出國報告（出國類別：其他 ，國際研討會議）

參加第12屆局部振動國際研討會

服務機關：行政院勞工委員會勞工安全衛生研究所
姓名職稱：潘儀聰副研究員
派赴國家：加拿大(渥太華)
出國期間：100年6月11日至6月20日
報告日期：100年9月

摘要

出國報告名稱：參加第12屆局部振動國際研討會
服務機關：行政院勞工委員會勞工安全衛生研究所
姓名職稱：潘儀聰副研究員
出國類別：國際研討會
派赴國家：加拿大(渥太華)
出國期間：100年6月11日至6月20日
報告日期：100年9月
關 鍵 詞：國際研討會、職業衛生、局部振動

內容：

本次行程主要為參加「第12屆局部振動國際研討會」，會議期間並發表本所有關局部振動研究之論文「Mitigation of hand-arm vibrations in workers on a pneumatic nail gun assembly line」。本研究係探討氣動釘槍組裝線，作業員對於使用氣動把手所造成的高速手臂振動情況，研究發現，氣動釘槍組裝線作業員，以單手握持釘槍手柄，另一手握持氣動把手進行螺絲的安裝，作業員長期處於高速手臂振動的狀態，造成手指麻木等肌肉骨骼的危害，為減低振動暴露，開發一組木製夾具來輔助固定氣動釘槍，以減少高速振動對手臂的衝擊，實驗結果顯示有效降低勞工振動暴露。

本次大會由加拿大聲學協會(Canadian Acoustics Association)、加拿大羅倫欣大學(Laurentian University)、多倫多大學(Toronto University)和康克迪亞大學(Concordia University)共同舉辦。參與人士主要來自世界各地人因工程、職業醫學與衛生危害相關領域的學術、研究、行政等方面專家。與會國家主要為來自歐洲、北美洲、南美洲、亞洲、大洋洲等地。

就整體研討會論文綜觀而言，人類無法避免使用工具，因此工具所產生的振動能量也就需要由人體來吸收，衍生之肌肉骨骼危害問題就相當重要，振動衝擊所造成的肌肉骨骼問題在不同層次、地理區域間，有相當大之差異性，因此需要各方主動交流，共同努力來解決因為局部振動所衍生之傷害問題。

關鍵字：國際研討會、職業衛生、局部振動

目 錄

壹、 活動背景及目的

局部振動國際研討會起源於1972年，於Dundee, Scotland舉辦。此研討會至今已舉辦12屆，是一個重要的國際研討會議。歷年來提供許多機會讓研究人員交流知識及實務經驗，分享新設備資訊、測量方法、電動工具和防護設備，並討論未來將面臨之振動醫學、流行病學、工程和法律相關的議題，使大眾體認到，局部振動問題為職業衛生議題當中重要的一環。此次會議由加拿大聲學協會、羅倫欣大學、多倫多大學和康克迪亞大學共同主辦。

本次行程主要為參加「第12屆局部振動國際研討會」，會議期間並發表本所有關局部振動研究之論文「Mitigation of hand-arm vibrations in workers on a pneumatic nail gun assembly line」，透過論文發表，可以讓世界各國職業衛生從業人員瞭解到台灣之研究能量與水準，經由國際性活動的參與，將可讓更多世界各國職業衛生人員，清楚勞研所在職業衛生上的研究成果。

貳、 會議過程

第12屆局部振動研討會(12th International Conference on Hand-Arm Vibration)於100年6月13日至100年6月17日於加拿大渥太華舉行。本次行程於6月11日台北出發經多倫多轉機，於6月12日抵達加拿大渥太華，本次研討會地點係在The Westin Ottawa ，由加拿大聲學協會(Canadian Acoustics Association)、加拿大羅倫欣大學(Laurentian University)、多倫多大學(Toronto University)和康克迪亞大學(Concordia University)共同舉辦。整個會議包含有生理學和流行病學(Physiology and Epidemiology)、臨床評估(Clinical Assessment)、

量測(Measurements)、生物動力反應(Biodynamic Responses)、生理反應(Physiological Responses)、減振(Vibration Reduction)、頻率比重(Frequency Weightings)、預防、評估和補償(Prevention, Assessment & Compensation)等共八大議題。研討會期間有就主題區分的系列專題論文發表、圓桌論壇(Roundtable)、及研討會(Workshop)。在時間的安排上，13日當天下午3:30~18:30為大會開幕及專題演講，演講主題為歐洲國家近40年在局部振動領域的發展；14日至16日9:00~17:00為就生理學和流行病學(Physiology and Epidemiology)等八大議題專題口頭論文發表及海報論文發表的議程；15日為圓桌論壇(Roundtable)提供各國專家學者討論在局部振動相關計畫推動的過程中，會遇到哪些問題，以及因應的方法；17日研討會(Workshop)主題是Alternative Frequency Weightings，探討ISO frequency weighting 與造成局部振動傷害相關的評估方式。因為參與學者專家人數眾多，討論相當熱烈。

本所在專題論文議程中，發表有關局部振動之論文「Mitigation of hand-arm vibrations in workers on a pneumatic nail gun assembly line」如附件一。本研究係探討氣動釘槍組裝線，作業員對於使用氣動把手所造成的高速手臂振動情況，研究發現，氣動釘槍組裝線作業員，以單手握持釘槍手柄，另一手握持氣動把手進行螺絲的安裝，作業員長期處於高速手臂振動的狀態，造成手指麻木等肌肉骨骼的危害，為減低振動暴露開發一組木製夾具來減少對組裝線作業員所造成的HAV，並透過實驗驗證木製夾具對於降低HAV的效益。本研究由3名男性、3名女性，共6名有經驗的作業員，進行組裝氣動釘槍時的振動測試，木製夾具固定在工作檯上以減少氣動扳手對工作台和釘槍組裝的影響，利用聚氨酯材料吸收衝擊來減少操作者的雙手振動暴露。受測者分別在有木製夾具和沒有木製夾具的情況

下，進行六次鎖緊螺絲的任務，每次操作將以三軸壓電式加速度規測量手部的HAV值，每次量測為十秒，並將結果輸出至記錄器。結果顯示，受測者在於有木製夾具的情況下進行氣動釘槍組裝，手部所受的HAV明顯降低，因此，使用夾具是一個減少HAV並且經濟可行的方法。

第12屆局部振動研討會會場如圖1，研討會口頭報告會場及專家學者討論情形如圖2，研討會口頭報告論文情形如圖3，研討會與會者發問如圖4、圖5，與研討會會場與學者合影如圖6、圖7，機械設備展示區照片如圖8、圖9，研討會歡迎晚宴如圖10。

圖1 研討會會場

圖2 研討會口頭報告論文的會場及專家學者討論情形

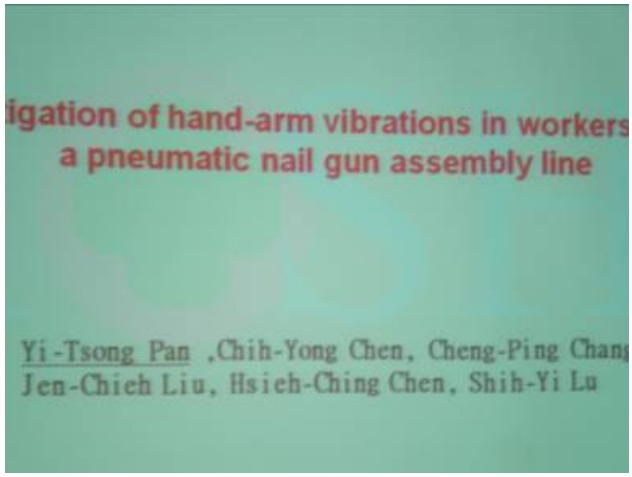

圖3 研討會口頭報告論文情形

圖4 研討會與會者發問

圖5 研討會與會者發問

圖6 於研討會會場與學者Dr. Mohammad Muzammil)及其研究同仁合影

圖7 於研討會會場與學者Dr. Ren G.Dong (左) Concordia University
Dr. Subhash Rakheja(中)、及日本近畿大學 前田節雄教授(右)合影

圖8 局部振動傷害減振機械設備展示區

圖9 局部振動傷害防護手套護具展示區

圖10 研討會歡迎晚宴

參、 參加研討會心得

一、在此次研討會中，局部振動(Hand-Arm Vibration)為各國學者投稿文章及參與程度最踴躍的議題，本次研討會將局部振動議題細分為八大領域，再針對細部主題進行不同的方式討論、發表。各國學者於會議中廣泛分享了目前各國與局部振動研究相關的現況、目標與未來規劃。

二、我國勞工安全設施規則，訂有針對預防局部振動造成危害之相關條文，由這次研討會當中，看到許多先進國家對於局部振動危害的防範與保護措施，值得學習。

三、本研討會每四年舉辦一次，亞洲國家在局部振動議題不如歐美國家發展迅速，但我國、大陸及日本等亞洲國家皆盡心參與，並提出國內相關研究論文。

四、第13屆的研討會在大陸極力爭取下，將在大陸舉辦，未來在局部振動相關的議題，應可學習歐美工業先進國家經驗，投注更多資源於此領域當中，在下一屆研討會中更積極參與。

肆、 結論與建議

此次參與第12屆HAV局部振動國際研討會，除了深感榮幸與國際學者分享研究成果外，亦深刻體驗職業衛生局部振動領域研究議題的廣泛，隨著國情不同各國對於局部振動的執行焦點亦不相同，當然能夠直接與國際學者直接交換研究心得，聽取不同思考模式及觀點，是此次與會的最大收穫，除了增加視野與增廣見聞外，亦給自己在未來的研究規劃、執行及業務推動上有更多的啟發。針對此次參與國際會議，提供下列建議：

(一)、應經由教育體系深植局部振動預防概念

當國外學者們積極討論如何將職業衛生局部振動領域觀念建立在教育體系內及完整規劃教育內容時，我們也應該思索局部振動預防概念在國內的教育環境中是否佔有過舉足輕重的角色。局部振動預防是與生活結合的，不是死板的研究學問，應深植局部振動預防概念於教育體制中，例如：使用電動手工具時，應了解該作業可能產生局部振動對人體的傷害，利用減振手套及其他方法，減少局部振動對人體產生的傷害及誘發相關疾病的可能性。

(二)、積極參與國際研討會議

HAV局部振動國際研討會每四年舉辦一次，雖多數亞洲國家在相關的議題不像歐美國家發展迅速，但仍有如大陸、日本等亞洲國家皆盡心參與，亦提出國內相關研究論文；大陸甚至極力爭取到下一屆的研討會之舉辦權。我國未來在局部振動相關的議題，可學習歐美國家經驗，投注更多資源於此領域當中，以及學習日、韓等亞洲國家積極參加各類型國際學術研討會議，以拓展勞研所在國際上能見度。

(三)、應加強國人對局部振動的重視

因台灣氣候不像歐美等國有寒冷的氣候，因此局部振動造成國人的危害相對較小；但因國內多數企業雇主與勞工較不注重局部振動危害。此次參與研討會當中，看到許多先進國家對於局部振動危害的防範與保護措施，值得學習，應加強國人對局部振動的重視。

(四)、善用外館等資源

我國在許多地方設有代表處，雖然外館通常作業都很忙碌，但是如果需要幫忙時仍可以先跟他們聯繫，獲得當地生活或交通資訊，故建議往後出國同仁，可以嘗試看看事先聯繫外館詢問相關事宜。

附件一　本所發表論文

Title: Mitigation of hand-arm vibrations in workers on a pneumatic nail gun assembly line

Authors & affiliations:
Yi-Tsong Pan [1],Chih-Yong Chen[1], Cheng-Ping Chang[1], Jen-Chieh Liu[2], Hsieh-Ching Chen[3], Shih-Yi Lu[4]
[1] Institute of Occupational Safety and Health, Council of Labor Affairs, Executive Yuan, Taiwan
[2] Department of Civil Engineering and Engineering Information, Chung Hua University, Taiwan
[3] Department of Industrial Engineering and Management, Chaoyang University of Technology, Taiwan
[4] Department of Occupational Safety and Health, Chung Shan Medical University, Taiwan

Keywords: prolonged standing, foot/floor interface, subjective rating

1. Introduction:

A pneumatic nail gun company has an assembly line on which operators have high rates of musculoskeletal complaints. The standard assembly procedure with highest complaint rate requires an operator grabbing the handle of an assembled nail gun by one hand and installing a screw top at the handle butt by the other hand (Fig.1(a)). Job rotation was adopted onsite to prevent operators from suffering numbness of the fingers. Inspectors interviewed operators and found that a task that involved the use of a pistol-grip air impact wrench caused high hand-arm vibration (HAV) to the both hands of each operator (Fig.1(b)).

In this preliminary study, a wooden fixture was developed to reduce the HAV caused by the impact wrench to assembly line operators. Experienced operators were recruited to assess the effectiveness of the fixture use in reducing their HAV. Experimental findings and operators' subjective feeling are reported in this paper.

(a) (b)

Figure 1. Work postures of an assembly operator while (a) installing a screw top at the handle butt and (b) tightening the screw top using an impact wrench

2. Methods:

2.1 Apparatuses

Vibrations transmitted to operators hand during the use of a pistol-grip air impact wrench were measured by using three piezoelectric accelerometers (model 4374L, Brüel & Kjær, Denmark). These accelerometers had a frequency sensitivity range of 1–26000Hz, and was pre-calibrated for excitation of 10 m/s2 (r.m.s.)/159.2 Hz with a hand-held calibrator (model 4294, Brüel & Kjær). These three accelerometers were mounted on a lightweight adapter, which is held in contact with the handle-hand interface by the operator, to measure the vibration level in three orthogonal axes (X, Y

and Z). Accelerometer outputs were connected to a 3-channel amplifier (model 2693, Brüel & Kjær) with a signal conditioning gain of 31.6 mV/G. Outputs of the amplified signals were recorded on a portable data logger at a rate of 5000 samples/s per channel. The logger stores collected data on a compact flash memory card. The logged data were downloaded onto a personal computer using a card reader for further data processing (Chen et al. 2006).

A simple wooden fixture, which fastened the impact wrench to a worktable and held the assembly part of nail gun, was designed to reduce the vibrations of operators' hands with shock absorbable polyurethane material (Fig. 2).

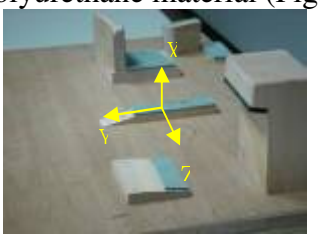

Figure 2. The designed wooden fixture and directions of coordinate system for HAV measurement.

2.2 Subjects

Six experienced operators (three males and three females) were recruited as subjects from assembly line for HAV tests. All subjects were informed about the purpose of the study and signed a consent form before conducting the experiments. All subjects were asked to complete two assembly tasks of fastening screw top, with and without the wooden fixture (WF/WOF), with a 5-minute rest break between each task. For task with fixture plate, each subject caped the screw top, held the assembled nail gun and lodged it in L-shape hook of the fixer, and triggered a fastened impact wrench to tighten the screw top up (Fig. 3(a)). For task without a fixture, subjects performed daily assembly task by holding the assembled nail gun on the worktable by their left hand while tightening up the screw top using an impact wrench (Fig. 3(b)). Each operator repeated six trials with HAV measured three times in each hand. A 10-second data was taken for each trial.

(a) (b)

Figure 3. Subjects' typical posture in performing screw top fastening task (a) with and (b) without the fixture use

2.3 Data Analysis

The HAV levels, frequency-weighted root mean square acceleration, with and without fixture plate use were evaluated according to the ISO 5349-1 (2001) and ISO 8041 (2005) standards using Viewlog software (Chen et al., 2009). The improvement made in each measurement direction by use of the fixture was tested by using Wilcoxon test. The difference was considered significant at a level of $p<0.05$.

3. Results:

Experimental measurements show the greatest mean HAV level (8.88 m/s2) was

obtained in the part-holding hand in palmar direction (X-direction). The greatest mean HAV level (4.14 m/s2) in the tool-gripping hand was in the bushing spinning direction (Z-direction). Measured results indicate that the dominant HAV levels were significantly reduced in both hands (Table 1). The dominant frequency-weighted root mean square acceleration was reduced by 73.4% (from 4.14 to 1.10 m/s2) in the tool-gripping hand and by 47.4% (from 8.88 to 4.67 m/s2) in the part-holding hand. All subjects reported a recognizable reduction of HAV in task with fixture use.

Table 1. HAV level in the tool-gripping and part-holding hands (Mean±SD, unit: m/s2) and differences between tasks

Part-holding	Task (n=5)		Difference
Direction	WF	WOF	
X*	8.880 ±0.528	4.667 ±0.198	47.4%
Y*	4.857 ±0.253	2.208 ±0.459	54.5%
Z*	2.709 ±0.156	1.275 ±0.583	52.9%
Tool-gripping			
X	2.237 ±0.585	1.563 ±0.387	30.1%
Y	0.981 ±0.445	0.627 ±0.106	36.1%
Z*	4.144 ±0.361	1.102 ±0.348	73.4%

* $p<0.05$ for significant task difference by Wilcoxon test

4. Discussion:

Despite significant decrease in dominant requency-weighted acceleration was acheived using fixture plate, only 30% reduction (from 2.237 m/s2 to 1.563 m/s2) was obtained in palmar direction (X-direction) in the tool-gripping hand. This may because the plastic tie, which fixes and restricts vertical movement of the impact wrench, cannot diminish verticval vibration effectively. Metal binders together with anti-vibration material should be able to replace the plastic tie and obtain better vibration attenuation in operators' tool-gripping hands.

Under consideration of work efficiency, the fixture design requires assembly parts to be fixed and removed easily. Therefore, the loose-fitting L-shape hook was used to expedite lodging in the assembly part. However, such design still requires an operator to hold the assembly part while tightening the screw top by an impact wrench. This design reduces HAV of the part-holding hand without the fixture use only by 47.4% to reach a vibration level of 4.67 m/s2.

This preliminary study demonstrates an economically feasible means of reducing HAV in an industrial context by using a fixture and anti-vibration polyurethane material. An improved fixture design in the future that helps holding the assembly part seems promising to reduce the HAV level further in operators' part-holding hands.

附件二　會議議程及內容

Program

Langues officielles

Les renseignements généraux et les services offerts lors de la conférence sont dans les deux langues officielles du Canada : en anglais et en français. Toutefois, dû à la nature internationale de la conférence, le programme scientifique sera offert en anglais seulement.

Official Languages

General information and services at the Conference are provided in Canada's two official languages: English and French. However, due to the international nature of this conference, the Scientific Program will be offered in English only.

Monday 13 June 2011	
1530-1645	**Conference Official Opening and Welcome** – Governor General III Room Honorary Guest Speaker: Mr. Rognvald Taylor, formerly Assistant Principal, North Highland College and Dean of Science and Technology, University of The Highlands and Islands, Scotland.
	Plenary Lecture: *Joël's Breaker: Forty Years of European Vibration Experience* Patrice (Manu) Donati
1700-1830	**Opening Reception and Exhibitors** – Governor General II Room
Tuesday 14 June 2011	
0900-1700	**Exhibits** – Governor General II Room
0900-1030	Physiology and Epidemiology – Governor General III Room Chairs: M. Bovenzi and K. Krajnak
0900-0915	*Assessing Impact-Tool Vibration Damage of Tissues in a Rat-Tail Model* D.A. Riley, S. Govinda Raju, J.L.W. Bain
0915-0930	*Recovery of Vascular Function After Exposure to a Single Bout of Vibration* K. Krajnak, S. Waugh, C. Johnson, R. Miller, S. Li, M. Andrew
0930-0945	*Analysis of Spatial Resonance in a Small Vessel to Study Vibration-Induced Digital Vascular Disorder* S. Pattnaik, R. Banerjee, J. Kim
0945-1000	*Follow-Up Study of Vascular and Sensory Functions in Vibration-Exposed Shipyard Workers* M. Bovenzi, F. Ronchese, M. Mauro
1000-1015	*Neurophysiologic Symptoms and Vibration Perception Thresholds in Young Vibration-Exposed Workers – A Follow-Up Study* L. Gerhardsson, L. Burström, M. Hagberg, R. Lundström, T. Nilsson
1015-1030	*Longitudinal Study of Suomussalmi Forestry Workers – Vibrotactile Thresholds* A. Brammer, P. Sutinen, E. Toppila, I. Pyykkö. M.G. Cherniack, M.J. Eaman, D.R. Peterson, J. Starck
1030-1100	**BREAK and EXHIBITS – Governor General II Room**
1100-1230	Clinical Presentation – Governor General III Room Chairs: R. House and T. Nilsson
1100-1115	*Detection of Sensory Disturbances in 23 HAVS Cases with Typical Arterial Disorders: 15 Hypothenar Hammer Syndrome, 3 Thromboangiitis Obliterans and 5 Arteriosclerosis Obliterans* H. Kaji, K. Endo, K. Takeda, H. Hagihara, M. Asada, K.Eya, H. Honma
1115-1130	*Hypothenar Hammer Syndrome: An Under-Diagnosed Cause in Workers Exposed to Hand-Arm Vibration* A. Turcot, M. Fortier, M.D. Dimitrescu
1130-1145	*Qualitative and Quantitative Characteristics of Pain Syndrome in Hand-Arm Vibration Syndrome (HAVS)* V. Shirokov , I. Krivtsova, E. Bakhtereva, O. Shirokova, M. Granovskya

1145-1200	*Combinations of Exposure to Vibration, Noise and Ergonomic Stressors in the Swedish Work Force Affect Musculoskeletal Health Outcomes* M. Hagberg, A. Jonsson
1200-1215	*Vibration-White Foot in a Worker with Direct Vibration Exposure to the Feet* A. Thompson, T. Eger, K. Krajnak, R. House
1215-1230	*New Standard Criteria for Cold Provocation Test with Hand Immersion for Cases of HAVS in Japan* T. Ishitake, S. Sato, Y. Kume, T. Nagase, H. Sakakibara, N. Toibana, Y. Kurozawa, K. Miyashita, H. Mahbub, N. Harada
1230-1400	**LUNCH – Delegates free for lunch**
1400-1530	Measurements – Governor General III Room Chairs: U. Kaulbars and P. Marcotte
1400-1415	*Examination of the Adaptor Approach for the Measurement of Hand-Transmitted Vibration Exposure* X.S. Xu, D.E. Welcome, C. Warren, T.W. McDowell, R.G. Dong
1415-1430	*Method to Evaluate the Running Time of Pneumatic Tools in a Car Workshop* E. Toppila, R. Pääkkönen, R. Sauni
1430-1445	*Development of a Low-Cost System to Evaluate Coupling Forces on Real Power Tool Handles* P. Marcotte, S. Adewusi, S. Rakheja
1445-1500	*Laboratory Assessment of Vibration Emissions from Vibrating Forks Used in Simulated Beach Cleaning* T.W. McDowell, X.S. Xu, C. Warren, D.E. Welcome, R. G. Dong
1500-1515	*Longitudinal Study of Suomussalmi Forestry Workers – Vibration Exposure* D.R. Peterson, A.J. Brammer, E. Toppila, M.G. Cherniack, P. Sutinen
1515-1530	*Gunshot Power Absorption Field Measurement* E. Marchetti, R. Di Giovanni, A. Tirabasso, A. Lunghi, F. Morgia
1530-1600	**BREAK and EXHIBITS – Governor General II Room**
1600-1730	Biodynamic Responses – Governor General III Room Chairs: R. Dong and J. Kim
1600-1615	*Investigation of the 3-D Vibration Transmissibility on the Human Hand-Arm System Using a 3-D Scanning Laser Vibrometer* D.E. Welcome, R.G. Dong, X.S. Xu, C. Warren, T.W. McDowell, J.Z. Wu
1615-1630	*3-D Mechanical Impedances Distributed at the Fingers and Palm of the Hand* R.G. Dong, D.E. Welcome, X.S. Xu, C. Warren, T.W. McDowell, J.Z. Wu
1630-1645	*Factors Influencing the Hand-Arm Mechanical Impedance* G. Moschioni , B. Saggin, M. Tarabini
1645-1700	*Analyses of Distributed Absorbed Power Responses of the Human Hand-Arm System in the Bent- and Extended-Arm Postures* S. Adewusi, S. Rakheja , P. Marcotte
1700-1715	*Study of Vibration Transmission on a Paver's Hand Hammer* U. Kaulbars, N. Raffler
1715-1730	*New Approach to Model the Hand-Arm System for Analysis of Musculoskeletal Disorders* S. Pattnaik, J. Kim

Wednesday 15 June 2011	
0900-1100	**Exhibits – Closing Session** Governor General Room II
0900-1030	Physiological Responses – Governor General III Room Chairs: T. Eger and M. Griffin
0900-0915	*Reductions in Finger Blood Flow Induced by Low Magnitude Hand-Transmitted Vibration* Y. Ye, M.J. Griffin
0915-0930	*Perception of Hand-Transmitted Vibration: Can Vibration of One Hand Mask Perception of Vibration in the Other Hand?* M. Morioka
0930-0945	*Thermotactile Thresholds Before, During, and After Exposure to Hand-Transmitted Vibration* S.A. Seah, M. J. Griffin
0945-1000	*Evaluation of Gender Differences in Foot-Transmitted Vibration* P. Singh, T. Eger, J. Dickey, R. House, M. Oliver
1000-1015	*Fundamental Study of Vibrotactile Perception Threshold on Japanese –* *Vibrotactile Perception Thresholds Using New Measurement Equipment* M. Tateno , R. Nakajima, K. Yoshikawa, J. Fukumoto, S. Takemura, K. Yoshimasu, K. Miyashita, N. Miyai, Y. Nasu, S. Maeda
1015-1030	*Effect of Work Rest Schedule on Perceived Discomfort Score and Thermal Threshold Shift of Operators Using Hand-Held Vibrating Machines* J. Singh, A.A. Khan, M. Muzammil
1030-1100	**BREAK and EXHIBITS – Governor General II Room**
1100-1230	Clinical Assessment – Governor General III Room Chairs: N. Harada and A. Thompson
1100-1115	*Effect of Hand-Arm Vibration and Proximal Neuropathy on Current Perception Threshold Measurement in the Fingers* R. House, K. Krajnak, A. Thompson, D. Jiang
1115-1130	*Fundamental Study of Vibrotactile Perception Threshold on Japanese –* *Effectiveness of New Equipment to Diagnose Workers Exposed to Hand-Transmitted Vibration* J. Fukumoto, S. Maeda , S. Takemura , K. Yoshimasu, R. Nakajima, M. Tateno, K. Yoshikawa, N. Miyai, Y. Nasu, K. Miyashita
1130-1145	*Measuring Conditions of Cold Provocation Tests: A Review of the Literature* S. Takemura, S. Maeda, J. Fukumoto, K. Yoshimasu, R. Nakajima. M. Tateno, K. Yoshikawa, N. Miyai, Y. Nasu, K. Miyashita
1145-1200	*Comparison of Cold Immersion Tests With Water 12 and 10 Degrees Celsius for 5 Minutes in Diagnosing Vibration-Induced White Finger* H. Mahbub , T. Ishitake, N. Kurozawa, N. Toibana, N. Harada
1200-1215	*Guidelines of the Japanese Research Society for Vibration Syndrome to Diagnose Hand-Arm Vibration Syndrome* N. Harada, M. Hirata, T. Ishitake, Y. Kume, Y. Kurozawa, K. Miyashita, H. Sakakibara, S. Satou, N. Toibana, H. Mahbub
1215-1230	*Clinical Assessment of HAVS: Controversies in Diagnosis and Measurement* R. House, A. Thompson
1230-1400	**LUNCH - Delegates free for lunch**

1400-1730	**Roundtable for Screening and Surveillance for HAVS** Governor General III Room Chairpersons: A. Turcot and R. House *The Roundtable will provide an opportunity to share experiences and discuss perspectives on the challenges of developing successful screening and surveillance programs for HAVS. It will include presentations and discussion on what's not working, and what seems to be working, which in turn will provide direction on how such programs can be improved. Invited speakers:* 1405 **R. House:** Issues with screening and surveillance for hand-arm vibration syndrome. 1415 **L. Bherer:** Presentation of the Quebec Reference Framework for occupational disease screening and medical surveillance. 1435 **A. Turcot:** Application of the Quebec Framework to a population of workers exposed to vibration in the workplace. 1455 **S. Stock:** Organizational context for occupational disease screening and medical surveillance in Quebec: The public health network for occupational health. 1515 Questions and discussion 1530 – 1600 BREAK 1600 *Panel discussion of experiences in different jurisdictions. Guest panelists and the audience will be invited to discuss the approaches used in their countries.* 1730 Close
1400-1530	**Poster Session** – Governor General II Room Chairs: M. Hagberg and D. Reynolds
1530-1600	**BREAK - Governor General II Room**
1530-1630	**Poster Session – Final**
Thursday 16 June 2011	
0900-1030	Vibration Reduction – Governor General III Room Chairs: P.-E. Boileau and S. Rakheja
0900-0915	*Redesign of Hand-Held Impact Machines to Reduce Hand-Arm Vibration* H. Lindell
0915-0930	*Reduction of Vibrations Generated by an Impact Wrench* G. Moschioni, B. Saggin, M. Tarabini, M. Marrone
0930-0945	*Mitigation of Hand-Arm Vibration in Workers on a Pneumatic Nail Gun Assembly Line* Yi-Tsong Pan, Chih-Yong Chen, Cheng-Ping Chang, Jen-Chieh Liu, Hsieh-Ching Chen, and Shih-Yi Lu
0945-1000	*Quantification and Comparison of Selected Material Properties for Anti-Fatigue Mats to Investigate Vibration Transmission Reduction Potential* D. Boucher, M. Oliver, T. Eger
1000-1015	*Evaluation of the Transmissibility Properties of Anti-Fatigue Mats Used by Workers Exposed to Foot-Transmitted Vibration* M. Leduc, T. Eger, A. Godwin, J.P. Dickey, M. Oliver
1015-1030	*Ergonomic Modification and Evaluation of the Chain Saw Handle in Wood Cutting* G. Raghav, M. Farooq, A.A. Khan, M. Muzammil
1030-1100	**BREAK – Governor General II Room**

1100-1230	Frequency Weightings – Governor General III Room Chairs: S. Maeda and T. McDowell
1100-1115	*Characterization of Frequency-Dependent Responses of Sensory Nerve Function to Repetitive Vibration* K. Krajnak, S. Waugh, C. Johnson, R. Miller, S. Li, M.L. Kashon
1115-1130	*Frequency Weighting of Hand-Transmitted Vibration for Evaluating Comfort* S. Maeda, S.G. Geridonmez, K. Miyashita, K. Ishimatsu
1130-1145	*Relative Performance of Frequency Weighting W_s and Candidates for Alternative Frequency Weightings When Used to Predict the Occurrence of Hand-Arm Vibration Induced Injuries* P. Pitts, H.J. Mason, K.A. Poole, C.E. Young
1145-1200	*Posture-Related Change in Frequency Weightings Derived from Vibration Power Absorption of The Hand-Arm System* N. Shibata, K. Ishimatsu, S. Maeda
1200-1215	*VPA-Based Weighting Curve: Preliminary Assessment of Gender Difference* E. Marchetti, F. Morgia, G. Filligoi, A. Lunghi, L. Fattorini
1215-1230	*Repetitive Shock Vibration Risk Assessment for Gunshots* E. Marchetti, R. Di Giovanni, A. Tirabasso, A. Lunghi, F. Morgia
1230-1400	**LUNCH – Delegates free for lunch**
1400-1530	Prevention, Assessment & Compensation - Governor General III Room Chairs: M. Donati and D. Peterson
1400-1415	*Investigation of the Relationship between Vibration Emission and In-Use Vibration for Electrical Tools* E.P. Shanks, S.M. Hewitt, P. Pitts
1415-1430	*Assessment of Hand-Arm Vibration Exposure by Means Estimation Methodologies: Comparison Between Vibration Databases (ISPESL) and Information Provided by Tool Manufacturers* R. Nitti, P. De Santis, P. Nataletti
1430-1445	*Impact of European Directive 2002/44/EC on the Risk of Developing Hand-Arm Vibration Syndrome in Great Britain* P. Brereton
1445-1500	*Current Status of Hand-Arm Vibration Syndrome in China – Occurrence, Laws, and Measures of Prevention and Control* Gao Xing, Sun Li, He Li Hua, Liu Yao Yao, Wei Yun Fang, Liu Zhao Qi
1500-1515	*Compensation of Hand-Arm Vibration Syndrome in Canada* A. Thompson, A. Turcot, S. Youakim, R. House
1515-1530	*Review of Legal Suits Involving Hand-Arm Vibration* T. Jetzer
1530-1600	**BREAK – Governor General II Room**
1600-1645	Outreach, Knowledge Transfer and Implementation – Governor General III Room Chairs: M. Cherniack and M. Eaman
1600-1615	*Glove Use and Education in Workers with Hand-Arm Vibration Syndrome* K. Rowley, D. Ajami, D. Gervais, L. Mooney, A. Solheim, I. Kudla, D.L. Holness, S. Switzer-McIntyre
1615-1645	Panel Discussion
1645-1715	**Conference Closing** – Governor General III Room Presentation of the Taylor Award by Rognvald Taylor, formerly Assistant Principal, North Highland College and Dean of Science and Technology, University of The Highlands and Islands, Scotland. Invitation to the 13th International Conference on Hand-Arm Vibration, 2015 Closing: A.J. Brammer

Friday 17 June 2011	
0900-1630	**Workshop on Alternative Frequency Weightings** Governor General III Room Chairs: A.J. Brammer and P. Pitts *The suitability of the "ISO frequency weighting" for assessing the risk of persons developing vibration-induced white finger will be discussed, and alternative frequency weightings derived from different perspectives will be considered. Invited speakers:* 0900 **K. Krajnak:** Experiments with animals and other human surrogates. 0945 **M.J. Griffin:** Frequency-dependence of psychophysical and physiological responses to hand-transmitted vibration. 1030 – 1100 BREAK 1100 **R. Dong:** Foundation and derivation of biodynamic response-based frequency weighting. 1145 **M. Bovenzi, I. Pinto, M. Mauro, F. Ronchese:** Epidemiological evidence for new frequency weightings of hand-transmitted vibration. 1230 – 1400 LUNCH (Delegates free for lunch) 1400 **A.J. Brammer, P. Pitts:** Frequency weightings compatible with vibration exposure-based models. 1445 *The papers will be followed by unscheduled brief presentations, and discussion. The workshop will attempt to reach a consensus on the need for an alternative frequency weighting.* 1630 Close