries. In addition, the document was submitted to the scrutiny of the Scientific Advisory Board, which in turn had the opportunity to provide its input to ensure that it would meet the needs of the various stakeholders.

172 ACTIVE PROJECTS

Further to the recommendations that emerged from the 2011 institutional evaluation conducted by an independent international committee, the IRSST reduced the number of its research fields from seven to four, re-examined their objectives, demarcated their areas of development, redefined their programs, and reformulated their research orientations. All the research fields are now structured to promote interdisciplinary work and to approach issues from the broadest possible, multidimensional perspective; three concern prevention, while the fourth focuses on rehabilitation issues.

In 2012, the IRSST's research portfolio contained **172** active projects, including **37** new ones, four with special status.

I leave it to the research field leaders to describe their field, projects, and accomplishments in 2012.

SPECIAL PROJECTS

Accident-related occupational injuries and their determinants: a better understanding of the role played by the industrial sector and occupation, **PIERRE DURAND, NANCY BEAUREGARD, ANDRÉE DEMERS, ALAIN MARCHAND**.

Is there an association between summer temperatures, ozone levels and workers' compensation in Québec? **FRANCE LABRÈCHE, JOSEPH ZAYED, AUDREY SMARGIASSI, PATRICE DUGUAY, MARC-ANTOINE BUSQUE**.

The challenges of green jobs in Québec's photovoltaic industry: sustainable development opportunities and emerging health and safety risks for workers, **JOSEPH ZAYED**.

Québec annual occupational health and safety indicators, 2007-2010, **PATRICE DUGUAY, MARC-ANTOINE BUSQUE, ALEXANDRE BOUCHER, PASCALE PRUD'HOMME, MARTIN LEBEAU**.

4 NEW PROJECTS +ACTIVITIES

JOSEPH ZAYED

RESEARCH FIELD:
CHEMICAL AND BIOLOGICAL HAZARD PREVENTION

JOSEPH ZAYED PhD, RESEARCH FIELD LEADER

Despite the tangible progress made in recent years to reduce workers' exposure to chemical substances and biological agents, some workers are still contracting occupational diseases today. Ideally, this research field promotes the implementation of effective primary prevention measures, but it must also develop evaluation and prevention approaches to be used when hazards cannot be eliminated directly at source.

STUDIES THAT FALL UNDER THE CHEMICAL AND BIOLOGICAL HAZARD PREVENTION RESEARCH FIELD (CBHP) FOCUS ON THREE MAIN ORIENTATIONS:

Development of strategies and methods for evaluating exposure and estimating health risks using toxicological and epidemiological approaches;

Development and validation of technologies and tools designed to reduce and control exposure;

Development of methods for sampling and analyzing chemical substances and biological agents.

12 NEW **PROJECTS** +ACTIVITIES

IN 2012, THE CBHP FIELD WAS INVOLVED IN 12 NEW PROJECTS AND RESEARCH OR KNOWLEDGE TRANSFER ACTIVITIES:

Green jobs in Québec: definition of the sector and jobs, and assessment of the potential chemical and biological risks to worker health, **JOSEPH ZAYED, CLAUDE OSTIGUY, JACQUES LAVOIE, FRANCE LABRÈCHE, MARC-ANTOINE BUSQUE, MARIE-FRANCE D'AMOURS.**

Evaluating the performance of an N95 filter against ultrafine particles, including nanoparticles, with a cyclic airflow that simulates the breathing of workers, **ALI BAHLOUL, FARIBORZ HAGHIGHAT, CLAUDE OSTIGUY.**

Occupational exposures to chemical and physical contaminants: gender-differentiated analysis, **FRANCE LABRÈCHE, JÉRÔME LAVOUÉ.**

Tower silo ventilation taking the chute into consideration, **ALI BAHLOUL, MARCELO REGGIO.**

Updating of the Guide to Safe Use of Isocyanates, **BRIGITTE ROBERGE, CLAUDE OSTIGUY.**

New, improved edition of the best practices guide to nanoparticle risk management, **CLAUDE OSTIGUY, BRIGITTE ROBERGE, MAXIMILIEN DEBIA, ANDRÉ DUFRESNE.**

Development of a method for analyzing subtilisin and for evaluating exposure levels and sensitization rates: overview of the situation in a university hospital centre, **GENEVIÈVE MARCHAND, SÉBASTIEN GAGNÉ, JACQUES LAVOIE, YVES CLOUTIER.**

Development of a new approach to improve the identification and quantification of asbestos fibres in the air and in bulk materials, **MARTIN BEAUPARLANT, GILLES L'ESPÉRANCE, SÉBASTIEN SAUVÉ.**

Evaluation of the mycological biomass on the surfaces of air-handling ductworks of ventilation systems, **GENEVIÈVE MARCHAND, YVES CLOUTIER, JACQUES LAVOIE, MAXIMILIEN DEBIA.**

Assessing exposure to bioaerosols during bronchoscopy operations in hospital settings, **JACQUES LAVOIE, STÉPHANE HALLÉ, SYLVIE NADEAU, GILBERT PICHETTE, GENEVIÈVE MARCHAND, YVES CLOUTIER.**

Knowledge transfer activity – Development of an awareness-raising document on reducing risks associated with carcinogen exposure, **MARIE-FRANCE D'AMOURS, FRANCE LABRÈCHE, SABRINA GRAVEL, MARJOLAINE THIBEAULT.**

Knowledge transfer activity – Development of a prevention guide for the safe use of isocyanates. Industrial hygiene process. **MARIE-FRANCE D'AMOURS, BRIGITTE ROBERGE, SIMON AUBIN, LINDA SAVOIE.**

21 REPORTS, INCLUDING NINE TRANSLATIONS, **WERE PUBLISHED** DURING THE YEAR BY RESEARCHERS ASSOCIATED WITH THE CBHP FIELD:

ADAM-POUPART, A., LABRÈCHE, F., SMARGIASSI, A., DUGUAY, P., BUSQUE, M.-A., GAGNÉ, C., ZAYED, J. *Impacts des changements climatiques sur la santé et la sécurité des travailleurs* (impacts of climate change on occupational health and safety), Études et recherches / Rapport R-733, Montréal, IRSST, 2012, 45 p.

BRANTOM, P. G., HEIKKILÄ, P., REMKO, H., HEEDERIK, D., VAN ROOY, F. *Une revue des publications sur le cancer chez les travailleurs des chantiers maritimes*, Études et recherches / Rapport R-727, Montréal, IRSST, 2012, 132 p.

BRANTOM, P. G., HEIKKILÄ, P., HOUBA, R., HEEDERIK, D., VAN ROOY, F. *A Review of Cancer among Shipyard Workers*, Studies and Research Projects/Report R-715, Montréal, IRSST, 2012, 115 p.

DE MARCELLIS-WARIN, N., PEIGNIER, I., TRÉPANIER, M. *Les pratiques organisationnelles de sécurité chez les transporteurs routiers de matières dangereuses au Québec* (organizational safety practices at hazardous material motor carriers in Québec), Études et recherches / Rapport R-751, Montréal, IRSST, 2012, 121 p.

DEBIA, M., BEAUDRY, C., WEICHENTHAL, S., TARDIF, R., DUFRESNE, A. *Caractérisation et contrôle de l'exposition professionnelle aux nanoparticules et particules ultrafines* (characterization and control of occupational exposure to nanoparticles and ultrafine particles), Études et recherches / Rapport R-746, Montréal, IRSST, 2012, 66 p.

DION, C., PERRAULT, G., RHAZI, M. *Synthèse des connaissances sur la trémolite contenue dans le talc*, Études et recherches / Rapport R-724, Montréal, IRSST, 2012, 98 p.

DION, C., PERRAULT, G., RHAZI, M. *Synthesis of Knowledge on Tremolite in Talc*, Studies and Research Projects/ Report R-755, Montréal, IRSST, 2012, 98 p.

DROLET, D., BEAUCHAMP, G. *Guide d'échantillonnage des contaminants de l'air en milieu de travail (8e édition, version 8.1, mise à jour)* (sampling guide for air contaminants in the workplace, 8th edition, version 8.1, update), Études et recherches / Guide technique T-06, Montréal, IRSST, 2012, 150 p.

DUCHAINE, C., CORMIER, Y., GILBERT, Y., VEILLETTE, M., LAVOIE, J., MÉRIAUX, A., TOUZEL, C., SASSEVILLE, D., POULIN, Y. *Workers Exposed to Metalworking Fluids (MWF) – Evaluation of Bioaerosol Exposure and Effects on Respiratory and Skin Health*, Studies and Research Projects/Report R-745, Montréal, IRSST, 2012, 75 p.

GAGNÉ, S. *Guide de prélèvement des échantillons biologiques* (biological sample collection guide), Études et recherches / Guide technique T-25, Montréal, IRSST, 2012, 29 p.

HAGHIGHAT, F., BAHLOUL, A., LARA, J., MOSTOFI, R., MAHDAVI, A. *Development of a Procedure to Measure the Effectiveness of N95 Respirator Filters against Nanoparticles*, Studies and Research Projects/Report R-754, Montréal, IRSST, 2012, 73 p.

LABRÈCHE, F., DUGUAY, P., OSTIGUY, C., GOYER, N., BOUCHER, A., ROBERGE, B., BARIL, M. *Substances cancérogènes – Portrait de l'exposition des travailleurs québécois* (carcinogenic substances – exposure profile of Québec workers), Études et recherches / Rapport R-732, Montréal, IRSST, 2012, 89 p.

21

LAVOUÉ, J., GÉRIN, M., BÉGIN, D., OSTIGUY, C., ARCAND, R., ADIB, G. *Valorisation des données d'exposition professionnelle mesurées au Québec depuis 1980 par les équipes du Réseau public québécois en santé au travail – Étude préliminaire* (preliminary study on the promotion of data on the occupational exposure to chemical substances measured by the Québec occupational health network teams since 1980), Études et recherches / Rapport R-723, Montréal, IRSST, 2012, 80 p.

MULLER, C., MAZER, B., SALEHI, F., AUDUSSEAU, S., TRUCHON, G., LAMBERT, J., L'ESPÉRANCE, G., CHEVALIER, G., PHILIPPE, S., CLOUTIER, Y., LARIVIÈRE, P., ZAYED, J. *Evaluation of Beryllium Toxicity according to Chemical Form and Particle Size*, Studies and Research Projects/ Report R-750, Montréal, IRSST, 2012, 55 p.

OSTIGUY, C., MORIN, S., BENSIMON, G., BARIL, M. *Résultats des analyses de substances chimiques produites à l'IRSST pour chaque région administrative du ministère de la Santé et des Services sociaux pour la période 2001-2008* (results of chemical analyses produced at the IRSST for each administrative region of the ministère de la Santé et des Services sociaux for the 2001-2008 period), Études et recherches / Rapport R-731, Montréal, IRSST, 2012, 80 p.

ROBERGE, B., AUBIN, S., CLOUTIER, Y. *Characterization of Dusts in Traditional Bakeries*, Studies and Research Projects/ Report R-760, Montréal, IRSST, 2012, 74 p.

ROBERGE, B., AUBIN, S., CLOUTIER, Y. *Characterization of Dusts in the Food Seasonings Sector*, Studies and Research Projects/Report R-761, Montréal, IRSST, 2012, 58 p.

TRUCHON, G., TARDIF, R., LAVOUÉ, J., DROLET, D., LÉVESQUE, M., BOUCHER, J. *Variabilité biologique et guide de stratégies pour la surveillance biologique de l'exposition professionnelle* (biological variability and strategy guide for biological exposure monitoring), Études et recherches / Annexe RA-737, Montréal, IRSST, 2012, 34 p.

TRUCHON, G., TARDIF, R., LAVOUÉ, J., DROLET, D., LÉVESQUE, M., BOUCHER, J. *Guide de surveillance biologique de l'exposition – Stratégie de prélèvement et interprétation des résultats (7e édition)* (biological monitoring guides – sample collection and interpretation of results, 7th edition), Études et recherches / Guide technique T-03, Montréal, IRSST, 2012, 107 p.

VYSKOCIL, A., EL MAJIDI, N., THUOT, R., BEAUDRY, C., CHAREST-TARDIF, G., TARDIF, R., GAGNON, F., SKA, B., TURCOT, A., DROLET, D., ALIYEVA, E., VIAU, C. *Effects of Concentration Peaks on Styrene Neurotoxicity in the Fibreglass Reinforced Plastics Industry – Phase II*, Studies and Research Projects/Report R-728, Montréal, IRSST, 2012, 110 p.

VYSKOCIL, A., LEROUX, T., TRUCHON, G., LEMAY, F., GAGNON, F., GENDRON, M., BOUDJERIDA, A., EL-MAJIDI, M., VIAU, C. *Effect of Chemical Substances on Hearing: Interactions with Noise*, Studies and Research Projects/Report R-747, Montréal, IRSST, 2012, 44 p.

For the CBHP field, 2012 was a productive year that contributed significantly to the advancement of knowledge and led to some important firsts in Québec. To begin with, an unprecedented portrait of Québec workers exposed to carcinogenic substances was published. This overview assessed the number of workers potentially exposed to at least one agent considered to be carcinogenic or probably carcinogenic to humans, and identified the ten substances or circumstances to which larger numbers of workers are exposed. While recognizing that the causes of occupational cancers are multifactorial and that it is difficult to assess the work-related portion of these causes, the IRSST proposed establishing a thematic program on this issue within the next few years.

INDUSTRIAL SECTORS with more than 50,000 workers exposed to at least one carcinogen: **manufacturing; transportation and warehousing; agriculture, forestry, and hunting and fishing[1]; health care and social assistance**

MANUFACTURING SECTORS with more than 10,000 workers exposed to at least one carcinogen: **wood product, furniture and related products, food, and paper manufacturing**

Another first was the publication of a report on the evaluation of nanomaterial and fine particle concentrations in real occupational settings: in two welding schools, an aluminum smelter, a thermoplastics processing plant, and three university laboratories. The results revealed that laboratory personnel were subject to little exposure, while high concentrations of ultrafine particles were found in the aluminium smelter. Apprentice welders, particularly those doing aluminium flame cutting, were mainly exposed to concentration peaks, while the processing plant workers were exposed to high levels of carbon nanoparticles in the storage and processing rooms.

Lastly, an unprecedented study established the main links between climate change and their impacts on OHS in Québec, while another study painted a portrait of safety risks facing carriers of hazardous materials.

To support preventionists, this field also published the **7TH EDITION** of the *Guide de surveillance biologique de l'exposition des travailleurs à des contaminants chimiques* (biological monitoring guide for worker exposure to chemical contaminants). It includes a biological sampling guide and a computer-based tool that facilitates the use and interpretation of monitoring data by utilizing the variability data associated with 31 biological indicators.

1. Agriculture, forestry, and hunting and fishing are all part of the same industrial sector

FRANCK SGARD

RESEARCH FIELD: MECHANICAL AND PHYSICAL RISK PREVENTION

FRANCK SGARD PhD, RESEARCH FIELD LEADER

The many risks posed by machines and the work environment in which they are used determine and influence the type of studies and evaluations conducted in the Mechanical and Physical Risk Prevention (MPRP) field. Our research field focuses mainly on mechanical risks such as cuts, lacerations, needle punctures, crushing, contact with machines, trench cave-ins, falls from heights or on the same level, and slipping, but also on physical risks such as noise, hand-arm and whole-body vibration, and heat stress. Looking at records of occupational injuries, we see that, despite the safety advances made, mechanical risks still cause often serious or even fatal accidents, mainly in manual labourers and young workers. Unfortunately, the same applies to physical risks, with noise causing more than half of all occupational disease claims. And these claims are constantly on the rise. In fact, the CSST data—with minimum data maturity of three years—indicate that the number of such claims rose from 2,166 in 2005 to 3,781 in 2010. The most frequent occupational disease site, particularly among men, remains the ears. Moreover, the average income replacement indemnity payouts for vibration-related injuries are generally much higher than the average cost for all injuries combined.

TO CONTRIBUTE TO MORE EFFECTIVE INJURY PREVENTION, THE MPRP FIELD FOCUSES ITS RESEARCH ON THREE MAIN ORIENTATIONS:

Assessment of the mechanical and physical risks generated by machines and the work environment;

Reduction of mechanical and physical risks;

Taking the human factor into account in the evaluation and control of mechanical and physical risks.

7 NEW PROJECTS +ACTIVITIES

IN 2012, THE MPRP FIELD HAD 7 NEW PROJECTS OR RESEARCH ACTIVITIES, THREE OF WHICH WERE AUTHORIZED* IN 2011 BUT FOR WHICH WORK ACTUALLY BEGAN IN 2012:

Review of the literature on the application of temporal simulation methods to resolve noise and vibration issues affecting occupational health and safety, **NOUREDDINE ATALLA, CELSE-KAFUI AMÉDIN, FRANCK SGARD.**

Practical experimentation with risk estimation tools and parameters relating to machine safety, **FRANÇOIS GAUTHIER, YUVIN CHINNIAH, NICOLA STACEY, DAMIEN BURLET-VIENNEY.**

Evaluation of physiological response to the wearing of personal protective equipment (PPE): application of new technologies to firefighters' clothing, **DENIS MARCHAND, CHANTAL GAUVIN, MYLÈNE AUBERTIN-LAHEUDRE, MARTIN FILTEAU.**

Development of a risk analysis and classification tool for confined-space interventions, **YUVIN CHINNIAH, ALI BAHLOUL.**

* Risk analysis and identification of ways of preventing overboard falls of crew members on Québec lobster boats, **FRANCIS COULOMBE, ANTOINE RIVIERRE, SYLVIE MONTREUIL, JEAN-GUY RICHARD.**

* Use of hearing aids in a noisy work environment, **TONY LEROUX, CHANTAL LAROCHE, JÉRÉMIE VOIX, CHRISTIAN GIGUÈRE.**

* Feasibility study on reducing tonal noise from industrial fans, **PATRICE MASSON, GÉRARD ANTHONY, RÉMY ODDO, STÉPHANE MOREAU, PATRICK LÉVESQUE, CHANTAL SIMARD, FRANÇOIS OUELLET.**

* Les versions françaises de ces rapports ont été publiées en 2010-2011.

The MPRP field contributed in numerous ways to the advancement of knowledge in 2012. Among other things, we enhanced our knowledge of **LOCKOUT PRACTICES** in the municipal sector, where such programs are just beginning to be implemented in many cities. Of the 12 municipalities participating in the study, the lockout programs documented were found to be comprehensive and personalized, although some shortcomings were noted, mainly with regard to subcontractor training, practical training of personnel, and continuity in lockout management. This exploratory study supports municipalities by proposing a lockout implementation model that takes activity diversity into account (e.g. waste treatment, water filtration, or road repairs).

7 REPORTS,

INCLUDING TWO TRANSLATIONS, **WERE PUBLISHED** DURING THE YEAR BY RESEARCHERS ASSOCIATED WITH THE MPRP FIELD:

CHINNIAH, Y., BURLET-VIENNEY, D., BOIVIN, G., PAQUES, J.-J. *Secteur des affaires municipales au Québec – Étude exploratoire du cadenassage* (municipal affairs sector in Québec – exploratory study on lockout), Études et recherches / Rapport R-741, Montréal, IRSST, 2012, 113 p.

DOLEZ, P., SOULATI, K., GAUVIN, C., LARA, J., VU-KHANH, T. *Information Document for Selecting Gloves for Protection Against Mechanical Hazards*, Studies and Research Projects/Technical Guide RG-738, Montréal, IRSST, 2012, 62 p.

DOLEZ, P., VINCHES, L., PERRON, G., VU-KHANH, T., PLAMONDON, P., L'ESPÉRANCE, G., WILKINSON, K., CLOUTIER, Y., DION, C., TRUCHON, G. *Développement d'une méthode de mesure de la pénétration des nanoparticules à travers les matériaux de gants de protection dans des conditions simulant l'utilisation en milieu de travail* (development of a method for measuring nanoparticle penetration through protective glove materials under conditions simulating workplace use), Études et recherches / Rapport R-734, Montréal, IRSST, 2012, 127 p.

ODDO, R., SIMARD, C., ATALLA, N. *Mise à jour du répertoire des silencieux, soufflettes et pistolets aspirateurs* (updating of directory of compressed air mufflers, blow guns and vacuum guns), Études et recherches / Rapport R-612, Montréal, IRSST, 2012, 65 p.

RAKHEJA, S., KORDESTANI, A., MARCOTTE, P. *Evaluation of Whole-Body Vibration Exposure of Operators of Soil Compactors*, Studies and Research Projects/ Report R-735, Montréal, IRSST, 2012, 77 p.

VAILLANCOURT, V., NÉLISSE, H., LAROCHE, C., GIGUÈRE, C., BOUTIN, J., LAFERRIÈRE, P. *Sécurité des travailleurs derrière les véhicules lourds – Évaluation de trois types d'alarmes sonores de recul* (safety of workers behind heavy vehicles – evaluation of three types of back-up alarms), Études et recherches / Rapport R-763, Montréal, IRSST, 2012, 105 p.

VU-KHANH, T., DOLEZ, P., NGUYEN, C. T., GAUVIN, C., LARA, J. *Needlestick Resistance of Protective Gloves: Development of a Test Method*, Studies and Research Projects/Report R-753, Montréal, IRSST, 2012, 117 p.

We also developed a method for measuring the effectiveness of glove-manufacturing materials in protecting against nanoparticles (NPs). The experimental set-up makes it possible to simulate the workplace conditions, particularly mechanical stresses and the microclimate inside the gloves, under which gloves are used during nanoparticle exposure. Based on this study, we can now **RECOMMEND THAT WORKERS EXERCISE CAUTION** when they have to select and use this type of protective equipment, and that they replace their gloves at regular intervals, especially when they are thin or have been exposed to NPs in colloid solution.

Back-up alarms on heavy vehicles were evaluated by comparing a new type of alarm using a broadband signal to traditional tonal alarms. We now know that this new technology produces a much more homogeneous sound field behind vehicles that is easier for workers to locate spatially. Here again, the knowledge advances achieved led to the formulation of risk prevention recommendations.

Our researchers also addressed preventionists' needs by updating the **DIRECTORY OF COMPRESSED AIR MUFFLERS, BLOW GUNS, AND VACUUM GUNS**, applicable to industrial machines. The new document identifies some 150 manufacturers and 76 electrical, electronic, mechanical, pneumatic, and hydraulic safety devices, making it easy for interested parties to find information such as the names and contact details of manufacturers offering the appropriate type of device.

MARIE ST-VINCENT

RESEARCH FIELD: SUSTAINABLE PREVENTION AND WORK ENVIRONMENT

MARIE ST-VINCENT PhD, RESEARCH FIELD LEADER

While placing considerable importance on musculoskeletal disorders, the Sustainable Prevention and Work Environment (SPWE) field also focuses on social, organizational, and technological factors that impact on the occurrence of industrial accidents and occupational diseases, particularly in the context of economic globalization and transformations in industrial and demographic structures. The name of the field says it well: the accent is on **SUSTAINABLE PREVENTION**. The SPWE field also investigates the work activity and environment, concentrating primarily on the characteristics of companies, human and demographic aspects, labour force training, work schedules, and psychosocial factors, in order to advance knowledge that will help preventionists offer better support to companies during their workplace interventions.

THE SPWE FIELD PURSUES THE FOLLOWING RESEARCH ORIENTATIONS:

Analysis of OHS problems and assessment of risks in relation to social, organizational, and demographic aspects, and technological changes;

Development and application of measurement methods and evaluation tools (measurements of exposures and risk and protection factors, activity analyses, surveys, and data collection tools);

Interventions pertinent to, and management of, OHS problems (OHS management in small organizations, knowledge transfer and training, OHS management steps and tools, adjustment of work situations).

11 NEW **PROJECTS** +ACTIVITIES

IN 2012, THE SUSTAINABLE PREVENTION AND WORK ENVIRONMENT FIELD HAD 11 NEW PROJECTS AND RESEARCH OR KNOWLEDGE TRANSFER ACTIVITIES UNDER WAY:

Conditions facilitating first-level managers' adoption of preventive measures aimed at safeguarding psychological health in the workplace, **CAROLINE BIRON, GENEVIÈVE BARIL-GINGRAS, MICHEL VÉZINA, CHANTAL BRISSON, SYLVIE MONTREUIL, RENÉE BOURBONNAIS, LOUISE ST-ARNAUD, CLERMONT DIONNE, PIERRE-SÉBASTIEN FOURNIER.**

Employment trajectories of student workers and OHS: development of a data collection tool for a Québec-wide longitudinal study, **ÉLISE LEDOUX, LUC LABERGE, PASCALE PRUD'HOMME, JULIE AUCLAIR, NANCY ILLYCK, CHARLES GAGNÉ.**

For improved end-of-life services and palliative care: adapting and implementing workplace support programs and evaluating their impact on nurses' job satisfaction, sense of meaningfulness at work, and well-being (SATIN II), **LISE FILLION, MANON TRUCHON, LYSE LANGLOIS, JEAN-FRANÇOIS DESBIENS, CÉLINE GÉLINAS, MÉLANIE VACHON, GENEVIÈVE ROCH, MICHÈLE AUBIN, SERGE DUMONT, PIERRE GAGNON, SÉBASTIEN SIMARD, LISE TREMBLAY.**

The strategies developed during unforeseen events by adolescent apprentices in semi-specialized trades and their impacts on OHS risks, **MARIE LABERGE, BRESLIN CURTIS.**

Impacts of work posture on muscle activation patterns during repetitive manual tasks: indicators of musculoskeletal disorders, **JULIE CÔTÉ.**

Development of support tools for activities involving emergency call-taking and -dispatching activities in order to prevent musculoskeletal disorders and psychological health problems, **GEORGES TOULOUSE, LOUISE ST-ARNAUD, DENYS DENIS.**

Variability of muscle activation during computer work: can greater variability be generated?, **ALAIN DELISLE, FÉLIX BERRIGAN, JULIE CÔTÉ.**

Overview of primary and secondary prevention practices used by practitioners and workplaces in connection with computer use in Québec, **MARIE ST-VINCENT, SYLVIE MONTREUIL, GEORGES TOULOUSE, IULIANA NASTASIA.**

Knowledge transfer activity – 911 emergency call centre agents: shedding light on the shadow zones of a demanding job, **CHARLES GAGNÉ, GEORGES TOULOUSE, LINDA SAVOIE.**

Knowledge transfer activity – Preventing violence among employees of the same work organization, **CHARLES GAGNÉ, LINDA SAVOIE, NATHALIE JAUVIN, NADINE BOLDUC, MICHEL VÉZINA, MARIE-FRANCE LAFOND.**

Knowledge transfer activity – Organization of a *Café Scientifique* for presenting results of the activity entitled "For improved end-of-life services and palliative care: adapting and implementing workplace support programs and evaluating their impact on nurses' job satisfaction, sense of meaningfulness at work, and well-being (SATIN I)", **CHARLES GAGNÉ, LISE FILLION, MANON TRUCHON, MARIE-ANNICK ROBITAILLE.**

11 THE STUDIES CONDUCTED IN THE SPWE FIELD LED TO THE PUBLICATION OF REPORTS, INCLUDING THREE TRANSLATIONS:

BEAUGRAND, S., SUTTON, L. *Vibrations, exiguïté, faible marge de manœuvre – Comment améliorer le poste de conduite du métro de Montréal ?* Études et recherches / Rapport R-721, Montréal, IRSST, 2012, 19 p.

BEAUGRAND, S., SUTTON, L. *Vibration, Confined Space and Little Leeway for Improvement – Addressing the Challenges Posed by the Montréal Subway Operator Workstation*, Studies and Research Projects/Report R-722, Montréal, IRSST, 2012, 19 p.

CHATIGNY, C., NADON-VÉZINA, L., RIEL, J., COUTURE, V., HASTEY, P. *Analyse ergonomique de la santé et de la sécurité en centre de formation professionnelle* (ergonomic analysis of occupational health and safety in a vocational training centre), Études et recherches / Rapport R-756, Montréal, IRSST, 2012, 136 p.

CLOUTIER, E., FOURNIER, P.-S., LEDOUX, É., GAGNON, I., BEAUVAIS, A., VINCENT-GENOD, C. *La transmission des savoirs de métier et de prudence par les travailleurs expérimentés – Comment soutenir cette approche dynamique de formation dans les milieux de travail* (the transmission of job knowledge and prudent knowledge by experienced workers: how to support this dynamic training approach in workplaces), Études et recherches / Rapport R-740, Montréal, IRSST, 2012, 182 p.

DUSSAULT, J., JAUVIN, N., VÉZINA, M., BOURBONNAIS, R. *Preventing Violence Among Employees of the Same Work Organization – Evaluation of a Participatory Intervention*, Studies and Research Projects/Report R-739, Montréal, IRSST, 2012, 96 p.

GRAVEL, S., LORTIE, M., BILODEAU, H., DUBÉ, J. *Interaction entre la gestion des ressources humaines et la SST – L'enseignement aux futurs gestionnaires* (interaction between human resources management and OHS – teaching of future managers), Études et recherches / Rapport R-730, Montréal, IRSST, 2012, 76 p.

LABERGE, L., LEDOUX, É., THUILIER, C., GAUDREAULT, M., MARTIN, J.-S., CLOUTIER, E., AUCLAIR, J., LACHANCE, L., VEILLETTE, S., ROZON, C., GAUDREAULT, M., ARBOUR, N., BESCOU, S., AGENAIS, T., HOSTIOU, L. *Occupational Health and Safety of Students Who Hold Jobs during the School Year: Effects of Concurrent School Activity and Work Constraints*, Studies and Research Projects/ Report R-752, Montréal, IRSST, 2012, 151 p.

11

LORTIE, M., LAROCHE, E., DENIS, D., NASTASIA, I., FAYE, C., GRAVEL, S., GIRAUD, L., DESMARAIS, L. *Bilan des connaissances sur les guides de pratique en santé – Enseignements clés et transférabilité pour la santé et la sécurité au travail* (knowledge review of health practice guides – key lessons and transferability for occupational health and safety), Études et recherches / Rapport R-736, Montréal, IRSST, 2012, 127 p.

MARCHAND, D., GIGUÈRE, D. *Contraintes biomécaniques exercées aux membres supérieurs lors de l'utilisation de petits outils dans le secteur des services à l'automobile* (biomechanical constraints exerted on the upper limbs during use of small tools in the automobile services sector), Études et recherches / Rapport R-726, Montréal, IRSST, 2012, 88 p.

PLAMONDON, A., DENIS, D., LARIVIÈRE, C., DELISLE, A., GAGNON, D., ST-VINCENT, M., NASTASIA, I. *Les femmes manutentionnaires – Un point de vue biomécanique et ergonomique* (Material handling and women: from a biomechanical and ergonomic perspective), Études et recherches / Rapport R-757, Montréal, IRSST, 2012, 113 p.

TOULOUSE, G., ST-ARNAUD, L., DELISLE, A., DUHALDE, D., LÉVESQUE, J., MARCHÉ-PAILLÉ, A., MOORE, M., COMTOIS, A.-S., LARUE, C., PENA SALAZAR, E. *Study of Interventions to Reduce Musculoskeletal Disorders and Psychological Health Problems in 911 Emergency Call Centres in the Municipal Public Security System*, Studies and Research Projects/Report R-762, Montréal, IRSST, 2012, 118 p.

The new knowledge generated by the results of the activities of this research field is important both for understanding work activities and environments and preventing musculoskeletal disorders (MSDs). Based on a knowledge review and partners' concerns, our researchers therefore drew up a **FIRST OVERVIEW** of vocational training centres, which teach trades that pose OHS risks for both instructors, and for students, who constitute our future workers. While obstacles to prevention persist despite the efforts made, we are witnessing a broad collaborative movement in these centres and note that the commitment and determination of management and certain departments are reaping benefits, but more regarding safety issues associated with machine use than health issues. These observations will help the vocational training centres to further develop their approaches to prevention, particularly regarding methods of prevention, types of health risks, and prudent knowledge.

On this same topic of the transmission of trade skills and prudent knowledge, other researchers identified the conditions that promote these practices among experienced workers in order to more effectively prevent the loss of expertise and the exposure of all workers, regardless of age, to OHS risks. This is vital in the context of an aging labour force and the influx of new workers. A bank of complex OHS case studies was also mounted for students enrolled in administration or human resource management programs. This bank is designed specifically to improve their skills in diagnosing problems and implementing both a culture of prevention and preventive measures within a process of sustainable organizational change. Knowledge about MSD prevention also evolved in 2012. We gained a better understanding of differences between the working methods of male and female material handlers. To do so, researchers took muscle strength measurements, collected biomechanical data, and made ergonomic observations during three work sessions involving 15 female material handlers with several years of experience, 15 experienced male workers, and 15 novice male workers. These experiments revealed **DIFFERENCES BETWEEN THE SEXES** in a context where the loads to be lifted and put down were identical or relatively similar.

Another study was conducted in the automotive services sector, where MSDs involving the upper extremities generate nearly **15% OF THE WORK ABSENCE DAYS** taken by mechanics, painters, and autobody workers as a result of repetitive movements, intense muscular efforts, vibrations, and static postures. The results of the study suggest that solutions aimed at improving work postures have a greater impact on reducing physical stresses on the upper extremities than does the reduction of tool weight. Strategies were also proposed for reducing and even eliminating MSD risks.

CHRISTIAN LARIVIÈRE

RESEARCH FIELD: OCCUPATIONAL REHABILITATION

CHRISTIAN LARIVIÈRE PhD, RESEARCH FIELD LEADER

The annual number of occupational injuries involving lost time may indeed be declining, but the proportion of workers referred for rehabilitation continues to rise. It increased from **5%** of all injuries in 2000 to **9%** in 2008. During the 2005-2007 period, 8% of the injuries requiring rehabilitation accounted for as much as 58% of income replacement indemnity payouts. It therefore comes as no surprise that the goal of the Occupational Rehabilitation research field is to help prevent or reduce the risks of prolonged disability in injured workers, while supporting CSST counsellors and interventions in clinical settings and the workplace. To achieve this goal, our research field studies the various factors—whether personal, organizational, administrative, or medical—that facilitate or hinder a smooth return to work. Our work concerns not only rehabilitation intervention methods, but also methods aimed at workers' occupational reintegration.

FOUR MAJOR RESEARCH ORIENTATIONS GUIDE THE STUDIES CONDUCTED WITHIN THE OCCUPATIONAL REHABILITATION FIELD:

Development of tools for assessing the health of workers who have sustained occupational injuries and are at risk of disability;

Study of the individual, clinical, organizational, and administrative determinants of a return to work;

Development and implementation of rehabilitation and return-to-work interventions;

Development and implementation of strategies designed for rehabilitation and return-to-work professionals.

13 NEW **PROJECTS** +ACTIVITIES

IN 2012, THE OCCUPATIONAL REHABILITATION FIELD ADDED 3 NEW PROJECTS OR RESEARCH ACTIVITIES TO ITS PORTFOLIO:

Clinical and neuromechanical determinants of the development of low back disability among workers, **MARTIN DESCARREAUX, MATHIEU PICHÉ, VINCENT CANTIN.**

IRSST-REPAR-FRSQ – Occupational shoulder injuries: review of knowledge on clinical evaluation, rehabilitation, and return to work, **JEAN-SÉBASTIEN ROY, FRANÇOIS DESMEULES, PIERRE FRÉMONT, JOY MACDERMID, CLERMONT DIONNE.**

Development of a preliminary clinical prediction rule for identifying patients with non-acute low back pain who respond best to a lumbar stabilization exercise program, **CHRISTIAN LARIVIÈRE, MARIE-FRANCE COUTU, JEAN-PIERRE DUMAS, DANY GAGNON, SHARON HENRY, RICHARD PREUSS, MICHAEL J.L. SULLIVAN.**

In concrete terms, the work done by the Occupational Rehabilitation field provides decision makers, professionals, and practitioners with an overview, in the form of a literature review, of the major trends in research on the most promising types and methods of intervention related to work disability prevention. Based on our analysis of studies conducted between 2000 and 2008, we now know that the **BEST STRATEGIES** are the following:

- Early identification of workers who represent a risk of chronicity and concentration of intervention efforts on them;
- Early intervention involving the combination of various types of interventions within a single program;
- Improvement of collaboration, communication, and coordination among the key stakeholders and professionals;
- Raising awareness among injured workers, but also all the professionals involved, of the human, financial, and social repercussions of disability, ultimately to ensure a sustainable return to work.

In addition, the scientific literature revealed that one of the most important current trends is interventions related to the workplace (e.g. maintaining contacts, adjusting work stations or jobs, involving co-workers). This literature review was also useful for researchers as it revealed the five main topics in research: **1)** assessment of predictors of long-term disability or return to work, **2)** assessment of interventions, **3)** documentation and assessment of key stakeholders' practices, **4)** questions related to disability compensation, **5)** instrument development, validation, and assessment methodologies, and results measurement.

DURING THE YEAR, THE RESEARCHERS ASSOCIATED WITH THE OCCUPATIONAL REHABILITATION FIELD PUBLISHED 7 REPORTS, INCLUDING TWO TRANSLATIONS:

CÔTÉ, D. *La notion d'appartenance ethnoculturelle dans la recherche et l'intervention en réadaptation: un bilan des connaissances* (the concept of ethnocultural identity in rehabilitation research and intervention: a knowledge review), Bilans de connaissances / Rapport B-080, Montréal, IRSST, 2012, 68 p.

COUTU, M.-F., NASTASIA, I., DURAND, M.-J., CORBIÈRE, M., LOISEL, P., LEMIEUX, P., LABRECQUE, M.-E., PETTIGREW, S. *A Systematic Approach for Identifying the Psychological Health and Work-Related Determinants of Occupational Disability in a Target Sector*, Studies and Research Projects/Report R-759, Montréal, IRSST, 2012, 102 p.

DURAND, M.-J., CORBIÈRE, M., BRIAND, C., COUTU, M.-F., ST-ARNAUD, L., CHARPENTIER, N. *Development of an Instrument for Evaluating the Factors Influencing Long-Term Sick Leave Attributable to Mental Health Problems*, Studies and Research Projects/Report R-743, Montréal, IRSST, 2012, 59 p.

LARIVIÈRE, C., GAGNON, D., DE OLIVEIRA JR., E., HENRY, S., MECHERI, H., DUMAS, J.-P., VADEBONCŒUR, R. *Mesures par ultrasons des muscles profonds du tronc – Évaluation de la fidélité intra et interévaluateurs – Programme REPAR-IRSST* (ultrasound measurements of the deep muscles of the trunk – evaluation of intra- and interevaluator reliability – REPAR-IRSST program), Études et recherches / Rapport R-729, Montréal, IRSST, 2012, 80 p.

LARIVIÈRE, C., KEARNEY, R., MECHERI, H., LUDVIG, D., ABOULFAZL, S.-A., GAGNON, D. *Évaluation biomécanique des déterminants de la stabilité lombaire – Étude exploratoire* (biomechanical assessment of lumbar stability determinants – exploratory study), Études et recherches / Rapport R-742, Montréal, IRSST, 2012, 82 p.

LOISEL, P., CORBIÈRE, M., DURAND, M.-J., COUTU, M.-F., DÉSORCY, B., HONG, Q. N., GENEST, K. *Évolution comparée de la douleur et du statut de travail à la suite d'un programme de réadaptation pour des travailleurs ayant des troubles musculo-squelettiques* (comparative evolution of pain and work status following a rehabilitation program for workers with musculoskeletal disorders), Études et recherches / Rapport R-744, Montréal, IRSST, 2012, 45 p.

NASTASIA, I., TCACIUC, R., COUTU, M.-F. *Stratégies de prévention de l'incapacité prolongée au travail chez les travailleurs indemnisés pour troubles musculo-squelettiques d'origine professionnelle – Une revue systématique et descriptive de la littérature* (strategies for preventing prolonged disability in workers compensated for work-related musculoskeletal disorders: a systematic and comprehensive literature review), Études et recherches / Rapport R-748, Montréal, IRSST, 2012, 166 p.

In rehabilitation, pain perception (i.e. how it is perceived) is a key issue as it influences the entire process, including the return to work. Using existing data, a retrospective study revealed associations between the work status, resumption of regular activities, and pain-intensity progression profile of 107 participants.

> "Only half (54%) of the respondents who perceived an increase in their pain returned to work, compared to 87% of those who said their pain had diminished."

These results confirm the **IMPORTANCE OF BELIEFS** about pain since those workers who said they had perceived a decrease in their pain intensity demonstrated a higher employment rate after three years. More of them also resumed their regular activities than did those who perceived an increase in their pain levels. However, it is not pain alone that constitutes a determining factor in rehabilitation. Ethnocultural identity can also play an important role. A review of the literature from the past 20 years in fact provided an overview that gives rehabilitation counsellors and other professionals a better understanding of the intercultural issues involved in occupational rehabilitation intervention. The points that emerged concern obstacles that immigrants have to overcome, but also highlight the cultural barriers that add further complexity to the relationship between immigrant workers and their therapists, and that fuel, for both worker and therapist, a feeling of powerlessness and frustration conducive to the formation of stereotypes and prejudices.

PATRICE DUGUAY

INDICATORS GUIDING SCIENCE

PATRICE DUGUAY
COORDINATOR, STATISTICAL SURVEILLANCE GROUP

Working closely with the scientific watch team, the **STATISTICAL SURVEILLANCE GROUP** uses existing data sources and develops often innovative OHS indicators. The group primarily provides the Scientific Division with statistical data to ensure that it has the information required to identify priority needs related to important issues and required during the research project evaluation process.

FIVE-YEAR INDICATORS

For more than 25 years now, the IRSST has been producing occupational injury frequency and severity indicators every five years in order to determine the groups of workers with the most significant OHS problems recognized by Québec's Commission de la santé et de la sécurité du travail (CSST). In 2012, the group again published these innovative injury risk and severity profiles, combining CSST data for the years 2005-2007 with data from Statistics Canada's 2006 census. These numerous and varied data take into account the economic activity sectors, occupations, gender, and age of workers who have sustained occupational injuries or contracted occupational diseases. They also include separate indicators for manual and non-manual workers and workers who perform combined tasks, young workers ages 15 to 24, workers age 45 or over, the highest-risk industries, and a frequency-severity indicator that takes into account both frequency rate and average duration of benefit payments for accepted time-loss injuries (TLIs).

Another feature of these indicators is that they are calculated on the basis of the number of full-time equivalent (FTE) workers rather than the number of actual workers. This approach is adopted to reflect the importance of various types of work, notably atypical work, and particularly part-time or casual work, as well as differences by age and sex.

The results of the 2012 study confirm the **DOWNWARD TREND** in the number of accepted time-loss injuries. The number dropped by 19.3% between the 2000–2002 and 2005–2007 periods, even though the number of FTE workers increased by over 8% during that time. This trend persisted until 2010, the last year for which we have statistics compiled. However, the average duration of benefit payments for accepted time-loss injuries rose from 73 days in 2000–2002 to 88 days in 2005–2007.

17 INDUSTRIAL ACTIVITY SECTORS, WHICH ACCOUNT FOR 7% OF THE LABOUR FORCE BUT 23% OF THE TIME-LOSS INJURIES, POSTED FREQUENCY-SEVERITY RATES THREE TIMES HIGHER THAN THAT OF THE QUÉBEC AVERAGE.

Manual workers in the waste management and water treatment services sector had the highest rate of accident frequency, or 20.5 time-loss injuries per 100 FTE workers per year, compared to the Québec average of 3.4 time-loss injuries per 100 FTE workers per year. They were followed by manual workers in the local, municipal, and regional public administration sectors (19.3), building material and garden equipment and supply dealers (15.5), and agriculture and forestry support-activity workers (15.2).

Every year, **5,000 NEW CASES OF OCCUPATIONAL DISEASES** are recognized on average. They constitute slightly more than 4% of all accepted occupational injuries and affect more men (2.7 diseases per 1,000 FTE workers), particularly ages 45 and up (5), than women (0.9). The frequency rate is the highest in the secondary sector (manufacturing and construction), with more than four diseases per 1,000 FTE workers affected.

The main occupational disease in Québec, hearing disorders (including deafness) affect more men than women, while the opposite is true of musculoskeletal disorders. Together, these two types of injuries represent more than eight out of ten recognized occupational diseases.

These five-year indicators are also used by preventionists and our partners in the prevention-inspection network to better prioritize their actions in the workplace. While the indicators have their limitations, they are of the utmost important in determining research or intervention priorities when it comes to targeting the groups of workers with the most significant, recognized, and compensated occupational health and safety problems.

In 2012, a feasibility study conducted by the Statistical Surveillance Group also established that occupational injury indicators can conceivably be produced on an annual basis. As a complement to the five-year indicators, these annual indicators will reveal short-term fluctuations and medium-term trends. A first set of annual indicators will be produced for the various economic activity sectors and occupational categories. Another set linking age, gender, and occupational category will also be developed.

IN 2012, THE MEMBERS OF THE STATISTICAL SURVEILLANCE GROUP PUBLISHED 3 REPORTS:

DUGUAY, P., BOUCHER, A., BUSQUE, M.-A., PRUD'HOMME, P., VERGARA, D.
Lésions professionnelles indemnisées au Québec en 2005–2007 : Profil statistique par industrie – catégorie professionnelle (employment injuries compensated in Québec in 2005–2007: statistical profile by industry – occupational category), Études et recherches / Rapport R-749, Montréal, IRSST, 2012, 202 p.

DUGUAY, P., BOUCHER, A., BUSQUE, M.-A., PRUD'HOMME, P., VERGARA, D.
Lésions professionnelles indemnisées au Québec en 2005-2007 : Tableau de classement par industrie – catégorie professionnelle (employment injuries compensated in Québec in 2005–2007: grading schedule by industry – occupational category), Études et recherches / Rapport / Annexe RA-749, Montréal, IRSST, 2012, 230 p.

DUGUAY, P., BUSQUE, M.-A., BOUCHER, A.
Indicateurs annuels de santé et de sécurité du travail pour le Québec – Étude de faisabilité (annual occupational health and safety indicators for Québec – feasibility study), Études et recherches / Rapport R-725, Montréal, IRSST, 2012, 115 p.

LOUIS LAZURE

TRANSFER OF SCIENTIFIC KNOWLEDGE

LOUIS LAZURE
DIRECTOR, COMMUNICATIONS AND KNOWLEDGE TRANSFER DIVISION

For us, the very principle of the dissemination and application of research results and transfer of knowledge is crucial and forms a fundamental component of the IRSST's mission. Throughout the research and knowledge translation cycle and for each and every project, we assess the potential application of the results in collaboration with knowledge users. By systematically integrating knowledge transfer into our research activities, we are able to multiply the positive impacts of our research results on occupational health and safety. Guides, fact sheets, computer-based tools, Web sites, colloquia, and videos are but some of many forms that the dissemination and application of research results takes, but the ultimate goal remains the same: ensure that workplaces assimilate and utilize the results for purposes of preventing occupational injuries and rehabilitating affected workers.

The year 2012 saw the completion of a number of highly appreciated projects. The following examples illustrate our dissemination, application, and communication practices.

SYMPOSIA

There had been no occupational health data available to date, either in Québec or elsewhere in the world, for understanding the magnitude of the health problems experienced by 911 emergency call centre agents. Thanks to the knowledge generated by two multidisciplinary research projects—one on musculoskeletal disorders (MSDs) and the other on psychological risk factors for agents—and to an enhanced understanding of the risks to which they are exposed, courses of action were developed and implemented in several centres. Organized jointly by the IRSST, the Association paritaire pour la santé et la sécurité du travail – secteur affaires municipales (APSAM, or joint sector-based association for occupational health and safety, municipal affairs sector), and the Municipal Finance and Development Agency for Emergency 9-1-1 Call Centres in Québec in collaboration with the Association des centres d'urgence du Québec, symposia were held in Laval and Québec City under the theme *Les préposés aux appels d'urgence 9-1-1 : Éclairer les zones d'ombre d'un travail exigeant* (911 emergency call centre agents: shedding light on the shadow zones of a demanding job). With over 200 participants, these events were sold out and met with resounding success. Participants heard from agents and a dispatcher at a 911 emergency call centre about the difficulties related to their work and the advantages they derived from their participation in this project. In addition, one emergency call centre coordinator explained the importance and relevance of participating in these research efforts and of assimilating the results in order to

INTRODUCE SOLUTIONS TO ASSIST WORKERS.

A VIDEO

A video was also produced to improve understanding of the work done by emergency call centre agents. Aimed at both the agents' collaborators (such as police officers, firefighters, and paramedics) and municipal administrators and citizens, this video explains the role these agents play in the overall process of emergency call management, including all the steps involved in collecting and managing information and the physical and psychosocial demands that call centre agents face.

Only 17 minutes long, the *9-1-1, lumière sur un travail méconnu* video was designed for use in training sessions for call centre agents, police officers, and other emergency personnel.

A CAFÉ SCIENTIFIQUE

In the current context of limited access to palliative care and a labour shortage, the task of making organizational choices that take into account, among other things, changes in the world of work, new occupational requirements, and improved workplace management, poses a major challenge. One research project was carried out with the primary aim of preventing occupational injuries in nurses working in the palliative care field. The members of the follow-up committee were quick to agree on the importance of disseminating the research results to all stakeholders involved (e.g. professionals, decision makers, and families) and the general public. To reach all these parties, we opted for a participatory formula. A Café Scientifique was held in Québec City in collaboration with the team from the Laval University Cancer Research Center and the Équipe de recherche Maison Michel-Sarrazin en oncologie psychosociale et soins palliatifs (ERMOS). All members of the follow-up committee invited three stakeholders of their choice who were interested in the results and likely to have influence on their application to come and discuss the study with the scientists. The clientele recruited and numerous discussions held confirmed this strategy's relevance for the transfer of the research results to the workplaces targeted by the study.

INSTRUCTOR TRAINING

As part of its activities, the Réseau d'échanges sur la manutention (REM) organized a breakfast seminar where the administration of the city of Blainville, located in Québec's Lower Laurentian region, had the opportunity to attest to the positive results of an instructor training session given to its fire department. This intervention provides a good example of the application of the new, IRSST-developed approach to material handling training. REM, the exchange network launched by the CSST and IRSST, seeks to raise awareness in workplaces and help them take charge of prevention in order to reduce the risks related to manual material handling. Responding to the needs expressed by the workplaces concerned and our partners, the committee responsible for this network included in its action plan the intention to publish an information newsletter twice yearly and to hold breakfast seminars for research stakeholders and material handling stakeholders in the field.

A SMALL-SCALE BUT HIGHLY USEFUL PROJECT

If we judge from the positive comments received from users of the *Directory of Safety Devices for Industrial Machines*, it is not solely large-scale research projects and scientific breakthroughs that generate highly useful results for workplaces. Frequently consulted by preventionists and OHS professionals, this directory was updated in 2012 to include new products that have come on the market and several manufacturers. It provides practical information on the most frequently used safety devices in Québec. Readily accessible, user-friendly, and available in both English and French, the directory lists some 150 manufacturers and 76 devices grouped into ten categories, to facilitate the process of those seeking to make machines and industrial processes safer.

ON SITE

Every year, the IRSST hosts an information booth to publicize its research results and products at a number of carefully selected events. In 2012, it was present at seven such events: the Salon Réadaptation et gestion d'invalidité, the Forum Santé et sécurité du travail, the Salon de la recherche de l'Association francophone pour le savoir (ACFAS), the Congrès de l'Association québécoise pour l'hygiène, la santé et la sécurité du travail (AQHSST), the Career Fair of the École Polytechnique de Montréal, the Grand rendez-vous de la SST, and the conference of the joint sector-based association Via Prévention.

TRANSLATION

First and foremost, the Institute focuses on publishing its results and documents in French. However, it is also aware that the use of French alone is not enough to earn recognition in the rest of Canada and around the world. In accordance with the 2011 recommendations of the independant international committee, the IRSST assesses the translation potential of its research reports in light of their nature and the importance they represent for the scientific and workplace communities. To reach these clienteles more effectively, 16 reports were therefore translated into English in 2012 and posted on the Institute's Web site at **www.irsst.qc.ca**, representing twice the number of the previous year.

JACQUES LESAGE

SCIENCE LABORATORIES

JACQUES LESAGE
DIRECTOR, LABORATORY DIVISION

With nearly 70,000 analyses performed and a 3% increase in the number of hours spent calibrating, maintaining, and repairing its inventory of direct measurement and sampling instruments compared to 2011, the Laboratory Division clearly had a productive year. Also compared to the previous year, the number of analyses performed for the prevention-inspection network dropped by 6%, while the number of analyses requested by the private sector rose by 11%. In addition to supporting Québec's prevention-inspection network, the IRSST's laboratories developed and validated new analytical methods. In 2012, the analytical process, particularly that used in toxicological matters, was updated to reflect state-of-the-art instrumentation and the highest quality standards. This work paved the way for designing methods and publishing scientific articles in scholarly journals. The Laboratory Division published four new methods, one of which was translated into English:

GAGNÉ, S., BARRETTE, M.-C., LESAGE, J. *Dosage de l'acide t,t-muconique urinaire (determination of urinary t,t-muconic acid)*, Méthodes analytiques MA-317, Montréal, IRSST, 2012, 13 p.

GAGNÉ, S., BARRETTE, M.-C., LESAGE, J. *Dosage de l'acide mandélique et de l'acide phénylglyoxylique urinaire (determination of mandelic acid and urinary phenylglyoxylic acid)*, Méthodes analytiques MA-378, Montréal, IRSST, 2012, 14 p.

GAGNÉ, S., BARRETTE, M.-C., LESAGE, J. *Dosage des acides o,m,p-méthylhippurique urinaire (determination of urinary o,m,p-methylhippuric acids)*, Méthodes analytiques MA-379, Montréal, IRSST, 2012, 13 p.

HUARD, M., BARRETTE, M.-C., LESAGE, J. *Dosage de composés organiques volatils dans l'air par spectrométrie de masse*, Méthodes analytiques MA-369-fr, Montréal, IRSST, 2012, 25 p.

HUARD, M., BARRETTE, M.-C., LESAGE, J. *Determination of volatile organic compounds in the air by mass spectrometry*, Analytical Methods MA-369-en, Montréal, IRSST, 2012, 25 p.

The IRSST's laboratories also respond to specific requests for microbiology evaluations requiring interventions in the field. Our personnel's expertise was sought, among other things, in the context of two events that made the news headlines: the legionellosis outbreak in Québec City and the investigation into air quality in Québec elementary schools.

In the case of the legionellosis outbreak, the Direction régionale de la santé publique de la Capitale-Nationale asked us to support its efforts to control the legionellosis outbreak that caused 13 deaths and infected 168 persons, and to keep public authorities on high alert. As their contribution, the Institute's laboratories analyzed some 100 water samples taken from cooling towers, which proved to be the source of this microbial contamination that generated an unprecedented crisis in Québec City.

Our laboratories' expertise was also sought out by the Auditor General of Québec during its investigation of air quality in elementary schools. Concerned about the risks posed to teachers' and students' health, the Auditor General asked the IRSST for analytical support. The laboratories therefore collected and analyzed air samples from a number of Québec elementary schools. Our scientists wrote an intervention report on risk factors involving the building envelopes and the quality of their maintenance, both factors that impact air quality.

As well, the high calibre of the laboratories' expertise led to the signing of a professional services agreement with Human Resources and Skills Development Canada (HRSDC). Under this three-year agreement, the IRSST is charged with calibrating the industrial hygiene equipment needed for monitoring workers' occupational exposure to physical, chemical, and biological agents, and with performing laboratory analyses for the Canadian government in the context of the HRSDC's Labour Program.

The Calibration Laboratory Assessment Service (CLAS) of National Research Council Canada renewed the IRSST's certifications in acoustic, electrical, capacity, frequency, and time calibration. These certifications provide our partners and clients with a guarantee of the quality and integrity of the Institute's work. To date, the IRSST's laboratories are still the only labs in Canada to hold acoustic calibration certification.

FRANÇOIS HÉBERT

SCIENCE OUTREACH

FRANÇOIS HÉBERT
COORDINATOR, INSTITUTIONAL RELATIONS AND INTERNATIONAL COORDINATION

Through its leadership in research, the IRSST seeks to earn recognition on the national and international stages. Several means are used to achieve this end. For example, the Institute holds events of national or international scope; forges ties with other scientific organizations; enters into partnership agreements that lead, among other things, to joint research projects; hosts foreign delegations; and authorizes its researchers to sit on standardization committees.
This constitutes one component of the IRSST's vision that involves several divisions and departments. And the year 2012 was no exception to the rule.

The Institute had agreements with some 40 national and international institutions. Nearly half (19) of these were Québec organizations, while the remainder included 11 European institutes, seven Canadian partners, one Japanese research centre, and one American institute.

11 AGREEMENTS WERE EITHER ADDED OR RENEWED DURING THE YEAR:

QUÉBEC

- **PARTNERSHIP CONTRACT** with the Association francophone pour le savoir (Acfas), under which the IRSST sponsors two new Acfas awards in the form of scholarships given to students who have begun work on their master's degree or doctorate, ultimately to ensure a new generation of OHS researchers;
- **RENEWAL** of the master cooperation agreement with NanoQuébec;
- **RATIFICATION**, with NanoQuébec, of a specific agreement to co-fund research projects on exposure to manufactured nanoparticles, specifically with regard to measuring exposure, potential risks, and control measures;

CANADA

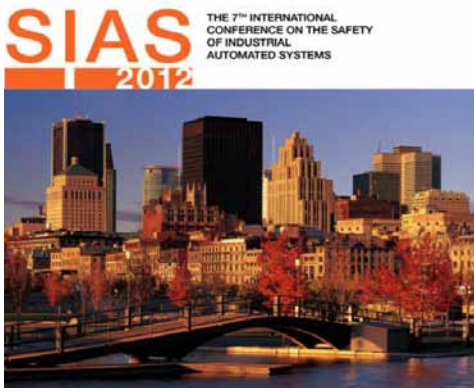
- **AGREEMENT** with the Institute of Gender and Health of the Canadian Institutes of Health Research (IGH-CIHR) in partnership with other organizations, including the IRSST, to jointly fund a research chair on gender, work and health;
- **PROFESSIONAL SERVICES AGREEMENT** with Human Resources and Skills Development Canada (HRSDC) under which the IRSST will provide an industrial hygiene equipment calibration and laboratory analysis service within HRSDC's Labour Program;

EUROPE

- **SPECIFIC AGREEMENT** with the Institut national de recherche et de sécurité pour la prevention des accidents du travail et des maladies professionnelles, France (INRS), regarding a chemical hazard evaluation and information system for a vocational setting (computer application known as **SEIRICH**, for ***s****ystème d'****é****valuation et d'****i****nformation sur le* ***ri****sque* ***ch****imique en milieu professionnel*); this agreement confirms the IRSST's participation in the SEIRICH steering committee;
- **RENEWAL** of the specific agreement with the INRS, France, concerning the monitoring of biometrology documentation;
- **RENEWAL** of the bilateral master cooperation agreement with the Health & Safety Laboratory, United Kingdom (HSL);
- **RENEWAL** of the specific agreement with the HSL, United Kingdom, regarding industrial machine safety, with a focus on the practical experimentation of risk estimation tools and parameters applied to the safety of these machines;
- **MEMORANDUM OF UNDERSTANDING** between the INRS, France, the Institute for Occupational Safety and Health of the German Social Accident Insurance, Germany (IFA), and the IRSST to ensure the holding of the International Conference on Safety of Industrial Automated Systems (SIAS) every two or four years;
- **AGREEMENT** with the Agence nationale de sécurité sanitaire, de l'alimentation, de l'environnement et du travail, France (ANSES), providing for the IRSST's participation in the working group on the evaluation of health risks for professionals exposed to atypical work schedules.

GIVEN THEIR SCOPE, DURATION, OR PRESTIGE, A NUMBER OF EVENTS FURTHER EXTEND THE GLOBAL REACH OF THE IRSST AND ITS PERSONNEL, AS ILLUSTRATED BY THE FOLLOWING EXAMPLES:

A GLOBETROTTING CONFERENCE



The International Conference on the Safety of Industrial Automated Systems (SIAS), launched by the IRSST in 1999, was held once again in Québec, where it first saw the light of day. After being hosted by the Germans (2001), the French (2003), the Americans (2005), the Japanese (2007), and the Finns (2009), the SIAS conference returned to Montréal in 2012. Organized by the IRSST, this 7th edition drew 114 international specialists and experts who wished to take stock of advances in knowledge in the area of machine safety, safety devices, analytical methods, risk assessment, control systems, industrial robot safety, and human/machine interactions. SIAS 2012 offered 25 lectures divided into seven sessions, one plenary session, and 27 poster presentations over a two-day period. The event was so successful that the Germans eagerly volunteered to host the sequel. The 8th edition of the SIAS will be held in Bonn in 2015.

THE SHEFFIELD GROUP

In September, the IRSST was pleased to host the Sheffield Group, which brings together the heads of leading OHS research institutes from around the globe. Fourteen institutes were represented at this year's annual meeting, where organizations exchange ideas and information with the goal of optimizing international cooperation and the coordination of research initiatives, ultimately to achieve more effective prevention of occupational injuries. At the table were the heads of German, American, Belgian, British, Danish, Finnish, French, Israeli, Italian, Dutch, Norwegian, Polish, and Québec institutes. A member of the Sheffield Group since its founding in 1988, the IRSST regards these meetings as an opportunity to forge new partnerships and strengthen existing ones. The IRSST first hosted this important meeting in 1993.

ISSA

During this same visit, the heads of several of the institutes agreed to participate in the International Section for Research on Prevention seminar of ISSA (the International Social Security Association). Organized by the INRS, France, which is responsible for the chairmanship and secretariat of this Section, the event provided a forum for exchanging ideas and information on best practices for identifying needs for advances in prevention knowledge and on the most effective ways of translating these into pertinent research projects. In particular, the Section for Research on Prevention discussed the idea of developing a monitoring and horizon-scanning activity, strengthening teamwork, and implementing reliable indicators to assess the impact of methods and tools in workplaces.

THE PEROSH GROUP

Comprising European institutes only, the PEROSH group (the Partnership for European Research in Occupational Safety and Health) took advantage of the Sheffield Group's meeting to convene in Montréal on the IRSST's premises.

ISO TC 199

The IRSST organized the 16th plenary of the ISO TC 199 Technical Committee on Safety of Machinery. Over a day and a half, some 50 delegates from various countries pondered the results of work done by the various subcommittees on the general principles of machine design and risk assessment, the general requirements for the design and construction of fixed and movable guards, the principles for the design and selection of interlocking guards, pressure-sensitive devices, and fire prevention and protection. The work done by the CEN[1]/TC 114 aimed at revising ISO Guide 78 "Safety of machinery—Rules for drafting and presentation of safety standards" was also taken into account. These meetings, where participants take stock of progress made in the numerous subcommittees' activities, are essential to smooth management of the standardization process.

1. CEN: Comité Européen de Normalisation, or European Committee for Standardization.

GENDER AND SEX IN OHS

FROM LEFT TO RIGHT: VALÉRIE LEDERER, JOHN OLIFFE, KAREN MESSING, PASCALE PRUD'HOMME, MARIE LARUE, PATRICE DUGUAY, ANDRÉ PLAMONDON, MELISSA FRIESEN, PAUL-ÉMILE BOILEAU.

The importance of taking worker gender and sex into account in research was the focal point of the IRSST's institutional colloquium. One hundred twenty-five people responded to the IRSST's invitation to participate in this event, where seven speakers discussed the topic of gender and sex in OHS from the vantage points of their respective disciplines. In addition to statistical profiles, various aspects of the issue were covered, including the importance of incorporating both sex and gender factors into prevention strategies. The speakers spelled out their concerns regarding sex- and gender-based differences in material handling, exposure to contaminants, and the various risk factors related to the rehabilitation and return-to-work process.

AN INVITATION FROM THE ICOH TO THE IRSST

As an emerging problem, exposure to nanoparticles is a topic of concern to both the research and regulatory communities. Already a member of committees of CSA Group and the World Health Organization (WHO), and having appeared as an expert witness before the House of Commons Standing Committee on Health, in 2012, IRSST chemist **CLAUDE OSTIGUY** was invited by the International Commission on Occupational Health (ICOH) to sit on its new Scientific Committee on Nanomaterial Workers' Health. Along with 28 international experts from five continents, he participated in developing a best practices guide for start-up and pilot plants.

The year 2012 saw a first when CSA Group's technical committee on nanotechnologies and OHS, of which Mr. Ostiguy is vice-chair, published its standard CSA Z12885-12 Nanotechnologies – Exposure control program for engineered nanomaterials in occupational settings.

STRONG PRESENCE AT THE ICOH

The IRSST made its presence felt at the 30th Congress of the International Commission on Occupational Health (ICOH) (held under the theme of "Occupational Health for All: from Research to Practice"). The members of the ICOH 2012 International Scientific Committee include **PAUL-ÉMILE BOILEAU**, who was also co-convenor, with **JOSEPH ZAYED**, of a special session on the impact of climate change on occupational health and safety. **FRANCE LABRÈCHE** and **ARIANE ADAM-POUPART** (Université de Montréal) presented the related challenges and research priorities at this session. The ICOH also welcomed **CLAUDE OSTIGUY** as a guest speaker on the current state of knowledge on the management of risks related to nanoparticles in the workplace.

SCIENCE HONOUR ROLL

Every year, the IRSST is proud to salute the outstanding achievements of members of its governing bodies and personnel, as well as external contributors, who have excelled in their work. Their many honours and distinctions help cultivate the brand image and reputation of our organization.

MOST SIGNIFICANT CONTRIBUTION

A chemist at the IRSST since 1982, **DANIEL DROLET** was awarded the prestigious **Edward J. Baier Technical Achievement Award** by the American Industrial Hygiene Association (AIHA), becoming the first Canadian recipient. This award is given to the individual or group that has made the most significant contribution to industrial hygiene in recent years. The AIHA thus recognized him as a scientific innovator in mathematical modelling for industrial hygiene. A volunteer member of the AIHA's **Exposure Assessment Strategies Committee**, he contributed to the development of modelling tools, notably **IHMOD** and **IH SkinPerm**, which allow industrial hygienists to better understand chemical exposure through skin contact.

SCHOLARSHIPS, BURSARIES, AND AWARDS

A doctoral student and trainee at the IRSST, **ALEXANDRA NOËL** earned not one or two but three awards and bursaries in 2012. For the second year in a row, the Environmental Health Research Network honoured her with an RRSE Presentation Bursary for the excellence of her poster presentation on the impact of the dose and agglomeration state of TiO_2 nanoparticles on pulmonary response. The doctoral candidate also received a bursary from the Réseau de recherche en santé et en sécurité du travail du Québec (RRSSTQ) for another presentation on nanoparticles. Lastly, the Society of Toxicology of Canada and Cantox Health Sciences International paid tribute to the scientific rigour and clarity of her presentation by giving her the STC Cantox Student Award for the best poster presentation by a PhD student.

A doctoral student in chemistry at the Department of Environmental and Occupational Health of the Université de Montréal and recipient of a 2012–2013 IRSST scholarship, **FLORENCE JANVIER**, continued to garner scholarships. In 2012, she was the only Canadian among recipients of the AIHF General Scholarship given by the American Industrial Hygiene Foundation. Her top academic marks and solid references earned her this support, which the Foundation offers to students whose academic achievements open doors to a career in industrial hygiene. Florence was also the recipient of an award for excellence given to students in their first year of doctoral studies at Université de Montréal's School of Public Health.

MÉRITAS AWARD FOR ACADEMIC MENTORSHIP

MR³ Montréal Relève saluted the efforts of IRSST laboratory technician **SUZANNE PARADIS** by honouring her with a Méritas award in the Environment and Sustainable Development category for her mentorship role with young people and her contribution to shaping the future generation of scientific workers. In the past ten years, she has organized and supervised internships as part of the Classes Affaires project, which strives to raise awareness among Secondary III and IV students of the importance of staying in school and obtaining a diploma. This award, which she also received in 2010, represents a form of appreciation from young participants for the quality of internships she organized in the IRSST's laboratories.

OUTSTANDING MERIT AWARD

Researchers **ALIREZA PAZOOKI** (Concordia University), **DONGPU CAO** (University of Waterloo), **SUBHASH RAKHEJA** (Concordia University), and **PAUL-ÉMILE BOILEAU** (IRSST) were presented with the Arch T. Colwell Merit Award, which recognizes the authors of articles or documents of outstanding merit that have contributed to advancements in knowledge of mobility engineering. The article entitled *Experimental and Analytical Evaluations of a Torsio-Elastic Suspension for Off-Road Vehicles* derived partly from IRSST work involving the study of the dynamic response analysis of a torsio-elastic suspension system for use in off-road vehicles. This prestigious award was handed out at the 2012 World Congress of SAE International, an association of more than 128,000 engineers, researchers, and technical experts from the aerospace, automotive, and commercial-vehicle industries from 98 countries.

NOTEWORTHY ARTICLES

An article written by **JACQUES LAVOIE** (IRSST), **CHRISTOPHER DUNKERLEY** (McGill University), **TOM KOZATSKY** (Direction de la santé publique de Montréal), and **ANDRÉ DUFRESNE** (Université de Montréal) topped the list of the 20 most frequently cited articles in its field. So we learned from BioMedLib, which operates a specialized search engine for finding scientific articles in the biomedical field and determining whether they have been cited and in which publications. Published six years ago in the journal *Science of the Total Environment*, the article titled "Exposure to aerosolized bacteria and fungi among collectors of commercial, mixed residential, recyclable and compostable waste" was also the most frequently cited article in its field in 2010.

Four years after it was published, an article based on a IRSST-conducted critical literature review that identifies and documents factors contributing to the improvement of MSD prevention practices, still ranks, in 2012, as one of the most frequently cited articles among those published in the journal *Applied Ergonomics*. The article "Intervention Practices in Musculoskeletal Disorder Prevention: A Critical Literature Review" was authored by **DENYS DENIS** (IRSST), **MARIE ST-VINCENT** (IRSST), **DANIEL IMBEAU** (Polytechnique Montréal), **CAROLINE JETTÉ** (Polytechnique Montréal), and **IULIANA NASTASIA** (IRSST).

Again according to BioMedLib's specialized search engine, an article on participatory processes used in Québec to prevent MSDs appears on the list of the 20 most frequently read articles in this field. The article was published in the journal *Word* under the title "Participatory Ergonomic Processes to Reduce Musculoskeletal Disorders: Summary of a Quebec Experience" and was written by **MARIE ST-VINCENT** (IRSST), **MARIE BELLEMARE** (Université Laval), and **GEORGES TOULOUSE** and **CHANTAL TELLIER** of the IRSST.

JEAN-GUY MARTEL

SCIENCE STEWARDSHIP

JEAN-GUY MARTEL
DIRECTOR, RESEARCH AND EXPERTISE DIVISION

On the administrative level, the year was shaped by a restructuring process that led us to regroup the research teams under three new divisions: Chemical and Biological Hazard Prevention, OHS Problem Prevention and Rehabilitation, and Mechanical and Physical Risk Prevention. Among other things, these changes were designed to clarify lines of authority, channel our efforts to allow us to offer more dynamic support to our scientific personnel, and create conditions conducive to expanding our research portfolio.

At the same time, we implemented measures to improve our research management in light of recommendations emanating from the internal audit team. In the fall of 2012, the team concluded that its 2009 proposals had been applied and progress had been made. All the IRSST's research project management steps were found to be improving, except for that concerning results evaluation and the obtention of permission to publish the final report. This progress reflected the impact of a series of measures taken to improve our processes and step up efforts, on the part of both researchers and managers, to change practices which had, all things considered, evolved little since the Institute was first created in 1980. The fact that we hired an additional advisor further facilitated administrative follow-up procedures and bolstered our capacity to manage projects carried out by external researchers.

OVERALL, THE AVERAGE TIME REQUIRED TO MANAGE RESEARCH PROJECTS AND ACTIVITIES (FROM EVALUATION OF PROJECT RELEVANCE AND PRIORITY TO PUBLICATION OF RESULTS) DROPPED FROM 1,004 DAYS IN 2009 TO 841 DAYS IN 2012, SIGNALLING A 16% IMPROVEMENT.

The management process is now more efficient during each of the three steps leading to approval of research projects and activities: recommendations regarding relevance and priority, evaluation of research protocol, and approval per se.

PROJECT ON THE RESEARCH ACTIVITY MANAGEMENT MODEL

Other actions were also undertaken, the main one being a project on research activity management. This process, aimed at ensuring that projects are designed, planned, and carried out with maximum efficiency, foresight, and impact, centred on the following:

1. Implementation of a follow-up system called *passage de portes* (passing progress milestones), which comprised reviewing achievements, identifying challenges, planning subsequent steps, and making necessary adjustments, right from project emergence through to filing of deliverables;
2. Establishing a scorecard designed to foster more efficient follow-up of the progress of the entire project portfolio;
3. Evaluation of the impacts of the project management process in terms of quality of activities, time, and resources required.

After offering researchers training and conducting a handful of conclusive pilot projects, the Institute applied the new model to all internal activities and to joint activities involving both internal and external researchers. In 2012, 23 projects passed one or another of the 27 progress milestones, depending on the advancement of the work. Participant feedback was positive. Most participants regarded the new practice as an added value compared to traditional project management, a fact that augurs well for the future.

LISE TOUPIN

HUMAN RESOURCES IN SCIENCE

LISE TOUPIN
DIRECTOR, FINANCE AND ADMINISTRATION DIVISION

One of every two managers at the IRSST and four of every ten researchers (38%) turned 55 years of age or older in 2012, while an ever-growing number of its employees had accumulated nearly 30 years of service. It therefore comes as no surprise that the issue of workforce renewal is a pressing one. While the Institute succeeds year after year in filling routine positions for technical, professional, and office staff, and foresees no particular problem in this regard, it is quite another matter when it comes to research positions. Recruitment problems are recurrent, particularly for certain researcher positions in the Mechanical and Physical Risk Prevention and Chemical and Biological Hazard Prevention fields. This situation was in fact deemed sufficiently critical that in the summer of 2009, a special committee was struck under the Scientific Advisory Board to address the succession issue. It became abundantly clear that the usual recruitment methods, while they had to be maintained, would be insufficient to meet all the anticipated needs. It was proposed that staffing programs be established in fields where the external supply of new researchers was scarce or nonexistent. Since 2010, thanks to a budget earmarked for human resource development, the Institute has therefore released from their routine tasks a number of employees with manifest aptitudes for graduate studies in certain target sectors and hopes of pursuing a research career. This approach has already begun to bear fruit, and the Institute intends to continue along this path. Under these programs, four candidates who recently registered in doctoral programs will be completing their studies over the next five years in the fields of machine safety, chemistry, and industrial toxicology.

ON DECEMBER 31, 2012, THE IRSST HAD A WORKFORCE OF 142 EMPLOYEES, INCLUDING 117 RESEARCHERS, PROFESSIONALS, AND TECHNICIANS.

During the year, three new regular employees and 11 temporary employees were added to its human capital. The Institute also opened its doors to 14 trainees, students, and scholarship recipients, and hosted one professor on sabbatical.

The lease on the premises occupied by the IRSST was renewed for 20 years, with plans to add more space to meet the needs of future research and of the Institute's laboratories.

STAFF HEALTH AND SAFETY

Not only does the IRSST help prevent occupational injuries among Québec workers through research, but it also invests energy in promoting and safeguarding its own staff's health and safety. In 2012, its health and safety committee (HSC) stepped up its actions to ensure that everything possible was done to prevent work-related accidents and occupational diseases. As such, its respiratory protection program was renewed to allow employees and trainees exposed to certain contaminants to protect themselves properly when their tasks so require. Respirator fit tests were performed on all employees concerned. The latter were also given appropriate training on how to adjust, maintain, and use protective masks.

With regard to machine safety in the IRSST's laboratories, the HSC saw fit to develop a lockout program. After appointing staff members to implement the program, the Committee oversaw the development of lockout forms for the mechanical workshops, as well as the purchase and installation of lockout equipment. In addition, a number of procedures were updated. The staff was informed to this effect and the procedures can now be consulted easily via the IRSST's intranet.

During workplace health and safety week, the annual "Mont-Royal walk" activity was repeated, with 49 IRSST employees participating. The activity promotes the benefits of physical exercise for employee health.

In 2012, the HSC reported 11 entries in its incident, first-aid and accident register. Three events required an accident investigation and two ergonomic studies.

SCIENCE AND SUSTAINABLE DEVELOPMENT

After carrying out a first sustainable development action plan, which called upon the Institute's entire staff to contribute, in 2012, the IRSST decided to draw up a second action plan for the 2013–2017 period. To set the tone and underscore its adherence to the sustainable development philosophy, the Institute was inspired to adopt a new name for one of its research fields: **SUSTAINABLE PREVENTION** and Work Environment.

The activities detailed in the second action plan continue to focus on three main orientations:

1. Informing, raising awareness, educating, and innovating;
2. Reducing and managing risks to improve health, safety, and the environment;
3. Producing and consuming responsibly.

The Institute sees its mission as meshing perfectly with the sustainable development philosophy because it is based on the principle of eliminating risks and hazards for workers directly at the source, ensuring access to knowledge, and disseminating knowledge on health, safety, and well-being in the workplace. Over and above the research projects and activities it conducted in pursuit of these objectives, in 2012, the IRSST promoted sustainable development in numerous ways: by revising its goods and services procurement policy, offering online versions of documents as an alternative solution to print versions, and writing five columns in the in-house newsletter to encourage sustainable development and environmentally responsible behaviour.

SCIENCE GOVERNANCE

On behalf of the IRSST and its personnel, the president and CEO welcomes the new members of the board and committees and offers her sincerest thanks to outgoing members for jobs well done.

BOARD OF DIRECTORS

The Board of Directors determines the Institute's orientation, development framework, and financing. As a labour/management body, it is composed of the chair, seven representatives of employer associations, and seven worker representatives.

The members of the Board of Directors held seven meetings, while those of the Executive Committee met eight times.

CHAIR
Michel Després*

EMPLOYER REPRESENTATIVES
Françoise Bertrand
Yves-Thomas Dorval*
France Dupéré
Martine Hébert
Patricia Jean
Carmel Laflamme
Simon Prévost

WORKER REPRESENTATIVES
Michel Arsenault*
Andrée Bouchard
Claude Faucher
Jean Lacharité
Lucie Levasseur
Yves Ouellet
Daniel Roy

OBSERVER
Suzanne Thérien

IRSST REPRESENTATIVE
Marie Larue

* Members of the Executive Committee

SCIENTIFIC ADVISORY BOARD

A tri-partite advisory body for the president and CEO, the Scientific Advisory Board judges the relevance, priority, and scientific merit of internal and external research programs and projects. This board comprises the Institute's president and CEO, six members of the scientific and technical communities, four worker representatives, and four employer representatives.

In 2012, the Scientific Advisory Board met nine times, including once at a special meeting where the Board of Directors participated.

CHAIR
Marie Larue

EMPLOYER REPRESENTATIVES
Lionel Bernier
Germain Gaudreault
Dominique Malo
Marc La Barre
Marie-France Turcotte

WORKER REPRESENTATIVES
Micheline Boucher
Jean Dussault
Daniel Flynn
Denis Mailloux

MEMBERS OF THE SCIENTIFIC AND TECHNICAL COMMUNITIES
Christine Colin
Pierre Galarneau
Camille Limoges
Alain Rondeau
Yves Rousseau
Céline Saint-Pierre

OBSERVER
Claude Sicard

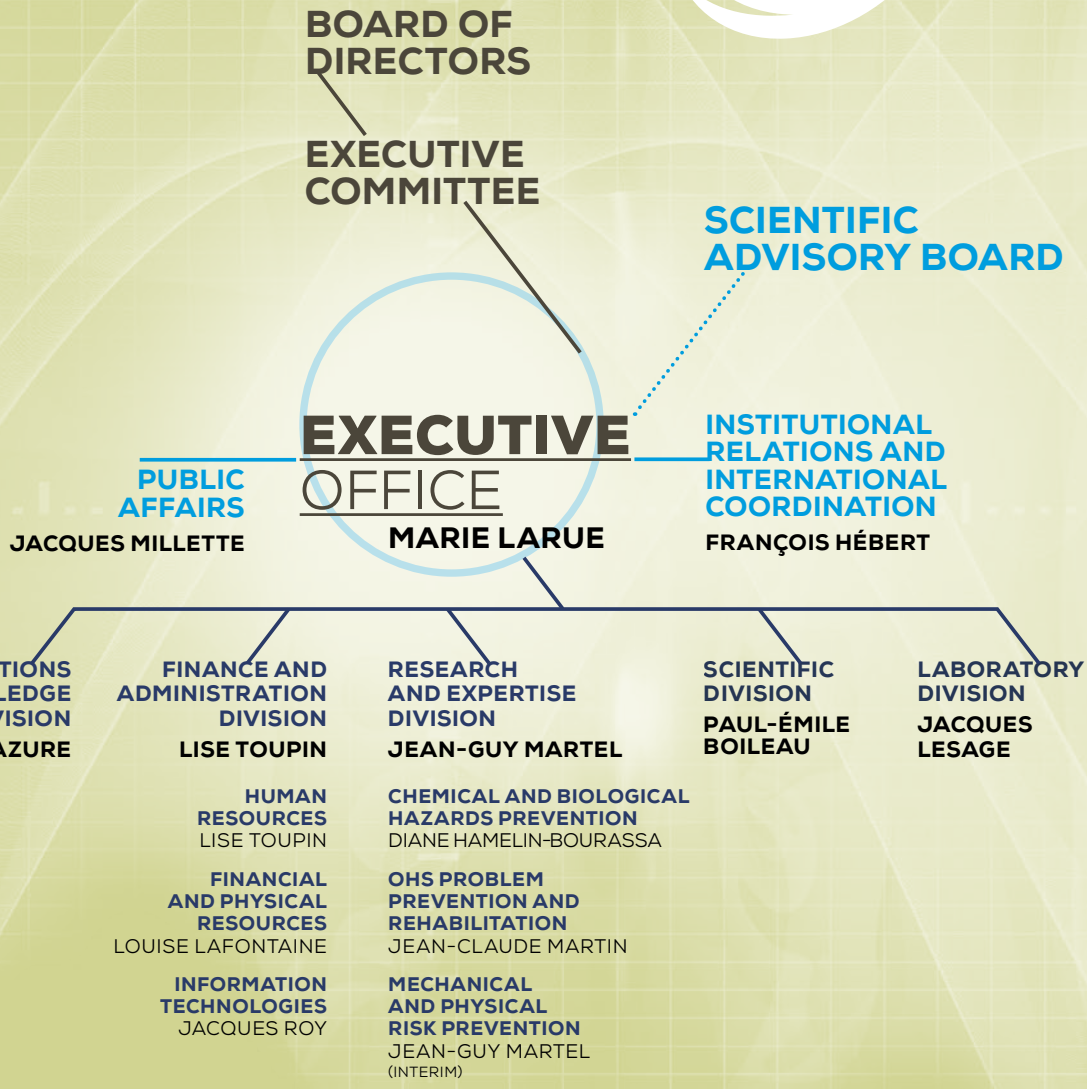
APPOINTMENTS
Germain Gaudreault
Marc La Barre
Marie-France Turcotte

RENEWALS
Pierre Galarneau
Yves Rousseau

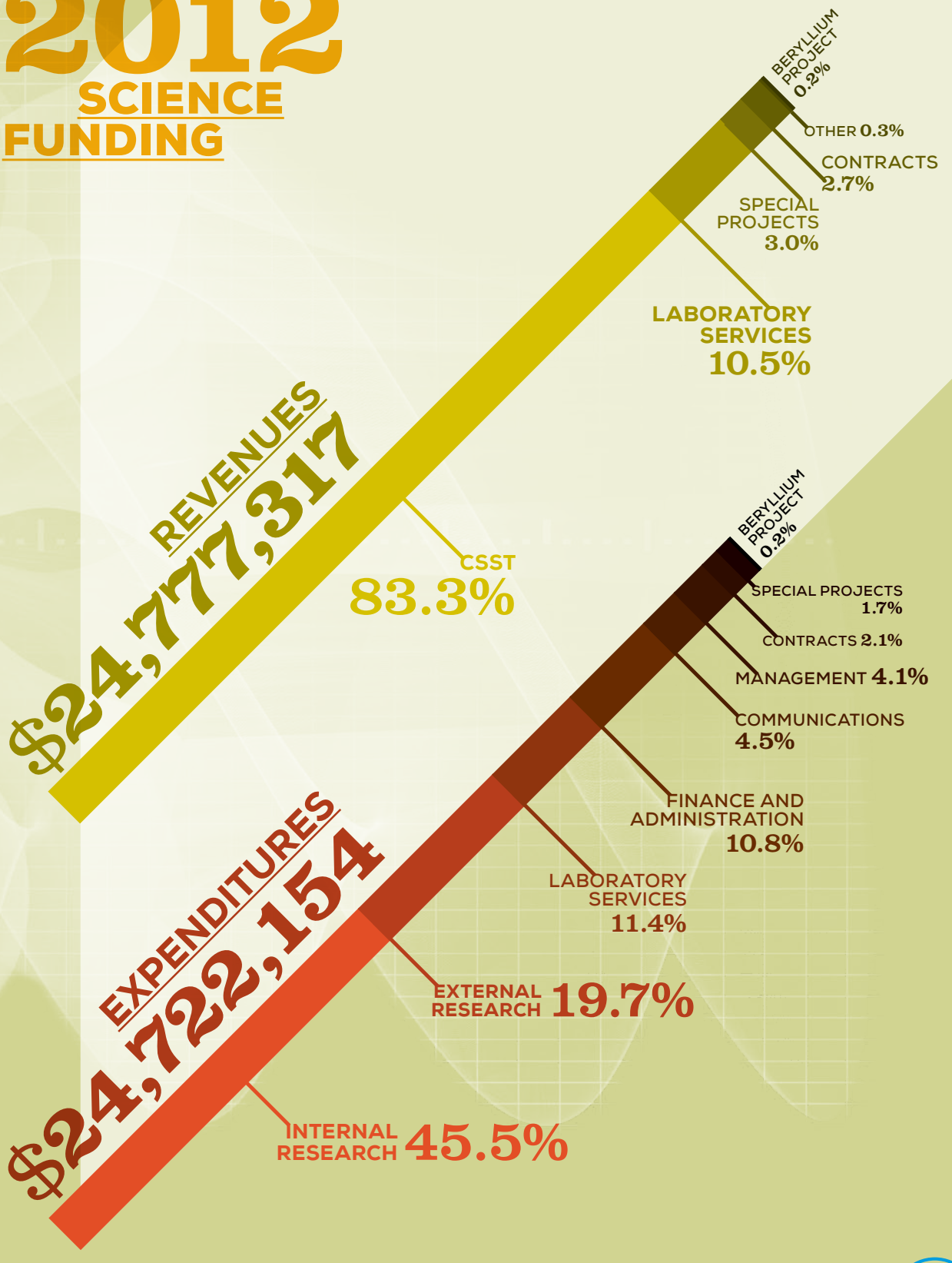
DEPARTURES
Marc La Barre
Céline Saint-Pierre

ORGANIZATIONAL CHART

(AS AT DECEMBER 31, 2012)



2012 SCIENCE FUNDING



SCIENTIFIC PUBLICATIONS

SCIENTIFIC PUBLICATIONS

1. **ABDEL RAHMAN A.M., GAGNÉ S., HELLEUR R. J.** *Simultaneous determination of two snow crab aeroallergens in processing plants using isotopic dilution tandem mass spectrometry*. Analytical and Bioanalytical Chemistry, vol. 403, nº 3, 2012, p. 821-831.

2. **ADEWUSI S. A., RAKHEJA S., MARCOTTE P.** *Biomechanical models of the human hand-arm to simulate distributed biodynamic responses for different postures*. International Journal of Industrial Ergonomics, vol. 42, nº 2, 2012, p. 249-260.

3. **AIBAHNASSI H., HAMMAD A.** *Near real-time motion planning and simulation of cranes in construction: framework and system architecture*. Journal of Computing in Civil Engineering, vol. 25, nº 1, 2012, p. 54-63.

4. **ARJMAND N., PLAMONDON A., SHIRAZI-ADL A., PARNIANPOUR A., LARIVIÈRE C.** *Predictive equations for lumbar spine loads in load-dependent asymmetric one- and two-handed lifting activities*. Clinical Biomechanics, vol. 27, nº 6, 2012, p. 537-544.

5. **BAHLOUL A., CHAVEZ M., REGGIO M., ROBERGE B., GOYER N.** *Modeling ventilation time in forage tower silos*. Journal of Agricultural Safety and Health, vol. 18, nº 4, 2012, p. 259-272.

6. **BLAIS LECOURS P., VEILLETTE M., MARSOLAIS D., DUCHAINE C.** *Characterization of bioaerosols from dairy barns: reconstructing the puzzle of occupational respiratory diseases using molecular approaches*. Applied and Environmental Microbiology, vol. 78, nº 9, 2012, p. 3242-3248.

7. **CHAVEZ M., HAJRA B., STATHOPOULOS T., BAHLOUL A.** *Assessment of near-field pollutant dispersion: effect of upstream buildings*. Journal of Wind Engineering and Industrial Aerodynamics, vol. 104-106, 2012, p. 509-515.

8. **CLOUTIER E., LEDOUX É., FOURNIER P.-S.** *Knowledge transmission in light of recent transformations in the workplace*. Relations industrielles/Industrial Relations, vol. 67, nº 2, 2012, p. 304-324.

9. **DEBIA M., WEICHENTHAL S., TARDIF R., DUFRESNE A.** *Ultrafine particle (UFP) exposures in an aluminium smelter: Soderberg vs. Prebake Potrooms*. Environment and Pollution, vol. 1, nº 1, 2012, p. 2-11.

10. **DURAND M. J., BERTHELETTE D., LOISEL P., IMBEAU D.** *Étude de la fidélité de l'implantation d'un programme de réadaptation au travail auprès de travailleurs de la construction ayant une dorsolombalgie*. Pistes (Perspectives interdisciplinaires sur le travail et la santé), vol. 14, nº 1, 2012, 14 p.

11. **DURAND M. J., BERTHELETTE D., LOISEL P., IMBEAU D.** *Validation of the program impact theory of a work rehabilitation program*. Work: A Journal of Prevention, Assessment and Rehabilitation, vol. 42, nº 4, 2012, p. 495-505.

12. **GAGNÉ S.** *A reliable method by ultra-performance liquid chromatography coupled with tandem mass spectrometry to quantify and confirm simultaneously the presence of solvent metabolites in workers' urine*. Rapid Communication in Mass Spectrometry, vol. 26, nº 7, 2012, p. 845-852.

13. **GAUTHIER F., LAMBERT S., CHINNIAH Y.** *Experimental analysis of 31 risk estimation tools applied to safety of machinery*. International Journal of Occupational Safety and Ergonomics, vol. 18, nº 2, 2012, p. 245-265.

14. **GÉLINAS C., FILLION L., ROBITAILLE M.-A., TRUCHON M.** *Stressors experienced by critical care nurses when providing end-of-life palliative care in the intensive care unit*. Canadian Journal of Nursing Research, vol. 44, nº 1, 2012, p. 18-39.

15. **GRAVEL S., RHÉAUME J., LEGENDRE G.** *Les inégalités sociales des travailleurs immigrants au Québec victimes de lésions professionnelles*. Revue européenne des migrations internationales, vol. 28, nº 2, 2012, p. 57-80.

16. **MANDAPURAM S., RAKHEJA S., BOILEAU P.-É., MAEDA S.** *Apparent mass and head vibration transmission responses of seated body to three translational axis vibration*. International Journal of Industrial Ergonomics, vol. 42, nº 3, 2012, p. 268-277.

17. **MARTIN J.-S., HÉBERT M., LEDOUX É., GAUDREAULT M., LABERGE L.** *Relationship of chronotype to sleep, light exposure, and work-related fatigue in student workers*. Chronobiology International, vol. 29, nº 3, 2012, p. 295-304.

18. **MARTIN J., BEAUPARLANT M., LESAGE J., VAN TRA H.** *Development of a quantification method for quartz in various bulk materials by x-ray diffraction and the Rietveld method*. Powder Diffraction Journal, vol. 27, nº 1, 2012, p. 12-19.

19. **MOSTOFI R., NOËL A., HAGHIGHAT F., BAHLOUL A., LARA J., CLOUTIER Y.** *Impact of two particle measurement techniques on the determination of N95 class respirator filtration performance against ultrafine particles*. Journal of Hazardous Materials, vol. 217-218, 2012, p. 51-57.

20. **NOËL A., MAGHNI K., CLOUTIER Y., DION C., WILKINSON K. J., TARDIF R., TRUCHON G.** *Effects of inhaled nano-TiO_2 aerosols showing two distinct agglomeration states on rat lung*. Toxicology Letters, vol. 214, nº 2, 2012, p. 109-119.

21. **OHL X., BILLUART F., LAGACÉ P. Y., GAGEY O., HAGEMEISTER N., SKALLI W.** *3D morphometric analysis of 43 scapulae*. Surgical and Radiologic Anatomy, vol. 34, nº 5, 2012, p. 447-453.

22. **PLAMONDON A., LARIVIÈRE C., DELISLE A., DENIS D., GAGNON D.** *Relative importance of expertise, lifting height and weight lifted on posture and lumbar external loading during a transfer task in manual material handling*. Ergonomics, vol. 55, nº 1, 2012, p. 87-102.

23. **RIEDIKER M., OSTIGUY C., TRIOLET J., TROISFONTAINES P., VERNEZ D., BOURDEL G., THIERIET N., CADÈNE, A.** *Development of a control banding tool for nanomaterials*. Journal of Nanomaterials, vol. 2013, nº 879671, 2012, 8p.

24. **SAUVÉ J. F., BEAUDRY C., BÉGIN D., DION C., GÉRIN M., LAVOUÉ J.** *Statistical modeling of crystalline silica exposure by trade in the construction industry using a database compiled from the literature*. Journal of Environmental Monitoring, vol. 14, nº 9, 2012, p. 2512-2520.

25. **TRIKI E., NGUYEN-TRI P., BOUKEHILI H., VU-KHANH T.** *Investigation of tearing mechanisms of woven textile*. Polymer Composites, vol. 33, nº 9, 2012, p. 1578-1585.

26. **TRIKI E., ARRIETA C., BOUKEHILI H., VU-KHANH T.** *Tear behavior of polyester-based coated textiles after thermo-oxidative aging*. Polymer Composites, vol. 33, nº 6, 2012, p. 1007-1017.

27. **TRUCHON M., SCHMOUTH M. É., CÔTÉ D., FILLION L., ROSSIGNOL M., DURAND M. J.** *Absenteeism screening questionnaire (ASQ): a new tool for predicting long-term absenteeism among workers with low back pain*. Journal of Occupational Rehabilitation, vol. 22, nº 1, 2012, p. 27-50.

PEER-REVIEWED ARTICLES PUBLISHED IN CONFERENCE PROCEEDINGS

1. **ADAM-POUPART A., SMARGIASSI A., LABRÈCHE F., DUGUAY P., BUSQUE M.-A., ZAYED J.** *Climate change and workers' health and safety: research prioritization*. In 30th International Congress on Occupational Health / ICOH 2012 (30th: March 18-23, 2012: Cancun, Mexico), 2012.

2. **ARJMAND N., SHIRAZI-ADL A., PLAMONDON A., PARNIANPOUR M., LARIVIÈRE C.** *Regression models for spinal loads in lifting using a complex finite element model*. In 18th Congress of the European Society of Biomechanics / ESB 2012 (18th: July 1-4, 2012: Lisbon, Portugal), 2012.

3. **ARJMAND N., PLAMONDON A., SHIRAZI-ADL A., LARIVIÈRE C., PARNIANPOUR M.** *Regression equations for spinal loads in asymetric lifting tasks using a finite element biomechanical model (Poster)*. In 58th Annual Orthopaedic Research Society Meeting (58th: February, 4-7, 2012: San Francisco, USA), 2012.

4. **ARRIETA C., VU-KHANH T.** *Durability and performance of protective clothing after multi-stress aging*. In 5th European Conference on Protective Clothing (ECPC) and Nokobetef 10 (5th: May 29-31, 2012: Valencia, Spain), 2012.

5. **AUCLAIR J., GAUDREAULT M.** *Le travail rémunéré chez les adolescents québécois : un portrait de situation*. In 17e Congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012 (17e: 10-13 juillet, 2012: Lyon, France), 2012, p. 69.

6. **BAHLOUL A., CHAVEZ M., REGGIO M., ROBERGE B., GOYER N.** *Ventilation des silos tours à fourrage*. In Xe Conférence internationale sur la ventilation industrielle / Ventilation 2012 (10e: 17-19 septembre, 2012: Paris, France), 2012.

7. **BAYART M., VALLERY G., LEDOUX É., OUELLET S.** *Troubles musculo-squelettiques dans le secteur minier. Demande d'expertise au poste de mineur d'entretiens dans une entreprise minière (Affiche)*. In 17e Congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012 (17e: 10-13 juillet, 2012: Lyon, France), 2012.

8. **BLAIS LECOURS P., VEILLETTE M., MARSOLAIS D., DUCHAINE C.** *Characterization of bioaerosols from dairy barns: reconstructing the puzzle of occupational respiratory diseases using molecular approaches*. In 11th Conference of the Canadian Rural Health Research Society (11th: October 25-27, 2012: Lévis, Canada), 2012.

9. **BRUMMUND M., SGARD F., PETIT Y., LAVILLE F.** *On the influence of the material properties of the external ear on occlusion effect simulations*. In Acoustics Week in Canada 2012 (10-12 octobre, 2012: Banff, Canada), 2012.

10. **BURLET-VIENNEY D., CHINNIAH Y.** *Development of knowledge about the practice and the specificities of lockout in the municipalities in Quebec*. In 7th International Conference on the Safety of Industrial Automated Systems / SIAS 2012 (7th: October 11-12, 2012: Montreal, Canada), 2012.

11. **CATTIN C., DEBIA M., DUFRESNE A., HUBERT P.** *Workplace safety in polymer nanocomposite research*. In Materials Research Society (MRS) Proceedings, vol. 1413, 2012, DOI: http://dx.doi.org/10.1557/opl.2012.197.

12. **CHAVEZ M., STATHOPOULOS T., BAHLOUL A.** *CFD modelling of flow and dispersion in the built environment: different RANS models and a first attempt to use URANS*. In Seventh International Colloquium on Bluff Body Aerodynamics and Applications / BBAA VII (7th: September 2-6, 2012: Shanghai, China), 2012.

13. **CORBIÈRE M., NEGRINI A., ST-ARNAUD L., DURAND M.J., COUTU M.F., LECOMTE T., CHARBONNEAU C., LEMIEUX P., BEAUDRY M.** *Les facteurs influençant l'embauche de personnes ayant une dépression, selon le point de vue des directeurs de ressources humaines*. In XVIe Colloque de l'Association québécoise pour la réadaptation psychosociale / AQRP (16e: 31 octobre–2 novembre, 2012: Québec, Canada), 2012.

14. **CORBIÈRE M., NEGRINI A., ST-ARNAUD L., DURAND M.J., COUTU M.F., LECOMTE T., CHARBONNEAU C., LEMIEUX P., BEAUDRY M.** *Les facteurs influençant le retour au travail d'un employé ayant une dépression : résultats d'entrevues conduites auprès de directeurs de ressources humaines*. In 17e Congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012 (17e: 10-13 juillet, 2012: Lyon, France), 2012.

15. **CÔTÉ J., LEMAY F., VYSKOCIL A., VIAU C.** *A computer tool for the assessment of potential combined acute effects of chemicals in mixtures*. In Canadian Association for Research on Work and Health (CARWH) 2012 Conference (1-2 juin, 2012: Vancouver, Canada), 2012.

16. **CÔTÉ D.** *Regional variations in sickness absence in Québec: an exploration of compensation and rehabilitation duration and costs, and a cross-sectorial comparative overview (Poster)*. In Canadian Association for Research on Work and Health (CARWH) 2012 Conference (1-2 juin, 2012: Vancouver, Canada), 2012.

17. **COUTU M.-F., DURAND M. J., CORBIÈRE M., LOISEL P., NASTASIA I., LABRECQUE M. E.** *Étude des facteurs déterminants de l'incapacité au travail dans une Agence gouvernementale du Québec*. In 34e Congrès annuel de la Société québécoise pour la recherche en psychologie / SQRP (34e: 23-25 mars, 2012: Sherbrooke, Canada), 2012.

18. **DESSUREAULT P.** *Managing exposure to very hot environments*. In 4th International Conference on Environment Health and Safety Aspects Related to the Production of Aluminium / EHSARPA 2012 (4th: September 24-27, 2012: Montréal, Canada), 2012.

19. **DEWANGAN K. N., SHAHMIR A., RAKHEJA S., MARCOTTE P.** *Gender effect on the seated body apparent mass response to vertical whole body vibration*. In Proceedings of the 4th American Conference on Human Vibration (4th: June 13-15, 2012: Hartford, USA), 2012, p. 10-11.

20. **DEWANGAN K. N., SHAHMIR A., RAKHEJA S., MARCOTTE P.** *Measurement of vertical apparent mass responses of human subjects seated on elastic seats*. In Proceedings of the 4th American Conference on Human Vibration (4th: June 13-15, 2012: Hartford, USA), 2012, p. 8-9.

21. **DROLET D.** *Potpourri of computer tools to help occupational hygienists, keynote conference*. In Australian Institute of Occupational Hygienists 30th Annual Conference and Exhibition / AIOH 2012 (30th: December 1-5, 2012: Adelaide, South Australia), 2012.

22. **DROLET D., LARA J., HADDAD S.** *Respiratory protection and multi-exposure: integrating toxicological notions in the calculation of the lifespan of activated carbon cartridges*. In INRS Occupational Health Research Conference 2012 (April 2-4, 2012: Nancy, France), 2012.

23. **DUGUAY P., BOUCHER A., BUSQUE M.-A., PRUD'HOMME P.** *Utilité et limites des données de la CSST pour la surveillance statistique*. In Journées annuelles de santé publique / JASP (16e: 26 novembre, 2012: Montréal, Canada), 2012, (http://jasp.inspq.qc.ca/Data/Sites/1/SharedFiles/presentations/2012/jasp2012_26nov_surveillancesantetravail_pduguay.pdf).

24. **DURAND M. J., CORBIÈRE M., BRIAND C., COUTU M. F., ST-ARNAUD L., HONG Q. N.** *Assessing factors influencing long-term work absence attribuable to common mental disorders: development of a new tool*. In Second Scientific Conference on Work Disability Prevention and Integration / WDPI 2012 (2nd: October 22-24, 2012: Groningen, The Netherlands), 2012.

25. **DURAND M. J., VÉZINA N., LOISEL P., RICHARD M. R.** *A new guide to help clinicians plan a progressive return to work for workers absent due to musculoskeletal disorders (Poster)*. In 30th International Congress on Occupational Health / ICOH 2012, (30th: March 18-23, 2012: Cancun, Mexico), 2012.

26. **EMOND C., OSTIGUY C., DOSSA I., MALKI Y., BOILY C., ROUGHLEY D., PAVSKI A., ENDO C.A.** *Mapping the use of nanoparticles in Quebec's industries and research laboratories (Poster)*. Third International Conference on Safe Production and Use of Nanomaterials / Nanosafe 2012 (3rd: 13-15 November, 2012: Grenoble, France), 2012.

27. **FATISSON J., HALLÉ S., NADEAU S.** *Vers une gestion adaptative des risques de l'invisible... (Affiche)* In Conférence NanoQuébec 2012 (20-21 mars, 2012: Montréal, Canada), 2012.

28. **FATISSON J., HALLÉ S., NADEAU S., ATEME-NGUEMA B., VIAU C., CAMUS M., CLOUTIER Y.** *Towards an integrated and adaptive risk assessment tool for engineered nanoparticles*. In Proceedings of the 3rd International Conference on Nanotechnology: Fundamentals and Applications / ICNFA 2012 (3rd: August 7-9, 2012: Montréal, Canada), 2012.

29. **FIALA Z., KRAJAK V., KREMLACEK J., BEDNARCIK P., BORSKA L., FIALA O., VYSKOCIL A., LEMAY F., BORSKY T.** *Biological interactions in mixtures of chemical substances*. In 48th Congress of the European Societies of Toxicology / Eurotox 2012 (48th: June 17-20, 2012: Stockholm, Sweden), Toxicology Letters, vol. 211, 2012, p. S158-S159.

30. **GAGNÉ C., TOULOUSE G.** *Development of a sector-based strategy for supporting the transmission of the knowledge and skills involved in the work activities of 911 emergency telecommunication centre agents*. In 13th European Conference on Knowledge Management / ECKM 2012 (13th: September 6-7, 2012: Cartagena, Spain), 2012.

31. **GAUDREAULT M., AUCLAIR J.** *Occuper un emploi : quelles conséquences scolaires pour les étudiants québécois ?* In 17e Congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012 (17e: 10-13 juillet, 2012: Lyon, France), 2012, p. 69.

32. **GAUVIN C., LARA J.** *Dexterity and comfort evaluation of needle puncture resistant gloves*. In 5th European Conference on Protective Clothing (ECPC) and Nokobetef 10 (5th: May 29-31, 2012: Valencia, Spain), 2012.

33. **GIRAUD L., JOCELYN S.** *Design of fault-tree-based software to improve the safety of printing press operators*. In 7th International Conference on the Safety of Industrial Automated Systems / SIAS 2012 (7th: October 11-12, 2012: Montreal, Canada), 2012.

34. **GONELLA M., ST-VINCENT M., DENIS D., IMBEAU D., FARBOS B.** *Mettre en place la rotation dans un contexte de cycles longs : une démarche d'intégration novatrice*. In Congrès de l'Association canadienne de Recherche en Santé au Travail / ACRST 2012 (1-2 juin, 2012: Vancouver, Canada), 2012.

35. **GONÇALVES D., ARNEDO E. C., BABIN K., GIRARD D.** *Evaluating the in vitro an in vivo pro-inflammatory potential of polyhydroxylated C60 fullerene (fullerenol)*. In International Symposium The Neutrophil in Immunity 2012, (June 9-12, 2012: Québec, Canada), 2012.

36. **HEGG-DELOYE S., BRASSARD P., JAUVIN N., LAROUCHE D., PRAIRIE J., SIMONEAU M., TEASDALE N., POIRIER P., TREMBLAY A., CORBEIL P.** *Modulation parasympathique cardiaque en récupération d'un quart de travail chez les paramedics: impact du travail de jour et de nuit*. In 20e Réunion scientifique annuelle de la Société québécoise d'hypertension artérielle / SQHA (20e: 18-20 janvier, 2012: Québec), 2012.

37. **HERETER J. G., BILLUART F., BUREAU N., HAGEMEISTER N.** *A ratio of stabilizing-elevating forces of the deltoid*. In 18th Congress of the European Society of Biomechanics / ESB 2012 (18th: July 1-4, 2012: Lisbon, Portugal), 2012.

38. **JOCELYN S., BAUDOIN J., CHINNIAH Y., CHARPENTIER P.** *An a posteriori estimation of the performance level for a safety function using NF EN ISO 13849-1:2008*. In 7th International Conference on the Safety of Industrial Automated Systems / SIAS 2012 (7th: October 11-12, 2012: Montreal, Canada), 2012.

39. **LABERGE L., GAUDREAULT M., AUCLAIR J., ARBOUR N., LEDOUX É.** *Correlates of acute work-related fatigue in students aged 19-21 years who have jobs during the school year*. In Associated Professional Sleep Societies 26th Annual Meeting / SLEEP 2012 (26th: June 9-13, 2012: Boston, U.S.A.). Sleep, vol. 35, 2012, p. A444.

40. **LABERGE L.** *Les effets du cumul d'activités et de contraintes de travail sur la fatigue aiguë et chronique chez des étudiants qui occupent un emploi durant l'année scolaire*. In 17e Congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012 (17e: 10-13 juillet 2012: Lyon, France), 2012.

41. **LABERGE L., GAUDREAULT M., LEDOUX É.** *Factors associated with chronic work-related fatigue in students aged 19-21 years who work during the school year*. In Sleep Health & Safety 2012 (March 2-3, 2012: Washington, USA), 2012, p. 10.

42. **LABRÈCHE F., SMARGIASSI A., ADAM-POUPART A., DUGUAY P., BUSQUE M.-A., ZAYED J.** *Issues related to climate change impacts in the workplace*. In 30th International Congress on Occupational Health / ICOH 2012 (30th: March 18-23, 2012: Cancun, Mexico), 2012.

43. **LACOURT A., LAVOUÉ J., LABRÈCHE F., SIEMIATYCKI J.** *Gender differences in occupational exposures assessed by experts in a community based-case control study of lung cancer*. In 7th International Conference on the Science of Exposure Assessment / X2012, (7th: July 2-5, 2012: Edinburgh, Scotland), 2012.

44. **LAGACÉ P. Y., CRESSON T., HAGEMEISTER N., BILLUART F., OHL X., DE GUISE J., SKALLI W.** *3D reconstruction of the scapula from biplanar radiographs*. In SPIE Medical Imaging (February 4-9, 2012: San Diego, USA), 2012.

45. **LARIVIÈRE C., MECHERI H., GAGNON D.** *Criterion validity and between-day reliability of an inertial sensor-based trunk postural stability test during unstable sitting*. In Proceedings of the XIXth Congress of the International Society of Electrophysiology & Kinesiology / ISEK 2012 (19th: July 19- 21, 2012: Brisbane, Australia), 2012.

46. **LAROCHE C., NÉLISSE H., GIGUÈRE C., VAILLANCOURT V., BOUTIN J., LAFERRIÈRE P.** *Safety behind heavy vehicles: comparisons of propagation and perception of two types of reverse alarms*. In Proceedings of the XXIVth Annual International Occupational Ergonomics and Safety Conference (24th: June 7-8, 2012: Fort Lauderdale, USA), 2012.

47. **LARUE C., PLAMONDON A., DESJARDINS P., SALAZAR E., MECHERI H., SIRARD C.** *Improving inertial sensor measurement of the relative orientation between trunk and pelvis using a potentiometer*. In XIIth International Symposium on 3D Analysis of Human Movement / 3DHMA (12th: July 18-20, 2012: Bologna, Italy), 2012.

48. **LEBEAU M., DUGUAY P., BOUCHER A.** *The costs of occupational injuries and diseases in Quebec, 2005-2007*. In International Symposium on the Challenges of Workplace Injury Prevention through Financial Incentives (November 29-30, 2012: Toronto, Canada), Institute for Work & Health / IWH, 2012 (http://www.iwh.on.ca/prevention-incentives-2012/proceedings/lebeau).

49. **MAHDAVI A., BAHLOUL A., OSTIGUY C., HAGHIGHAT F.** *Effectiveness of N95 filters for capturing nano-particles under cyclic and constant flow (Poster)*. In Conférence NanoQuébec 2012 (20-21 mars, 2012: Montréal, Canada), 2012.

50. **MARANDA M.-F., HÉON L., DESLAURIERS J.-S., VIVIERS S.** *Psychodynamics of work in schools*. In 8th International Conference on Education / ICE (8th: July 5-7, 2012: Samos, Greece), 2012.

51. **MARANDA M.-F., VIVIERS S.** *L'école en souffrance : psychodynamique du travail du personnel scolaire et pistes d'action de prévention des problèmes de santé mentale au travail*. In Colloque international de psychosociologie du travail élaborations actuelles en recherche et intervention (12-14 avril 2012: Belo Horizonte, Brésil), 2012.

52. **MARCOTTE P., OUELLETTE S., BOUTIN J., LEBLANC G.** *Exposure to whole-body vibration in Quebec underground mines*. In Proceedings of the 4th American Conference on Human Vibration / ACHV 2012 (4th: June 13-15, 2012: Hartford, USA), 2012, p. 35-36.

53. **MARTIN J., BEAUPARLANT M., LESAGE J., VAN TRA H.** *Development of a quantification method for quartz in various bulk materials by x-ray diffraction and the Rietveld method*. In Second ASTM D22- Symposium on Silica and Associated Respirable Mineral Particles (October 25-26, 2012: Atlanta, USA), 2012.

54. **MOATARI A., AGARD B., CHINNIAH Y.** *The application of risk assessment to facilities planning: A synthesis of risk assessment methods and layout design models*. In 7th International Conference on the Safety of Industrial Automated Systems / SIAS 2012 (7th: October 11-12, 2012: Montreal, Canada), 2012.

55. **MOATARI A., AGARD B., CHINNIAH Y.** *A guideline for occupational health and safety considerations in facility planning*. In 4th International Conference on Information Systems, Logistics and Supply Chain / ILS 2012 (4th: August 26-20, 2012: Montréal, Canada), 2012.

56. **NAHAS N., ATEME-NGUEMA B., FATISSON J., NADEAU S., HALLÉ S., VIAU C.** *Integrated and adaptive risk prioritization pilot test for engineered nanoparticles*. In 1re Conférence internationale du Réseau Ne3LS (1-2 novembre, 2012: Montréal, Canada), 2012.

57. **NASTASIA I., TCACIUC R., COUTU M.-F.** *Strategies to prevent prolonged disability in workers compensated for musculoskeletal disorders*. In Second Scientific Conference on Work Disability Prevention and Integration / WDPI 2012 (2nd: October 22-24, 2012: Groningen, The Netherlands), 2012.

58. **NASTASIA I.** *Développement d'un outil ergonomique d'évaluation de la charge de travail mentale*. In 17^{e} Congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012 (17^{e}: 10-13 juillet, 2012: Lyon, France), 2012.

59. **NEESHAM-GRENON E., LAVOIE J., SMITH S., MARCHAND G., CLOUTIER Y., DÉBIA M.** *Control banding method for respirator selection against bioaerosols in Quebec*. In 16th Biennal Conference of the International Society for Respiratory Protection / ISRP (16th: September 23-27, 2012: Boston, USA).

60. **NEGRINI A., CORBIÈRE M., ST-ARNAUD L., DURAND M.J., COUTU M.F., LECOMTE T., CHARBONNEAU C., LEMIEUX P., BEAUDRY M.** *The key role of the immediate superior in the return to work of employees with depression*. In 11th Congress of World Association for Psychosocial Rehabilitation / WAPR (11th: 10-13-november, 2012: Milan, Italy), 2012.

61. **NEGRINI A., CORBIÈRE M., ST-ARNAUD L., DURAND M.J., COUTU M.F., LECOMTE T., CHARBONNEAU C., LEMIEUX P., BEAUDRY M.** *Les facteurs influençant le retour au travail de personnes ayant une dépression, selon le point de vue des supérieurs immédiats*. In XVI^{e} Colloque de l'Association québécoise pour la réadaptation psychosociale / AQRP (16^{e}: 31 octobre-2 novembre, 2012: Québec, Canada), 2012.

62. **NEGRINI A., CORBIÈRE M., ST-ARNAUD L., DURAND M.J., COUTU M.F., LECOMTE T., CHARBONNEAU C., LEMIEUX P., BEAUDRY M.** *Les facteurs influençant le retour au travail d'une personne ayant une dépression selon la perspective du supérieur immédiat*. In 17^{e} congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012 (17^{e}: 10-13 juillet, 2012: Lyon, France), 2012.

63. **NÉLISSE H., LE COCQ C., BOUTIN J., LAVILLE F., VOIX J.** *Estimation of noise levels and HPD attenuation in the workplace using microphones located in the vicinity of the ear*. In Acoustics Week in Canada 2012 (10-12 octobre, 2012: Banff, Canada), 2012.

64. **NOËL A., MAGHNI K., CLOUTIER Y., DION C., WILKINSON K. V., HALLÉ S., TARDIF R., TRUCHON G.** *Rats pulmonary effects to acute inhalation of 5 nm TiO2 showing two distinct agglomeration states (Poster)*. In The Society of Toxicology of Canada 44th Annual Symposium, (44^{e}: 2-4 décembre, 2012: Montréal, Canada), 2012.

65. **NOËL A., CLOUTIER Y., CHARBONNEAU M., TARDIF R., TRUCHON G.** *Increase in lung neutrophil and macrophage levels in rats exposed to inhaled agglomerated TiO_2 nanoparticles*. In Society of Toxicology Annual Meeting and ToxExpo / SOT (51th: March 11-15, 2012: San Francisco, USA), 2012.

66. **OSTIGUY C.** *Risk management of nanoparticles in the workplace*. In 30th International Congress on Occupational Health / ICOH 2012, (30th: March 18-23, 2012: Cancun, Mexico), 2012.

67. **PLAMONDON A., LARIVIÈRE C., GAGNON D., DELISLE A., DENIS D., ST-VINCENT M., NASTASIA I., SALAZAR E.** *Comparison between male and female workers in a transfer of boxes during a palletizing task*. In 18th Congress of the European Society of Biomechanics / ESB 2012, (18th: July 1-4, 2012: Lisbonne, Portugal), 2012.

68. **POISSON P., CHINNIAH Y.** *Preliminary results of the lockout/tagout application and observation in the sawmills industries in Quebec*. In 7th International Conference on the Safety of Industrial Automated Systems / SIAS 2012 (7th: October 11-12, 2012: Montreal, Canada), 2012.

69. **PRUD'HOMME P., DUGUAY P., BOUCHER A., BUSQUE M.-A.** *Les chutes et glissades : un problème important pour les travailleurs québécois ?* In Congrès de l'Association canadienne de Recherche en Santé au Travail / ACRST 2012, (1-2 juin, 2012: Vancouver, Canada), 2012.

70. **SGARD F., BRUMMUND M., VIALLET G., BOYER S., PETIT Y., LAVILLE F., BOUTIN J.** *Acoustic finite element modeling of hearing protection devices*. In InterNoise 2012 (41th: August 19-22, 2012: New York, USA), 2012, 12p.

71. **SOHANI M., OUALI M.-S., CHINNIAH Y.** *An improvement in applying safety standard ISO 13849*. In 7th International Conference on the Safety of Industrial Automated Systems / SIAS 2012 (7th: October 11-12, 2012: Montreal, Canada), 2012.

72. **SOHANI M., CHINNIAH Y.** *Feasibility study of event-based PI controller*. In Proceedings of Power Engineering and Automation Conference / PEAM 2012, (September 14-16, 2012: Wuhan, China), 2012.

73. **ST-VINCENT M., DENIS D., IMBEAU D., GONELLA M., FARBOS B., MOREL D.** *La polyvalence : une forme d'organisation aux multiples enjeux*. In 47e congrès de la Société d'ergonomie de langue française / SELF, (47e: 5-7 septembre 2012: Lyon, France), 2012.

74. **TOULOUSE G., ST-ARNAUD L.** *Étude des facteurs de risques psychosociaux par une approche multidisciplinaire centrée sur l'analyse de l'activité, les mesures physiologiques et la psychodynamique du travail : le cas des centres d'appel d'urgence 9-1-1*. In 17e Congrès de l'Association Internationale de Psychologie du Travail de Langue Française / AIPTLF 2012, (17e: 10-13 juillet, 2012: Lyon, France), 2012.

OTHER PUBLICATIONS

1. **HAJRA B.** *A comprehensive experimental study of the effects of adjacent buildings on near-field pollutant dispersion*. Thèse de doctorat, Montréal, Université Concordia, 2012, 262 p.

2. **HERETER J.** *Étude statique du deltoïde moyen par IRM*. Mémoire de maîtrise, Montréal, École de technologie supérieure, 2012, 98 p.

3. **JOCELYN S.** *Identification et réduction du risque pour les interventions de maintenance et de production sur des presses à injection de plastique en entreprises*. Mémoire de maîtrise, Montréal, École polytechnique de Montréal, 2012, 246 p.

4. **LAGACÉ P.-Y.** *Développement et validation d'une méthode d'évaluation des translations glénohumérales 3D sous EOSmc*. Thèse de doctorat, Montréal, École de technologie supérieure, 2012, 138 p.

BOOK CHAPTERS

1. **CLOUTIER E., LEDOUX É., OUELLET F., GAGNON I., DAVID H., BOURDOUXHE M.** *Passer du public au privé : des compromis inquiétant pour la santé des infirmières*. In La vie professionnelle : âge, expérience et santé à l'épreuve des conditions de travail, Molinié, A.F., Gaudart, C., Pueyo, V. (éds), Paris, Octarès, 2012, (Collection travail et activité humaine), p. 285-304.

2. **GAUVIN C., DARVEAU O., ROBIN C., LARA J.** *Analysis of test parameters and criteria for characterizing and comparing puncture resistance of protective gloves to needles*. In Performance of Protective Clothing and Equipment: 9th volume, Emerging Issues and Technologies, Shepherd, A.M. (ed), Anaheim, ASTM, STP 1544, 2012, p. 340-353.

3. **GAUVIN C., LARA J., PROULX-CROTEAU S., DOLEZ P.** *A new test method to characterize the grip adhesion of protective glove materials*. In Performance of Protective Clothing and Equipment: 9th volume, Emerging Issues and Technologies, Shepherd, A.M. (ed), Anaheim, ASTM, STP 1544, 2012, p. 392-406.

=108 PUBLICATIONS

MISSION

To contribute, through research, to the prevention of industrial accidents and occupational diseases and the rehabilitation of affected workers.

To disseminate knowledge and serve as a scientific reference centre and expert;

To provide the laboratory services and expertise required to support the public occupational health and safety network.

To fulfill this mission, the IRSST:

- Carries out and funds research in its priority research fields;
- Supports the development of research and new knowledge in occupational health and safety, in collaboration with the scientific community;
- Disseminates and promotes knowledge generated through research, in both the workplace and scientific communities;
- Plays a leadership role in anticipating emerging needs, raising awareness and creating synergy in the area of occupational health and safety research;
- Contributes to researcher training in occupational health and safety;
- Provides laboratory services to the CSST and its network;
- Contributes to the development of standards and regulations governing occupational health and safety;
- Responds to ad hoc requests for specific expertise originating from various occupational health and safety stakeholders.

VISION

Through its leadership in occupational health and safety research, the IRSST seeks to:

- consolidate its role as a reference centre vital to the operations and strategies of the CSST and its network;
- be used by its social partners in a spirit of joint collaboration;
- win recognition at national and international levels;
- derive maximum benefit from a well-established network of research and development collaborators.

PRODUCTION
IRSST, Communications and Knowledge Transfer Division
Louis Lazure, director

EDITOR
Jacques Millette

COORDINATION
Linda Savoie

COLLABORATION
François Hébert
Marjolaine Thibeault
Maura Tomi

GRAPHIC DESIGN
bertuch.ca

PHOTOS
Pierre Cloutier (p. 4, 8, 10, 16, 20, 26, 30, 34, 38, 40, 48, 50)
Dominique Desjardins (p. 43, 44)
Philippe Lemay (p. 43)
Jacques Millette (p. 42, 43, 45, 47)
iStock

TRANSLATION
Leslie Macdonald

505 De Maisonneuve Blvd. West
Montréal, Québec
Canada H3A 3C2
Phone: 514 288-1551
Fax: 514 288-7636

ISSN 0820-8409
ISBN 978-2-89631-665-6 (Print format)
ISBN 978-2-89631-666-3 (PDF)

Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST)

INSTITUT DE RECHERCHE ROBERT-SAUVÉ
EN SANTÉ ET EN SÉCURITÉ DU TRAVAIL

www.irsst.qc.ca