IRSST

ANNUAL REPORT 1992

ENGLISH ABRIDGED VERSION

A BETTER UNDERSTANDING THROUGH RESEARCH

MISSION AND GOALS

The Institut de recherche en santé et en sécurité du travail du Québec (IRSST, Québec Occupationnal Health and Safety Research Institute) was created in 1980 to contribute, through research, to the identification and elimination at source of occupational hazards, and to the rehabilitation of workers who have become victims of these hazards.

To fulfil its mission, the Institute:

- *performs, funds, and contracts research that responds to the needs of the working community;*
- *offers laboratory services and expertise to the Québec occupational health and safety prevention network;*
- *communicates the results of its research and consulting activities to the working community; and*
- *awards graduate scholarships.*

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LABORATORY SERVICES

In 1992, the Laboratory Division carried out approximately 46,123 environmental and toxicological analyses, and performed 4,138 hours of instrumental services for the CSST's prevention network. An additional 7,881 analyses were conducted, and 221 hours of instrumental services were performed for research projects.

Over 98.7% of the analyses were done for CLSCs and community health departments for the purpose of establishing health programmes for businesses in high-priority industries.

Solvent analyses accounted for 47% of all analyses, with metals and ions accounting for 11%, dusts for 10%, toxicological analyses for 25% and miscellaneous analyses for 7%.

Besides performing over 225 types of analyses, the Laboratory Division calibrates, maintains and repairs equipment used by members of the prevention network to sample air contaminants and measure gas concentrations and physical parameters such as noise.

The Laboratory Division's clientele is not limited to members of the prevention network, and in 1992 it provided services to employer groups, unions, companies and various other organizations.

PUBLICATIONS

In 1992, the Communications Division distributed over 19,000 documents related to occupational health and safety. These were issued either in response to specific requests or at events such as symposiums, conferences and exhibitions.

A total of 17 new research reports and guides were published, as well as an updated collection of the Institute's 326 research outlines. An update of this kind is published in the spring of every year.

In 1992, subscriptions to *L'IRSST* doubled, bringing the total number past the 4,000 mark. This year, the news magazine dealt with such issues as careers in occupational health and safety pursued by the Institute's grant-holders (Spring 1992), transferral of research applications (Summer–Fall 1992) and work-related musculoskeletal disorders in poultry slaughterhouses (Winter 1992).

The Communications Division assisted the Institute with its participation in the ACFAS symposium, entitled "Variété des approches scientifiques en santé et en sécurité du travail"; it was responsible for organizing the press conference on the study of risks in the collection of household waste.

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PRESIDENT'S MESSAGE

This year, the Institut de recherche en santé et en sécurité du travail (Québec Occupational Health and Safety Institute) gave more than ample proof of its willingness and ability to fulfil the needs of the working community.

At the end of 1992, a large number of people responded to a survey confirming that the fifteen research areas to which the Institute has given priority in its five-year strategic plan do, in fact, coincide with workers' and employers' concerns. Occupational health and safety research is going in the right direction, and will continue to steer along that course.

The Institute remains close to the working community in many ways by providing results that conform to its expectations. As the following report illustrates, more and more research projects are producing concrete results that can be used by workers and employers, and by the occupational health and safety network as well.

In addition, researchers in occupational health and safety are now in a position to make available a vast pool of knowledge that they have been accumulating over the years. The members of the working community are free to make use of this knowledge, and the Institute will do all in its power to share it with them.

The Institute has never had such a high profile within the working community and the health and safety network as it has enjoyed over the past year. It is clear, from this interaction and the resulting cooperation, that the Institute is fulfilling its required role and that it has become a key partner in improving occupational health and safety.

Robert Diamant,
President

CHIEF EXECUTIVE OFFICER'S REPORT

This past year, the Institut de recherche en santé et en sécurité du travail (Québec Occupational Health and Safety Institute) channelled its efforts into five research areas on which it intends to have a significant impact.

The Institute and its partners worked together to define the directions toward which research should move in certain fields, to put them into context and to establish priorities. It was therefore able to place a call for bids in two fields, namely the accident process and the evaluation of prevention activities, in conjunction with a concerted action by the Fonds pour la formation de chercheurs et l'aide à la recherche (FCAR). The concept of working together as partners to conduct research and apply the results seems a promising one that the Institute intends to explore in other areas.

The Institute will continue to focus its research objectives in 1993 so that it may have a clearly defined goal that will inspire new research in those fields. We intend to ensure that our entire body of work moves in one predetermined direction.

This step of rationalizing available resources in order to apply them to certain priorities goes hand in hand with efforts designed to ensure systematic application of research results, and they are both bearing fruit, as the results being put to use and the marketing agreements being signed testify.

Research in occupational health and safety has benefited enormously from the active participation of workers and employers: now, more than ever, it studies concrete problems in the working community and offers solutions that can be put to use. Between the lines in this report, the positive aspects of this cooperation and the satisfaction of our partners are plain to see.

Jean Yves Savoie,
Chief Executive Officer

In 1992, the Institute completed a key planning process, and the resulting strategies will be applied to the Institute's activities up to 1998. The Institute recognizes that it is unable to cover all the possible fields of research and so, in consultation with its partners, it has decided to give priority to fifteen research areas, in which it intends to build up a critical body of research that will create a significant impact. This was also the year the Institute redefined its intervention guidelines, and revised its strategies for dealing with its major partners.

The research areas identified by the Institute as being relevant to current workplace health and safety issues are:

- Back problems;
- Work-related musculoskeletal disorders;
- Noise;
- Chemical and biological contaminants;
- Safety relating to tools, machines and industrial procedures;
- Vibration;
- Work organization;
- Protective equipment;
- The accident process;
- Evaluation of prevention activities;
- Air quality in non-industrial buildings;
- Occupational health and safety indicators;
- Rehabilitation;
- Risk-free pregnancy;
- Sociological and technological changes.

The Institute has redefined the guiding principles on which it bases its activities. They now read as follows:

- participation of employers and workers in research orientation and projects in the working community;
- inclusion within the occupational health and safety network in its role as that network's research arm;
- undertaking of original research that contributes to the advancement of knowledge or transfer of information;
- linking research activities to concrete problems;
- conformity of work to international standards concerning scientific quality;
- complementary nature of internal and external research activities;
- dissemination and development of research results.

In addition, the Institute has reexamined its communication channels by which research proposals are brought in line with the concerns of the working community, so that the latter may become aware of the research results and be able to put them to use.

A survey was conducted over the course of the year on behalf of the Institute. Respondents to this survey included decision makers, public figures, employer and union administrators, and members of the prevention network. Its results confirmed that the Institute's clientele consider it the leader in occupational health and safety research. Other facts revealed by the survey include:

- that the research areas given a high-priority rating by the Institute correspond to the preoccupations expressed by the working community;
- that the level of concern expressed by both employer and union respondents regarding the Institute's priority research areas was identical.

In 1992, in conjunction with the Fonds pour la formation de chercheurs et l'aide à la recherche (FCAR, a fund for training researchers and assisting research), the Institute founded a concerted action programme aimed at preventing work-related accidents. With a triennial budget of $1.2 million, the programme solicits occupational health and safety research proposals that must a) be in one of two research areas (the accident process or evaluation of prevention activities) and b) conform to predetermined methods and criteria. The Institute's goal for this programme is to provide an incentive for its research partners to develop initiatives that correspond to the expectations of the working community.

Also in 1992, the Institute formed the Comité d'exploitation des résultats de la recherche. Research results are presented to this committee and methods are proposed for the application and dissemination of the results.

FUNDING

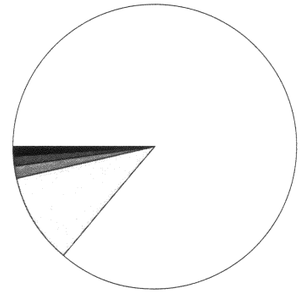
The Research Applications Transfer Unit develops expertise related to the application of research results, supports efforts by research teams to apply their results, develops strategies favouring the application of the results of Institute research, and collaborates in their application. It also markets the products and processes of Institute research.

The Communications Division is responsible for the dissemination of information about the Institute and its priorities, orientation, research and other activities. It prepares institutional publications, publishes research material and communicates with media.

The Administrative Services Division is responsible for human, financial and material resources, and industrial relations.

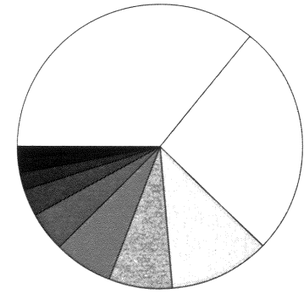
The Computer Services Division is responsible for the development and management of the Institute's computer systems.

The IRSST's total revenue in 1992 was $18,548,590, including a grant of $16,017,879 from the CSST. Expenditures stood at $18,127,502.



Revenue: $18,548,590 = 100%

CSST	86.3%
Laboratory services	10.3%
External contracts	1.3%
GST Refunds–1991	1.1%
Interest	0.8%
Miscellaneous revenue	0.2%



Expenditures: $18,127,502 = 100%

Internal research	36.0%
External research	26.3%
Laboratory services	11.5%
Administration	7.3%
Scientific administration and coordination	6.4%
Communications	4.7%
Computer services	2.8%
Documentation centre	2.2%
Research application transfer	1.5%
External contracts	1.3%

RESEARCH

Internal research teams and funded or contracted external researchers performed 130 research and consulting projects in 1992. Of these, 31 were begun, 59 were ongoing and 40 came to an end over the course of the year. A list and a summary of all the projects under way in 1992 appears in a supplementary report available in French.

In 1992, the Institute allocated $6,923,851 to its internal research programmes and $4,180,868 to its external research programmes. This latter amount was distributed as follows:

External research groups:	**$1,579,799**
Contract and funded research:	**$2,214,754**
Graduate scholarships:	**$386,315**

Through its graduate–studies bursary programme, the Institute awarded scholarships for work in high-priority research fields to the following: 1 post-doctoral fellow, 17 doctoral students and 9 masters' students.

PERSONNEL

At the end of 1992, the Institute's total of 126 employees could be broken down as follows: 15 management staff, 56 researchers and professionals, 30 technicians, and 25 support staff.

University diplomas are held by 79 of the Institute's employees (i.e., 63% of total personnel): 18 with doctoral degrees, 29 with masters', and 32 with bachelors'. A total of 134 refresher courses were taken during the year by 67 staff members.

ORGANIZATIONAL STRUCTURE

The General Executive is responsible for the overall management of the Institute. This mandate includes the formulation and execution of policy, particularly those related to leadership, presentation, development and coordination of research in occupational health and safety in Québec, and communication of research results. The Secretariat assists the Chief Executive Officer and is responsible for ensuring that the meetings of the Institute's various decision-making and advisory committees run smoothly.

The Scientific Executive assists the Chief Executive Officer in the formulation and evaluation of the Institute's research activities. It is also responsible for maintaining links with the CSST, sector-based associations, the working community and other scientific organizations, and for scientific documentation.

The External Research Directorate is responsible for the IRSST's relations with universities and other competent research organizations that perform research in fields it judges relevant and of high priority. It also manages the funded and contract research programmes and the graduate scholarship programme.

The Laboratory Division is responsible for the administrative and scientific management of the Analytical Support, Industrial Hygiene and Toxicology, and Safety Engineering programmes. All three programmes are mandated to provide laboratory and consulting services, and to perform research and development. The External Users Liaison Group manages requests for laboratory and consulting services, most of which come from CSST inspectors and hygienists from the Centres locaux de services communautaires (CLSC, local community-service centres), Départments de santé communautaire (DSC, community health departments) and joint sector-based health and safety associations.

Research in the Safety Engineering Programme is aimed at reducing or eliminating hazards, especially in the fields of industrial machines, protective equipment, and noise and vibration. The Industrial Hygiene and Toxicology Programme carries out environmental and toxicological analyses, provides the CSST and the rest of its occupational health and safety prevention network with the necessary expertise in this field, and conducts applied research in industrial hygiene and toxicology. The Analytical Support Programme conducts research and development in industrial hygiene, provides expertise in this field and maintains, repairs and calibrates all the industrial hygiene equipment used by the CSST and its prevention network.

The Work Organization Programme performs research that examines the effects of work organization on health and safety, develops new statistical indicators, applies data found in other databases, develops generally applicable models, and performs prospective analyses.

The Safety Ergonomics Programme conducts applied ergonomic research aimed at reducing occupational accidents and diseases. The primary research focus is on workstation analysis and design, and on risk factors for work-related musculoskeletal disorders.

RESEARCH

BACK PROBLEMS

This year, Michel Rossignol, an epidemiologist with the Community Health Department of the Hôpital du Sacré-Cœur, and Monique Lortie, an ergonomist with the Université du Québec à Montréal, completed a study among fitters in the aircraft manufacturing industry on the connection between back problems, workstation characteristics and the workers' perception of their job's level of difficulty.

The first section of the study attempted to measure to what extent workstation characteristics could be used to predict the general posture fitters adopt for their work. It appears that, for non-repetitive work where workstations vary and change over time, there is no significant connection between workstations and the workers' postures. It is, therefore, difficult to identify risk factors associated with those postures, based solely on observations of the workstation.

In the second section, the researchers measured the connection between workstation characteristics and the incidence of back problems among workers by means of a questionnaire, which the workers filled out at the beginning and end of a twelve-month period. The results revealed that there is, in fact, no connection between these variables, particularly as back problems can often be traced to previous jobs.

In the third section, researchers devised a questionnaire in which the workers identified—from photographs, diagrams and questions—the aspects of their job that they consider most painful for their backs. This questionnaire was given to those workers who had filled out another questionnaire dealing with the strength and fitness of their backs. Among other things, the second questionnaire revealed that the relative fitness of the worker's back is a definite factor in determining whether or not workers perceive their jobs as difficult. Some of the results were rather unexpected: using a rivet gun, for example, was perceived as painful only by respondents with back problems. Finally, instead of isolated elements, respondents identified situations in which several elements are combined, such as the combination of a type of posture and a kind of exertion. Future research in this field should take the connections between various elements into account when evaluating job difficulty.

In 1992, Monique Lortie, of the Université du Québec à Montréal, finished an analysis of the operating procedures and incidents that occur among handlers in the transport industry.

The researcher's intention was to analyse the techniques used for loading and unloading merchandise on the loading dock, and the incidents associated with that task, paying particular attention to containers other than boxes, as it is known that they cause more accidents. Thirty-two handlers employed by a large transport company were filmed on the job.

The observations and analyses revealed that the workers' handling techniques were much more complex and varied than those usually studied; the type of actions most frequently analyzed by researchers do not actually seem to be used much. On the one hand, certain postures such as an asymmetrical stance, which researchers strongly advise against, are used everyday by the workers, because they allow the worker to get a better grip on the container being handled. On the other hand, certain commonly recommended ways of avoiding back problems, such as bending at the knees, actually have no effect on the position of the back.

In addition to emphasizing the necessity of conducting field studies, this piece of research underlines the impossibility of describing a typical pattern for the tasks involved in handling. Given that they are constantly changing, comparing the different situations of handlers is not an easy task.

Moreover, the study also showed that there is an average of one incident for every seven handling activities. It seems likely that the types of incidents and the strategies used for preventing them would vary at least in part according to the handlers' abilities.

Finally, the principal aspect revealed by the study is that handling is the final result of a complex mental process that is more than the sum of some pre-determined movements.

WORK-RELATED MUSCULOSKELETAL DISORDERS

In 1992, Nicole Vézina and Lucie Geoffrion of the Université du Québec à Montréal, and Georges Toulouse of the IRSST, completed a study on the implications of ergonomics in the prevention of work-related musculoskeletal disorders in two pork slaughterhouses. Ergonomic experts conducted an analysis of two workstations; the team based their study on this, and on the participation of the occupational health and safety committee, made up of management and union representatives, who were specially trained for this purpose.

The team observed, measured and held individual and group interviews. The information thus gathered contributed to their analysis of the sequence of the workers' activities, their physical and temporal restrictions, the force they exert, the pain caused by the working conditions and the circumstances of the job, such as the nature of the carcasses, the tools and the layout of the workstation itself.

For each problem that was identified, the study was able to respond with recommendations concerning the circumstances of the job, specifically targeting musculoskeletal restrictions of the upper body. The 28 suggested improvements were discussed with the workers and many of these have already been put into practice.

NOISE

In the last 15 years, there have been 22 fatal work-related accidents in Québec caused by heavy vehicles backing up. The Institute asked Chantal Laroche and her colleagues at Sonométric Inc. to determine the optimum acoustic characteristics of a backup signal that could be fitted onto heavy vehicles.

After an initial field study performed by the acoustics groups of the Universities of Montréal and Sherbrooke (GAUM-GAUS), and a detailed survey of existing backup signals and their patents, the current legislation in effect, the vehicles, and all the documentation pertaining to these subjects, the team from Sonométric resumed their field studies. Their objective then was to perfect and validate a model of how sound is diffused by backup signals. This model was to take the reflection and diffraction of sound waves behind different types of vehicles into account.

The Détectson™ software program created by GAUM could be linked to the model to provide a better understanding of how sound is diffused behind heavy vehicles equipped with a backup signal, and the reasons why these signals are not heard. A first step for further research in this area would be to identify the backup signals that can be purchased and determine whether or not they meet the minimum safety requirements. The second step would be to identify the optimum characteristics of a heavy vehicle backup signal.

CHEMICAL AND BIOLOGICAL CONTAMINANTS

The pulp and paper sector reported problems of irritation to the eyes, nose and throat, associated with airborne emissions produced by the thermomechanical pulp and paper production process. In response to these reports, Nicole Goyer of the IRSST's Analytic Support Programme began the task of identifying and quantifying the existing pollutants and of tracing them to their source. The measuring stations were set up in such a way as to cover all the steps in the production process, and the sampling techniques were selected so that several classes of compounds, such as dusts, gases, and gaseous and particulate organic compounds, could be included in the study.

Certain contaminants likely to cause irritation were in fact detected, but they came from random leaks of various kinds of equipment rather than from fixed and continuous sources. A direct-reading photoioniser would provide a means of rapidly identifying the types of leaks, and checking and sealing work could be included as part of a regular maintenance programme.

In 1992, Jules Brodeur, Robert Tardif and Sylvain Laparé, of the Université de Montréal, finished developing and validating a technique that would make it possible to use air exhaled by the workers in biological investigations of their exposure to industrial solvents. Experimental data has been obtained for seven commonly used industrial solvents, such as toluene, xylene or acetone, and the researchers are at the stage of developing descriptive and predictive patterns for the behaviour of the various solvents under study within the organism.

The results obtained so far seem to indicate that the level of toluene, xylene, trichloroethylene and 1,1,1-trichloroethane in the air exhaled by the workers can be used as a biological indicator of exposure to these solvents. The simulation patterns drawn up by the researchers are an accurate reflection of the data obtained by measuring the solvents in the exhaled air, the blood and the urine, in the form of metabolites. It was, however, necessary to alter the pattern's structure for ketonic solvents (such as acetone, methylisobutylketone and methylethylketone), because of their solubility in water. The next step for the researchers is, in collaboration with the health services in the workplace, to find out how to make this method of biological surveillance more accessible to the working community.

In 1992, the work done by the Service de transfert des applications de la recherche (STAR, Research Applications Transfer Unit) resulted in patent and royalties agreements between the Institute and companies capable of marketing various products and equipment that were developed based on research conducted or financed by the Institute.

The following items have been discussed under just such agreements: a new type of railing to be used in construction, an aerosol-generator used in the diagnosis of occupational asthma, a device to contain welding fumes, and also the Détectson™ software package, used to evaluate a worker's hearing ability.

Moreover, the IRSST entered into an agreement with the École Polytechnique to market a hand prosthesis, which had been partially financed at the development stage by the Institute. The same type of agreement was concluded with the Université de Montréal and Lomédic Inc., concerning the marketing of a isocyanate-generator, used in the diagnosis of occupational asthma.

STAR also assisted in the process of transferring information acquired through research, particularly as it pertains to mobile shredding units, antireversal ratchets on sawmill radial saws and heated, dielectric-loss-powered industrial presses.

On the occasion of its 14th conference, the Association pour l'hygiène industrielle au Québec (AHIQ) bestowed the Antoine Aumont Award on the IRSST's Laboratory Division, with particular mention of the laboratory's excellent analyses, the role it played in referrals, and its research and development activities in the field of industrial hygiene.

Jean Arteau, an engineer with the Safety Engineering Programme, won an award from Occupational Health and Safety Canada for "the most significant personal contribution in the field of occupational health and safety." Jean Arteau and his colleagues perfected a method for evaluating the performance of leg protectors and safety pants worn by chain-saw operators.

Chantal Dion, Guy Perrault and their colleagues in the Industrial Hygiene and Toxicology Programme were chosen out of 107 participants as winners for the best scientific poster presented to the American Industrial Hygiene Conference and Exposition held in Boston. The poster dealt with four counting methods for determining the concentration of airborne fibres by phase-contrast microscopy.

In 1992, the IRSST participated in the 60th conference of the Association canadienne-française pour l'avancement des sciences (ACFAS) by holding a one-day symposium entitled: "Variété des approches scientifiques en santé et en sécurité du travail." There were eight lecturers—personnel from the Institute's science division or their associate university researchers—who presented contributions from various disciplines, such as toxicology, engineering and ergonomics as solutions to various occupational health and safety problems.

The Institute took part in an international scientific symposium organized by the Office des personnes handicapées du Québec, entitled "Functional Limitations and their Social Consequences: Report and Outlook," which attracted approximately 145 participants. It was held in Montréal in November 1992 and the participants, from North America and Europe, covered a wide range of disciplines and fields of expertise. Claire Lapointe, a scientist at the Institute, was mainly responsible for the workshop dealing with integration of handicapped people into the workforce. Those who attended the workshop emphasized the necessity of continuing to study work environments so that jobs can be adapted, and the importance of recognizing invisible handicaps, such as those that affect the musculoskeletal system.

The Institute has given special mention to the work done by Jean Arteau and his colleagues in the Safety-Engineering Programme in the field of protection against falls from high places, and particularly for preparing, on behalf of Hydro-Québec, a testing method for determining the resistance factor of metal spurs used for climbing wooden poles. Also, several companies and organizations, such as the CSST and the Société de transport de la Communauté urbaine de Montréal (STCUM, Montréal Urban Community Transit Commission), as well as construction companies, have asked the Institute to draw up stationary and mobile testing methods for evaluating different types of railings. Finally, in conjunction with the École Polytechnique, in 1992 the Institute offered an intensive course—geared toward designers, developers and users—on horizontal safety cables used in construction, and on metal frameworking.

Brigitte Roberge and Nicole Goyer, of the Analytical Support Programme, took on the task of evaluating six miniature carbon monoxide (CO) detectors, as an increasingly high number of workers are exposed to this contaminant in different workplaces. The detectors were subjected to tests, both in the laboratory and in the workplace, in an attempt to measure their analytical performance (accuracy, precision, ability to measure other gases), evaluate their physical characteristics (size, weight, design, means of securing it in the breathing zone), and determine their software characteristics (memory, user-friendliness, flexibility). The information revealed by the study made it possible to define each model's performance, thus simplifying, for hygienists and technicians, the task of choosing the detector that will best suit a given set of requirements.

A protective breathing mask for workers handling asbestos, put on the market by the 3M company, was adapted by the Institute to conform to Québec regulations and protection factors. The Laboratory Division was put to work on this following a request to the Institute by the union representatives of a mining company.

As it has in the past, the Laboratory Division participated in various inter-laboratory quality control tests, in particular those administered by AIHA (American Industrial Hygiene Association), but in 1992 it also initiated one. In Québec, the concentration of asbestos fibres and other air-born mineral fibres is evaluated by optical, phase-contrast microscopy, in accordance with the conditions outlined in the IRSST 243-1 testing method. This official counting method is based mainly on meticulous microscopic observation, and therefore demands a high standard of intra- and inter-laboratory inspection. In 1992, Chantal Dion and her colleagues with the IRSST's Hygiene and Toxicology Programme initiated a quality-control programme that would enable the various private laboratories, public organizations and mining companies involved in fibre counting to conform to the requirements. The programme specifies that fibre samples of various kinds and origins be sent to some 35 different counters, and that the results then be compared. If a counter passes three such tests, the IRSST officially recognizes its performance.

At the CSST's request, the Institute brought in a group of pneumology experts to update the protocols dealing with medical surveillance of pneumoconiosis victims, and referred its recommendations to the CSST. Patrick Sébastien, the Institute's Scientific Director, has been in communication with representatives from the International Labour Bureau, based in Geneva, which is also dealing, at its own level, with the same necessity of updating and standardizing protocols. A project at the international level is presently being developed and the Institute is planning to contribute to it. The first meeting on this topic has already been held in 1992 in Prague at the time of the Eighth International Conference of Victims of Pneumoconiosis.

SAFETY RELATING TO TOOLS, MACHINES AND INDUSTRIAL PROCEDURES

Lambert Laliberté, of the IRSST's Analytical Support Programme, has begun a study of the radio frequencies emitted by certain dielectric-loss-powered, heated industrial presses used for soldering, drying, heating, melting or treating substances such as plastics, fibres, rubber and glues.

The research director has studied the scientific documentation on the subject and has measured the levels that press operators are exposed to in 20 factories in the Greater Montréal area, and has concluded that there are several types of dielectric-loss-powered machines that expose their operators to high levels of radio frequencies. At this point, it seems possible to devise an efficient means of shielding dielectric-loss-powered presses.

The study also recommended that certain protective measures be taken by those working in close proximity to dielectric-loss-powered machines, such as not wearing metallic objects, so as not to concentrate the electric field; being as insulated as possible from the ground to reduce energy absorption; and using stools and work tables made of plastic rather than metal.

René Benoît and his colleagues at the Centre d'expertise acoustique BGL Inc. conducted a study on behalf of the Institute looking at ways of reducing the risks associated with mobile shredding units, such as chipping machines. The study includes a review of the documentation, field observations and measurements, interviews with machine operators and recommendations for designing a safer machine. The study is based on the concept of "simultaneous engineering," which simultaneously considers such variables as health, safety, productivity and the machine's basic functions, and allows the operators to become actively involved in the machine's design.

Identifying and analyzing the health and safety problems confirmed the extent to which machine operators are at risk, and underlined the many design flaws of some machines currently being used. Design criteria for a safer, less noisy and equally efficient machine have already been worked out.

WORK ORGANIZATION

In 1992, Madeleine Bourdouxhe and Esther Cloutier, of the IRSST's Work Organization Programme, and Serge Guertin, of Ergo-Norme, completed an initial in-depth study of the hazards associated with the collection of household garbage in Québec. In consultation with two joint sector-based associations, with contractors, municipalities and unions, the researchers called upon the resources of industrial science, ergonomics, sociology, statistics and verbal analyses, to put together a picture of the hazards inherent in this sector.

The study revealed, first and foremost, the extent to which refuse collectors are at risk: for every 100 refuse collectors who have worked 2,000 hours per year, there is a total of 109 accidents. The study also discerned how heavy the workload actually is: in an average day, in all kinds of weather, a collector will lift 16,000 kg of garbage and walk 11 km. A list of typical accidents was drawn up with back problems at the top, closely followed by sprains from falling or sliding, and cuts. Next, the nature of the hazards had to be identified: in addition to the workload, the collectors are also at risk from being in the streets, from the work organization, from the type of garbage, and from the delinquent behaviour of some of the people on the route.

Supported by an advisory committee of representatives from the working community, the researchers formulated 57 recommendations, dealing mainly with worker training programmes, the stability of the labour force, uniformity among garbage containers, and various aspects of municipal policy with respect to household garbage pickup.

In 1992, Michel Vézina and his team at GIROSST (Groupe interdisciplinaire de recherche sur l'organisation, la santé et la sécurité au travail) of Université Laval began an analysis of the accidents that occurred between 1976 and 1986 on James Bay construction sites in terms of the variables associated with work organization, such as professional qualifications, work intensity and the size of the company.

The team based its analysis on data from the data banks of the Commission de la construction du Québec and the CSST. A general conclusion drawn from the data's analysis was that work-related accidents happen less often on the James Bay sites than in the rest of Québec's construction sector, but that they are more serious.

In the field of skilled work, the incidence of accidents among apprentices was higher than it was among journeymen, but of the two groups, the latter had the more serious accidents. Both the incidence and the gravity of accidents among non-qualified workers appeared to be higher, and accidents seemed to increase in frequency in direct relation to the amount of overtime worked. And, finally, the incidence and severity appears to be higher in very small companies. Additional analyses are needed to explain the relation between professional qualifications, work intensity and safety, and also to hand down recommendations of a preventive nature.

PROTECTIVE EQUIPMENT

Current methods for evaluating the resistance of protective clothing to industrial solvents are both expensive and difficult to carry out, with the result that few workplaces are able to use them. Jaime Lara and Julie de Merchant of the IRSST's Safety Engineering Programme were therefore moved to develop a simpler, less expensive method. Their method, called gravimetric weight analysis, consists of exposing a piece of material from the item of protective clothing to a volatile solvent inside a permeation cell, and then using a scale to measure the weight loss caused by the solvent's evaporation once it has passed through the material.

The researchers measured the resistance of the two most commonly used materials for making protective clothing (neoprene and nitrile) by exposing them to a variety of different solvents that have already been studied with the standard method developed by the American Society for Testing on Materials (ASTM). Their results were comparable to those obtained by the Society's standard method, and statistical analyses revealed that the two methods give equivalent results. After trying out a variety of different cells, the researchers perfected a permeation cell that is safer and easier to handle, and that the working community can purchase fairly inexpensively.

This particular piece of research is merely a step in a much larger project, the aim of which is to predict the resistance of different types of materials to industrial solvents on the one hand and, on the other hand, to produce a standard classification test for protective clothing that can be used by the working community.

THE ACCIDENT PROCESS

A few years ago, the Institute funded research aimed at developing a methodology that would allow directors of underground mines to evaluate the potential for earth tremors on their excavation sites. Earth tremors occur when mining activity causes the ground to erupt suddenly and violently, and a large quantity of rock to be expelled; they are obviously extremely dangerous for the workers in the mines.

The creators of this methodology, Michel Aubertin and Denis E. Gill, of the École Polytechnique, have spent part of the past year working towards its validation, as it had only been partially applied to actual cases when it was first proposed. They completed the validation by analyzing *a posteriori* two earth tremors that occurred in an underground mine. The result of this "after-the-fact" analysis indicated that using the methodology would indeed have made it possible to determine the excavation's potential for earth tremors.

AIR QUALITY IN NON-INDUSTRIAL BUILDINGS

Jacques Lavoie, of the IRSST's Analytical Support Programme, and Paul Comtois, of the Université de Montréal, have undertaken a systematic evaluation of the measures recommended by various preventive bodies to eliminate the high concentrations of moisture and bacteria in specific ventilation systems, such as vacuuming all contaminated components and surfaces with high-efficiency filters, disinfecting with hypochlorites, and steam-cleaning. In order to evaluate these different recommendations, they compared the concentration of bacteria inside and outside a laundry, before and after the recommended cleaning methods were implemented.

Samples taken before the cleaning showed significant differences between bacteria concentrations outdoors and those found in proximity to various workstations and ventilation systems. After the cleaning methods, the researchers took a number of different samples both indoors and out, and the results revealed that there was no significant difference in either the concentration or the nature of the bacterial population.

On the basis of this study, the researchers concluded that similar cleaning techniques could be used in other locations, but they had difficulty determining how often the techniques should be implemented. A users' manual will be developed and published in 1993.

OCCUPATIONAL HEALTH AND SAFETY INDICES

Michel Rossignol and Marc Pineault, of the Community Health Department of the Hôpital du Sacré-Cœur, finished their study this year on the deaths that occurred due to work-related accidents between 1981 and 1988. The object of their study was to assist the occupational health and safety network in their goal of preventing such accidents.

In order to count the number of deaths that occurred, the researchers consulted the CSST's files, and found only 84% of the total number of deaths due to work-related accidents listed there. They recommend that subsequent studies make use of the records from the office of the Coroner du Québec; as of 1987, these records include information pertaining to deaths due to work-related accidents.

The study revealed that the gross average mortality rate for work-related accidents in Québec is 6.7 per 100,000, and that this rate is comparable to results obtained in the United States. It was observed that there are twenty times fewer deaths among female workers than among males.

The mortality rate for workers 55 years of age and older is twice as high as the Québec average; this is the age range in which death is most frequently caused by falls. Between 1984 and 1988, in the forestry sector, the number of deaths tripled, whereas it shrank considerably in the construction industry. Truck drivers and farm labourers work in occupations with the highest mortality rate due to accidents, but this fact is not well-represented in the CSST's statistics because these workers are, for the most part, self-employed. Automobiles are responsible for one third of all deaths due to work-related accidents.

The results of this study were disseminated among professionals in the prevention network and policy-makers in the area of prevention.

REHABILITATION

The researchers with the Groupe acoustique de l'Université de Montréal (GAUM), under the direction of Raymond Hétu, have studied the difficulties associated with wearing a hearing prosthesis in noisy work environments. They evaluated to what extent the tips of different prostheses could dampen sound and found that, depending on the shape, the tip's length and configuration, the material used, the type of prosthesis, the presence or lack of a vent, and the sound's angle of incidence, the hearing prostheses can dampen sound to the same extent that conventional earplugs and hearing protectors can. This similarity, however, assumes that the mould from which the tip is made be of extremely high quality.

Similarly, the researchers studied how the use of a hearing prosthesis in noisy environments affected the workers' ability to hear warning signals. The study revealed that workers should not wear a combination of prosthesis/hearing protector as one cancels out the other. However, when magnetic signals are picked up by the prosthesis' induction coil, a very satisfactory balance between signal and noise is achieved, since the tip of the prosthesis dampens the noise whereas the prosthesis itself amplifies the signal. Certain technical measures must be taken, however, to ensure that the device does in fact transmit within the frequency range used by the warning signals.