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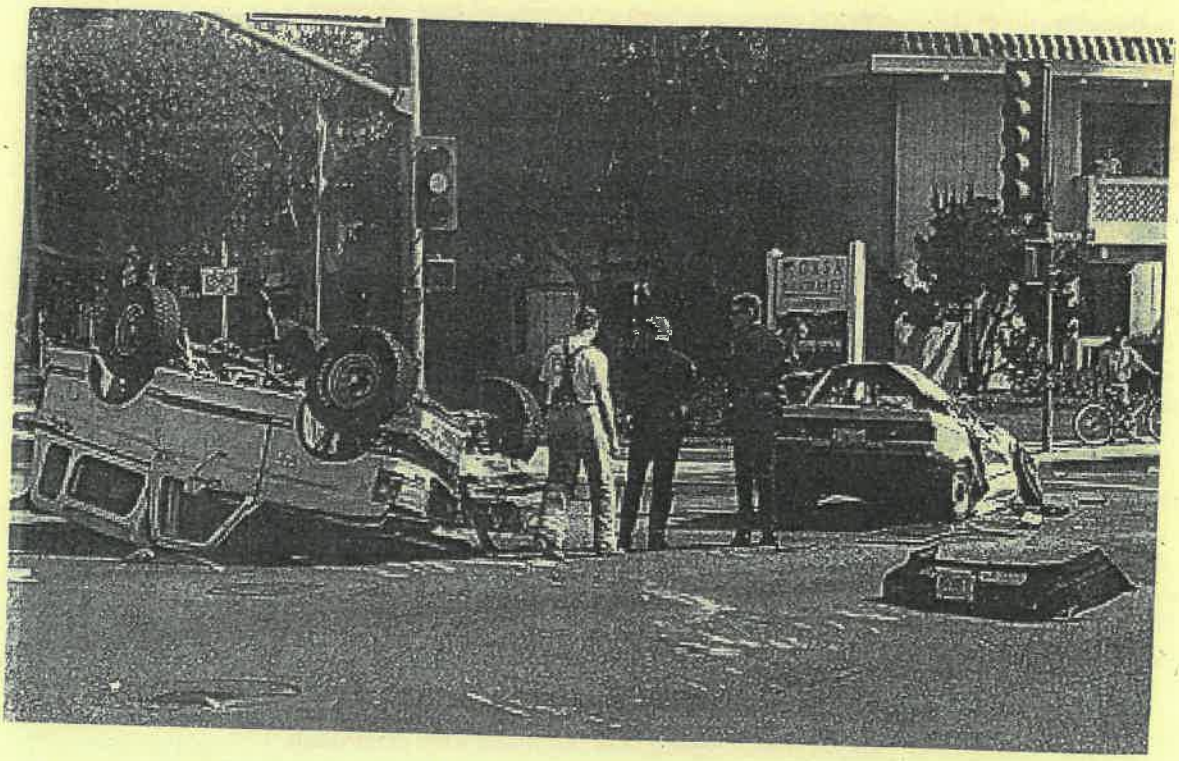

Pictured above: Road Safety

WORLD SAFETY ORGANIZATION (WSO)

Profile

The WSO was founded in 1975 in Manila, The Republic of the Philippines, as a result of a gathering of over 1,000 representatives of safety professionals from all continents at the First World Safety and Accident Prevention Congress. The WSO World Management Center was established in the United States of America in 1987 to be responsible for all WSO activities, the liaison with the United Nations, the co-operation with numerous Safety Councils, professional safety/environmental (and allied areas) organizations, WSO International Chapters/Offices, Member Corporations, companies, groups, societies, etc. The WSO is a not for profit corporation, non-sectarian, non-political movement to **"Make Safety a Way of Life"**.

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The World Safety Organization:

- Publishes WSO Newsletters, World Safety Journal - ESP, and WSO Conference Proceedings.
- Provides a network program linking various areas of professional expertise needed in today's international community.
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- Annual awards include the World Environmental/Occupational Safety Person Award, WSO James William Award, WSO Educational Award, WSO Concerned Citizen Award, WSO Concerned Safety Professional, WSO Concerned Company/Corporation Award, WSO Concerned Organization Award, Chapter/International Office of the Year Award, WSO Award For Achievement In Scientific Research and Development and International Award.
- Provides recognition for safety publications, films, videos and other training and media materials that meet the WSO required educational standards.
- Receives proposals from professional safety groups/societies for review and if applicable, submits them to the United Nations for adoption.
- Establishes and supports divisions and committees to assist members in maintaining and updating their professional qualifications and expertise.
- Chapters and International Offices located throughout the world provide contact with local communities, educational and industrial entities.
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- Members receive special hotel rates when attending safety programs, conferences etc., sponsored by the WSO.

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Editorial

By: Dr. Janis Jansz

In 2005 a six year old A340 Jet Air Bus of the Air France Airline seemed not to have enough room to stop in the wet at the Toronto Pearson Airport in Canada before the Jet ran out of tarmac. The aircraft careered off the runway and smashed into a ravine. The good news is that all of the 309 people on this jet were able to safely leave the crashed plane before it was consumed by fire.

The reason for everyone escaping alive after the jet crash was given as the fact that "*safety was included in the design stage*" of this plane. The jet had fire retardant materials used for everything from seat covers to cabin panels to curtains. When the jet burst into flames after it crashed the fire retardant materials slowed down the spread of the fire so that all passengers and crew were able to have the time required to safely exit the aircraft and move to a safe distance away from the burning plane. When investigating this accident James Hotson of the United Kingdom's Civil Aviation Authority (No miracle, just safer design, 2005) reported that the aircraft had seat anchors that withstood 16-g deceleration. This helped to prevent passengers sustaining crush injuries when the aircraft crashed. The seat anchor strength near the emergency exits held the passenger seats firmly and prevented loose seats from blocking the emergency exits. This meant that all emergency exits were available for use for safe exit by the crew and passengers from the crashed plane.

The professional people who included safety when planning for emergency situations were responsible for saving these passengers and crews life. The people who sold these safety products to Air France need to be proud of the fact that their products have been proven to be effective in an emergency situation. Company personnel, who planned, implemented and paid for safety to be included in the design stage of this aircraft are responsible for saving at least 309 lives through their actions. Equipment can be replaced. A mother, father, children and friends can not so easily be replaced. For people who promote safety in their workplace this is an important story to use to show the benefits of including safety in the design stage of workplace buildings, products and equipment used and in every day planning for work related activities and for emergency situations that could arise.

Reference: No miracle, just safer design. (2005, August) *New Scientist. 187*(2512), 4.

ARTICLE SUBMISSION

Articles for inclusion in this journal will be accepted at anytime. However there can be no guarantee that the article will appear in the following journal issue.

All articles shall be written in concise English and typed with a minimum font size of 12 point. Articles should have an abstract of not more than 200 words. Articles shall be submitted as Time New Roman print and on a 3.5" diskette with the article typed in rtf (rich text format) and presented in the form the writer wants published. On a separate page the author should supply the author's name, contact details, professional qualifications and current employment position. This should be submitted with the article.

Writers should include all references and acknowledgments. **Authors are responsible for ensuring that their works do not infringe on any copyright. Failure to do so can result in the writer being accountable for breach of copyright.** The accuracy of the references is the author's responsibility.

References.

Articles should be referenced according to the Publication Manual of the American Psychological Association 2002. For example. Books are referenced as follows.

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Author (Year). Title of article. *Name of Journal. Volume* (Issue), Page numbers of article.

Internet information.

Name of author. (Year of publication).*Name of article.* [on-line]. Available WWW;http:// and the rest of the Internet path address. [Access date].

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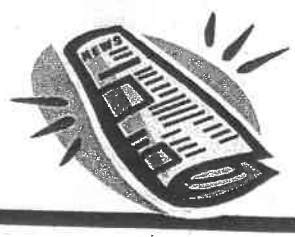
Or Emailed to editorialstaff@worldsafety.org

Articles, where ever possible, must be up-to-date and relevant to the Safety Industry.
All articles are Blind Peer Reviewed by at least two referees before being accepted for publication.

ISSUE DEADLINES

March	31 January	June	30 April
September	31 July	December	31 October.



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*) For your countries fee rate, please contact the World Management Center

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Education, Example and Foresight; Key Road Safety Factors

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Abstract

This article briefly sheds the light on the road safety situation in Lebanon. It stresses the fact that the three best methods of achieving a safer Lebanon, at least with respect to the human factor, are through education, example, and foresight.

Introduction

Accidents, no matter what the type, are all the result of inadequate knowledge, improper attitudes and habits, unsafe behavior, insufficient skill, environmental hazards, carelessness, or failure to assume personal responsibility for one's own actions. As it stands now, carelessness and its ever-present brothers: inattention, unconcern, neglect, ignorance, and poor judgment, lurk in every city, skulk in every home, and annually take a significant toll in terms of money, resources, and human lives on the road network of Lebanon. The poor safety record in Lebanon costs about $750 million dollars a year. This article describes some issues which could prove to be effective in bringing safety back to the roads of Lebanon.

Education, Example and Foresight

Looking ahead, probably the three best real methods of achieving a safer Lebanon, at least with respect to the human factor, are through education, example, and foresight.

- ***Education*** is the most positive and the most direct method of accident prevention. Safety education, however, must mean more than a course in grade school or high school. It must and should include all phases of informing the public. Education of this type would encompass everything from the most simple caption less poster to the most elaborate of safety education courses offered in schools or through some safety-promoting organizations.
- While education is a preventive means of averting accidents, it is hard to deny the fact that ***example*** and ***experience*** are the better teachers. Examples afford an extremely effective method of encouraging safety. A person who is constantly exposed to wise and carefully thinking people will undoubtedly adopt many of the good habits that are a vital part of safe living. Often this "silent" teaching method is more effective than words.
- ***Foresight*** means using the past as a possible mirror to the future.

Recommendations in the article "Learning from the experiences of others," are based on studies carried out by the European Union Working Party on Traffic Safety Education at School and Training of Young Drivers (European Road Safety Federation, 1995) These research based recommendations cover the following areas of activity:

- traffic safety education for pre-school children,
- traffic safety education at school,
- preparation for obtaining a driving license,
- qualification of driving instructors, and
- driving test,

and could prove, in the long run, effective in improving road safety in Lebanon. Specifically, efforts should be made to ensure in the future that all safety measures aimed at influencing behavior in traffic - in particular road safety training and driver instruction - are designed in such a way that individual activities build on one another.

Generally speaking, measures to train, educate or instruct are always more important at the beginning of a new phase of involvement in traffic, as pedestrian, cyclist, moped or motorcycle rider, car driver, etc. These activities should all have the following features:

- progressive increase in difficulty of tasks to be carried out in traffic and gradual transition from situations where participants are protected and guided to situations where they make their own independent decisions;
- creation of a (social and physical) environment in which learners' mistakes are picked up and do not lead to immediate catastrophes ('error-tolerant' system);
- an adequate level of preparation or training of those giving instruction or providing training (parents, nursery school teachers, teachers, driving instructors).

These basic principles are valid generally. Efforts to implement them must take account of both the age of the road user and the activity being introduced. The following paragraphs outline possible implementation for
(a) children of preschool age,
(b) children of school age, and
(c) young people learning to drive.

(a) Road safety training for pre-school age children

Children beginning to extend their activities onto the road must be protected and supervised. In the early stage the need for protection must predominate and should only gradually be replaced by measures which encourage children to be independent and make their own decisions.

The safety of children cannot be guaranteed by educational activities alone. Account must also be taken of children's potential behavior when planning roads and traffic measures, in drawing up traffic regulations and in town and in traffic planning. Motorists should be reminded of child safety both when they are learning to drive and later by means of publicity campaigns.

A most significant observation is that parents have the highest responsibility for providing their pre-school children

with road safety training. They should be prepared to carry this out. An appropriate source for training needs to be created, possibly involving nursery schools.

(b) Road safety training for children and young people at school

Road safety training at school should ideally be included in curricula at all stages and all types of school. When starting primary school, pupils should be given training on road safety related to the route to and from school. Cycle training should be offered at a later stage to those children who wish to ride bicycles.

During secondary education, cycle and moped/motorcycle riding and the selection of means of transport should be dealt with. Education should be provided on basic traffic matters. At this time increasing attention should be given to motor vehicles and preparation for learning to drive.

Qualified instruction in road safety training requires that teacher training schemes include appropriate courses. In addition, further training for teachers should incorporate new information and developments and demonstrate methods of providing effective road safety training.

(c) Stages in obtaining a full driving license

The driving test has a decisive influence on the teaching of driving, because previous experience has shown that only the areas which are examined are taught. Still, because of its random test nature, the driving test (in the opinion of some countries) alone cannot ensure that the novice driver is sufficiently qualified to master the complexities of traffic. Knowledge, understanding and correct conduct are more thoroughly attained during training and not by the test. Thus training before the driving test is compulsory in some countries.

However, it is by no means guaranteed that this training is provided by qualified driving instructors. In some countries, training by non-professionals (parents, relations, acquaintances) is possible, partly in combination with compulsory attendance at a driving school, but also sometimes not.

Training by professional and well-trained driving teachers has some indisputable advantages over training by non-professionals. These include: qualified driving instructors systematically structure the lesson, can better recognize learning progress and mistakes, and can provide better integration between theoretical and practical training. Conversely there are also advantages to training by non-professionals. It is cheaper and it may be assumed that the novice driver covers more kilometers during this type of training, thus gaining more experience of road traffic than through (expensive) driving lessons alone.

Since learning to drive is a demanding task, the importance of learning with professional driving instructors, who have been specially trained and have passed the appropriate examinations, should be stressed. The time between the instruction phase and fully independent and autonomous driving should be arranged so that the learner driver does not suddenly move from the status of learner to that of a fully entitled driver without a transitional period. It is important to differentiate between measures taking effect prior to the attainment of a driver's license (e.g. accompanied driving) and those after its attainment (e.g. restrictions for beginners).

Accompanied driving

Drivers should be allowed to drive only after a minimum number of hours of driving with a professional driving instructor and, depending on the instructor's assessment, only if accompanied by an experienced driver designated by name, for whom stringent requirements are stipulated. It should be ensured that accompanied driving lasts for at least six months and that the newly-qualified driver and his companion have professional supervision during this time.

This approach corresponds to the model which is in current use in France. Yet, as a restrictive condition, it should be noted that this model is in use with juveniles aged 16 and over, so that this fact already denies a generalization of this model. Furthermore, Germany, for example, rejects any driving education not based on professional trainers.

Driving license following on probationary period

Newly-qualified drivers could be subject to special measures upon committing traffic offenses or causing accidents, such as further instruction by professional driving instructors or psychologists (e.g. in the case of drink-related offenses), retaking of the test and - where appropriate - withdrawal of their license (German approach).

Newly-qualified drivers could for a period of perhaps two or three years be subject to certain restrictions such as special speed limits, a total ban on alcohol or a ban on driving at certain times (e.g. at night, over the weekend), a limitation on vehicle power, or restriction on passenger numbers (the approach used for example in Italy and Spain).

It is important that restrictions and conditions during the probationary period are viewed positively, and not as discrimination aimed at newly-qualified drivers.

Conclusion

It is the thinking, the caring, and the acting of every human being through education, example, and foresight that will improve safety among the people of Lebanon.

Reference

European Road Safety Federation. (1995). Learning from the experiences of others. *European Newsletter on Road Safety*. 3, p.1.

The Effect Of Vibration On Inducing Fatigue In Heavy Truck Drivers

By: Mr. John Lambert, MIEAust, CPEng 180 785; Bachelor of Engineering (University of Melbourne), ARMIT (Mechanical); Director, John Lambert & Associates Pty Ltd. Email address for contact: lambertj@bigpond.com

Abstract

Fatigue and vibration with heavy vehicles have been referenced in the FORS *Investigation into the Specification of Heavy Trucks and Consequent Effects on Truck Dynamics and Drivers* by Sweatman and McFarlane, the ATSB report *Heavy Vehicle Seat Vibration and Driver Fatigue* by Mabbott, Foster and McPhee; and the *Report of Inquiry into Safety in the Long Haul Trucking Industry* by Professor Michael Quinlan Inquiry. All these have recommended "further research". However further research in not needed given the large numbers of trucks that have been subject to vibration testing by Vibration testing companies, and the results of the FORS and ATSB investigations which showed levels of vibration above health limits and/or that there was sufficient evidence that exposure to vibration could cause drivers to suffer back injury and other health problems.

This paper goes further based on information from drivers with "problem" trucks. It considers the indirect effects on drivers, and especially owner drivers, of unreasonable levels of vibration, and how these can result in driver fatigue. The indirect effects include:

- The driver having to reduce vehicle speed, hence increasing hours of driving and fatigue;
- Heavy vibration at the driver's seat usually means that the vehicle is subject to heavy vibration also so that vehicle components have a reduced life and there is more downtime for maintenance. The driver has to make up for the hours lost while the vehicle is being fixed. Hence he undertakes increased hours of driving and hence increased fatigue;
- There is an increase in maintenance costs due to the reduction in component life. Hence the driver has drive more hours to earn more money to pay for those maintenance costs. And the increased hours of driving increase fatigue; and

Finally the increased stress on the driver compounds the fatigue he experiences.

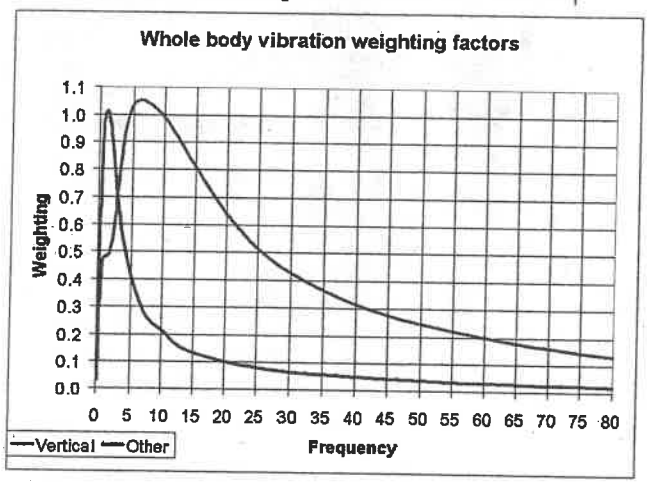
Whole Body Vibration – Effects on Humans

The Internationally recognized standard for whole body vibration is *ISO 2631-1 second Edition: Mechanical vibration and shock – Evaluation of human exposure to whole body vibration.* This has been adopted as the Australian Standard. For heavy vehicle vibration evaluation the relevant part is *Part 1 – General Requirements* For a seated driver, vibration must be measured in three directions:

- Forward and back (the x direction)
- Side to side (the y direction) and
- Vertically (the z direction)

at the seat pad level. In addition, it is recommended that vibration be measured in the x direction) at the seat back position, though analysis of this data is not considered in the same way as those above because of a shortage of evidence showing effects of this motion on health. Data is generally collected using a tri-axle accelerometer placed in a special enclosure and placed on the seat under the driver.

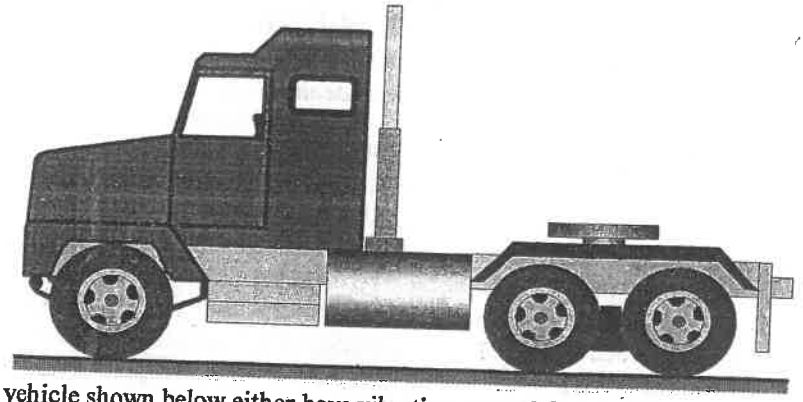
Vibration is measured in one third octaves from 0.02 Hz up to 400 Hz, though if frequency below 1 Hz is not important a range from 1 Hz to 80 Hz is recommended. The effects of different frequencies of whole body vibration on the health of the human body vary. To accommodate these differences weightings have been determined for each vibration band. These weightings are shown in the graph below.



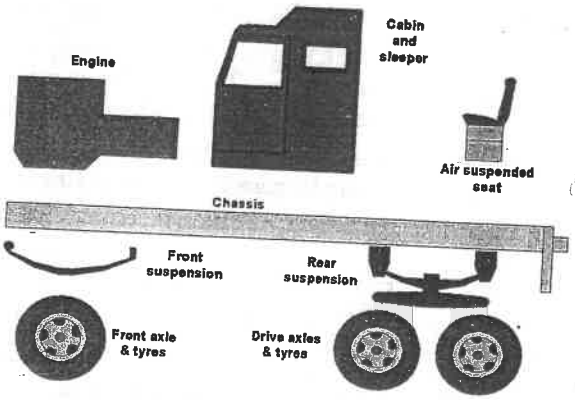
For vertical vibration, the effect on the human body is greatest in the 1 Hz – 25 Hz. For the two other directions the problem range is from 1 Hz to 10 Hz.

Vibration with older mechanically suspended trucks

Up until 1994 large prime movers were generally mechanically suspended. And up to 1990 cabins were often rubber bush suspended and smaller than current designs. On average engines were also smaller.

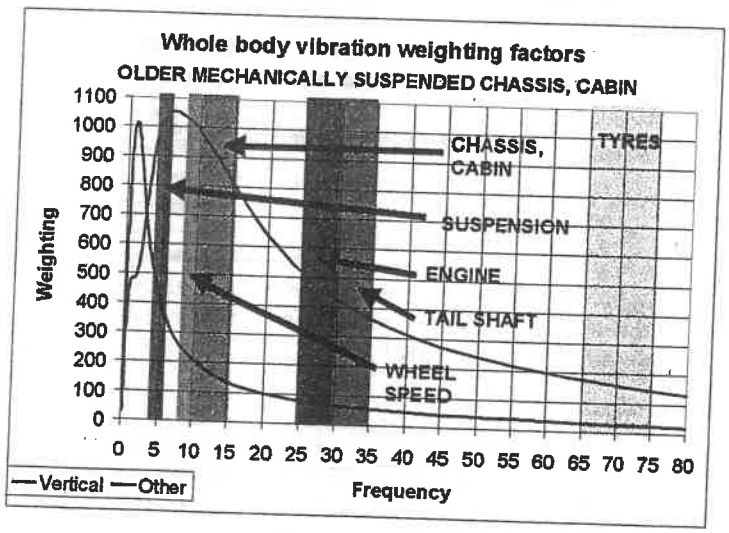


The larger components of the vehicle shown below either have vibration natural frequencies and damping characteristics in their own right – for example tyres and suspensions – or are connected to the chassis and sometimes each other by elastomer connectors.

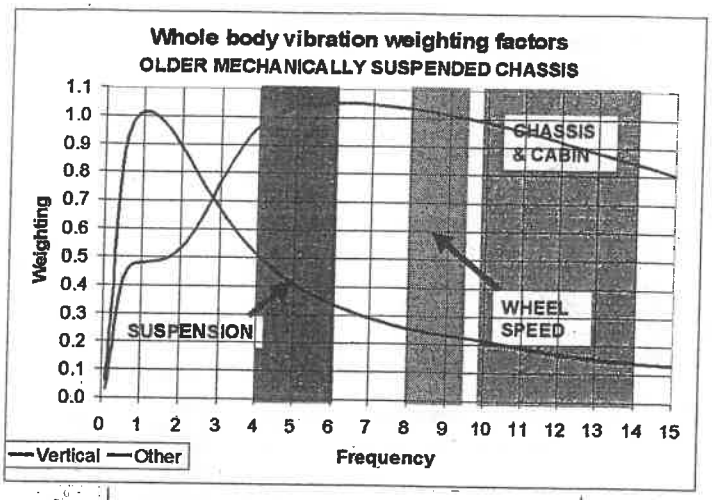


The interactions between the components are complex in a vibration sense. The graph below shows the frequencies of vibration of the various components.

Cabins attached to the chassis by elastomer bushes tended to have similar frequencies of vibration to the chassis. The major excitation sources are wheel and engine and drive shaft rotation. As shown numbers of components tend to vibrate at frequencies that can have significant impacts on the human body.



The more critical WBV frequency range of 1 – 15 Hz is shown below. While the suspension and cabin/chassis natural frequency and the wheel speed excitation frequency at 90 - 103 km/h are in the range that is more critical for WBV vertical vibration, there is nothing located in the front to back or side to side WBV critical range.

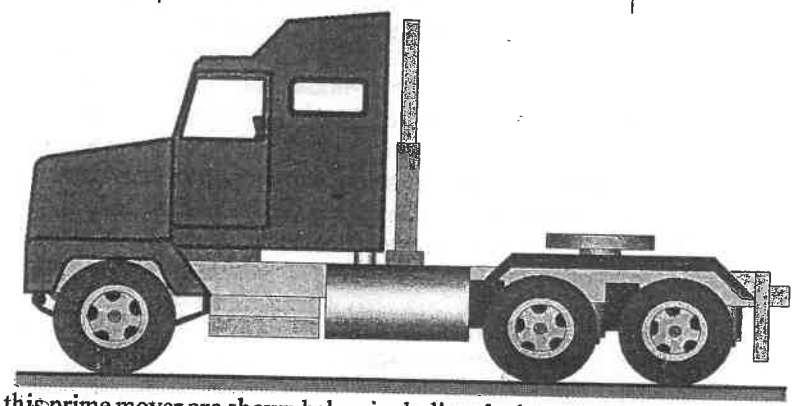


Vibration with newer air suspended trucks

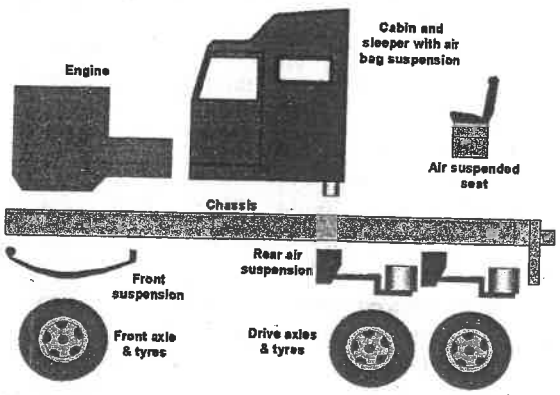
Research in the 1980's showed that air suspensions caused less pavement damage than mechanical suspensions. Principally this was due to the suspension being "softer", with lower maximum loads imposed on the pavement in travel. Proposals were developed to allow airbag suspended trucks to operate at higher masses. In turn market demand for these vehicles changed so that by 1993/94 most new heavy prime movers were airbag suspended.

Concurrently most cabins designs altered so that they were attached to the chassis by airbag suspension units at the rear and rubber bushes at the front. And the trends to larger engines and larger sleeper cabins continued. In turn air cooling requirements for the larger engines meant that cabins were raised to increase airflow through the radiator and around the engine. This increased the center of mass.

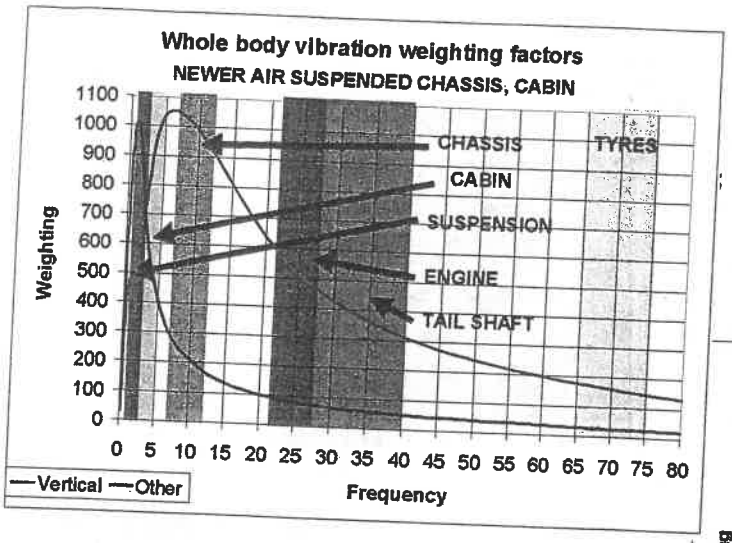
The increased torque of the larger engines meant that for cruising, lower engine speeds were possible so that overdrive gear ratios were lowered to ensure maximum fuel economy through lower engine speeds at 100 Km/h. However, pressures to keep prime mover tare weight low meant that the chassis rails were generally the same as for older vehicles. As they were more heavily stressed by the heavier and more powerful engine and heavier cabins, their natural frequencies dropped. The diagram below shows in concept one of these newer prime movers.

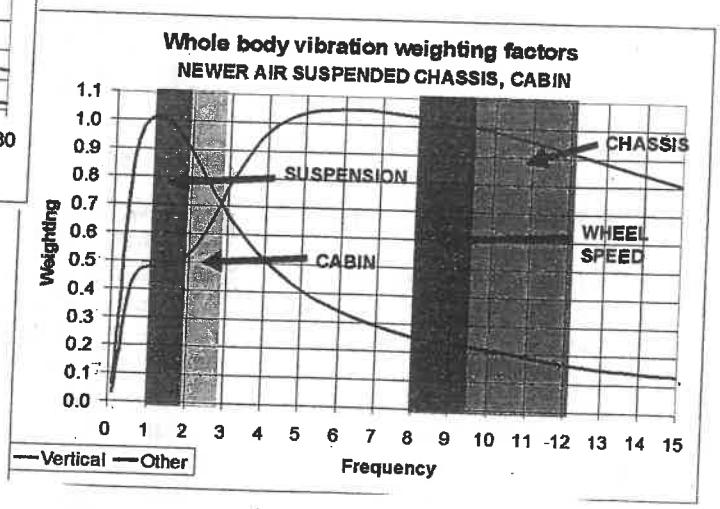


And the large components in this prime mover are shown below including the larger engine, the larger raised and airbag suspended cabin, and the rear airbag suspended drive suspension.



As a result of these changes the natural frequency of components were also altered as shown in the graphs below.





The major change is that now there are now components with natural frequencies in the critical front to back and side to side WBV range. In addition chassis natural vibration frequencies for beaming have lowered, as has engine speed when cruising. The end result is a vehicle with the potential to have a very soft ride if all components acted to minimize vibration at the drivers' seat.

Whole body vibration – The problem with newer trucks

In general, for the same energy input, the lower the frequency of vibration the greater the deflection. With cabins suspended on airbags located at the base and at chassis levels, large cabin deflections result in significant deflections of the chassis in beaming and twist. In turn these may alter the angles of the chassis to the suspension and/or the suspension to the road. And roll steer and other characteristics may generate vehicle deflections that can feed back into the prime mover dynamics. Thus there is the potential for a proportion of these vehicles to exhibit bad WBV characteristics.

The writer was involved in the FORS *Investigation into the Specification of Heavy Trucks and Consequent Effects on Truck Dynamics and Drivers Study* in 1999. In the course of that study he estimated that there were likely to be 1000 or more problem vehicles in the 42,500 large prime mover combinations in Australia. **Note that twisting of the chassis will be worse where the trailer has a high center of mass load, and where the trailer is torsionally rigid.** This is because the trailer will have greater resistance to roll movements so that the side to side movement of large cabins will be resisted at the fifth wheel or turntable.

WBV – Experience of the drivers of problem newer trucks

Lamber (2000) noted that the owners of problem vehicles report a range of problems generally or specifically including:

- wandering – the need for continual steering input to maintain a straight line;
- darting – occasional significant deviations of the vehicle to the left or right, without driver input. On average deviations to the right are more severe;
- reduced vehicle component life due to vibrations, including engine, cab, sleeper, bonnet and radiator mounts; cab structures, dashboards, shock absorbers, tyres (severe scalloping of steer tyres), and other components;
- symptoms of "vibration" sickness;
- variable behavior including handling and steering being good on high standard roads - very poor on secondary highways; good at start of the trip and then deteriorating over time (with relief sometimes achieved by de-coupling the prime mover and taking it for a short trip and re-coupling); and acceptable when tyres and other components new or in new condition and then rapidly deteriorating with kilometers of travel; and
- apparent "jacking up" of the rear axle airbags leading to pounding of the front axle.

Most drivers observed that at lower speeds of 80 km/h or less their vehicles were satisfactory but problem vehicles:

- had long wheelbases, with all but one of those known being at least 4800 mm, and up to 6150 mm – these result in lower natural frequencies of beaming and twist
- had high horsepower engines, with 86% of those known being at 420 to 610 hp – this means greater twisting forces are applied to the chassis
- had air bag suspended rear axles, being 27 out of 29 vehicles for which

information was available – hence low natural frequencies of the suspensions;

- were mainly Kenworths (44% of owners, 42% of vehicles), Macks (22% and 18%), and Fords (15% and 24%) Kenworths especially are highly customized and individual models are not subjected to any on road testing for problem behaviors;
- were used in operations or markets requiring curtain-sided trailers or vans, travel on secondary highways, generally high COG loads, and generally at axle mass limits – high resistance to roll as trailer torsionally stiff combined with rough roads so that prime mover and trailer fight each other.

Work by the writer and others have determined that these vehicles are prone to chaotic motion to the degree that the vehicle does not "settle down" between disturbances/bumps.

WBV – Direct effects on drivers of problem trucks

Mabbott, Foster and McPhee (2001) in the study Heavy Vehicle Seat Vibration and Driver Fatigue found that

In studies and in anecdotal evidence a relationship between vibration in heavy vehicles and driver fatigue has been assumed, without supporting evidence. A literature review identified a few studies showing a possible association between fatigue and low frequency vibration that is typical of the vibration frequencies experienced by heavy vehicle drivers. An experimental study would be needed to determine whether the effect of vibration would be noticeable among known contributors to fatigue (eg. time awake, time on task, rest and sleep, circadian factors).

Research has also associated whole body vibration exposure with adverse health effects on the human body. Limited available data suggests that exposure to vibration of Australian heavy vehicle drivers may be high, putting drivers at risk to health. A field study of vibration levels experienced by Australian truck drivers would be necessary to determine actual vibration exposure levels and establish standards for trucks sold in Australia.

While Mabbott, Foster and McPhee (2001) did not interview any drivers they did note that:

The typical range of exposure levels for a heavy transport truck is approximately 0.42 to 2.0 m/s2 in the vertical axis. The mean value of operational exposure levels (excluding test tracks) listed in Table 2 is 0.72 m/s2 in the z-axis and 0.78 m/s2 in the x axis.

This puts the average truck driver exposure within the caution zone of the International Standard for an 8-hour shift and just into the likely health risk zone for a 12-hour shift. Exposure periods of 12 hours are common in the transport industry (Sweatman & McFarlane, 2000). Some of the rougher truck rides will be in the some likely health risk zone in less than 8 hours. Most vehicle rides will exceed the comfort level of 0.315 m/s2 after a few hours. Many truck rides would also exceed the Australian Standard limits for health, fatigue and comfort.

It should be noted that in the Sweatman and McFarlane Study, average speeds varied. The average speed of test vehicles was 99 km/h on good roads (standard deviations 1.8 – 6.6 km/h; range of 96 – 102 km/h). On the rougher roads where vibration was an issue average speeds were 94.5 km/h (standard deviations 6.5 – 13.5 km/h; range of 84 – 98 km/h) and 90.4 km/h (standard deviations 5.0 – 8.3 km/h; range of 84 – 96 km/h). While the reasons for these different speeds are not explained, the rougher sections of road were also undulating and windy. This would have affected average speed to a degree. However the writer's knowledge of the test sections would suggest that vehicles were driven to some degree at the speed the driver was comfortable with – that is a lower speed was chosen in part due to either the driving demands or comfort.

Discussions with the drivers of problem vehicles revealed that:

- for those vehicles where wandering and darting was severe in relation to keeping the vehicle on the road pavement (narrow roads more of a problem than wide) speeds less than 100 km/h were chosen to make the driving task manageable;
- For those vehicles with a drivers seat vibration problem, the fore-aft vibration was the most uncomfortable – responses to being continually thumped in the back were either to slow down or to lean forward so that the seat upright did not contact their back.
- Symptoms they developed over time included sore backs, difficulty in uncurling their fingers after long periods of driving, gastric/intestinal problems and for some blood in the urine and other symptoms. In general these symptoms are consistent with observations of the effects of vibration on the hands or the whole body.

As symptoms got worse there was a tendency for drivers to drive at lower speeds, take additional time off to recover from driving, and/or for the drivers to reach the stage where they felt they could not continue a trip. Discussions with drivers indicated that trip times including rest and sleep breaks increased significantly and up to 20%. Interestingly of the FORS studies drivers only one actually set about obtaining medical advice in relation to their symptoms and the likely causes.

WBV – Indirect effects on drivers of problem trucks

The vibrations that affected the vehicle handling and/or the driver also affected the vehicle in that vehicle component life was significantly reduced. Items whose life was adversely affected commonly included tyres, engine, cab, sleeper, bonnet and radiator mounts; and shock absorbers. Less commonly affected were cab structures, dashboards, fuel tanks, other body components and wheels. These problems had two effects:

(1) Costs for spare parts tyres and in some cases fuel increased significantly when vibration was bad; and
(2) Maintenance downtime also increased

Whole body vibration – Effects on Commercial Viability

The Australian interstate truck industry

is structured so that good to very good commercial viability is achieved through completing 4500 – 6000 km per week. That is three round trips between Melbourne and Sydney or Brisbane and Sydney per week, or 1.5 round trips between Melbourne and Brisbane or Adelaide and Brisbane per week. This equates to 55 – 70 hours driving per week.

Of course problems getting loads, maintenance downtime, loading and unloading delays, vehicle problems and other factors reduce the actual average travel over the year to a much lower figure. The ABS Survey of Motor Vehicle Use has estimates that interstate travel by articulated trucks primarily used in interstate travel is around 50% - 60% of the distance expected based on 4500 – 6000 km per week. Survival in the interstate transport industry is possible at around 2500 - 3000 km per week and 50 hours of driving – returns will equal average male earnings after all operational and capital costs.

Impact of slower speeds on viability

Slower speeds resulting from efforts to control the negative impacts of vibration necessarily result in longer hours of driving. And excessive vibration can also increase the average length of breaks taken to recuperate. As indicated above the increase in driving or total hours can be up to 20%.

Impact of increased maintenance and fuel costs on viability

An increase in 5% in maintenance costs will result in an increase in downtime of about 1% directly. A total increase in fuel and maintenance costs including tyres of 5% will require an increase in driving hours of around 9% - 13% if total returns are to be maintained. Hence the overall impact is to require an increase of driving hours of around 10% - 14%.

Psychological impacts of excessive vibration related problems

The driver may chose to drive longer hours to maintain his total income before tax, or to accept a significantly reduced standard of living. In either case there will be a degree of increase in stress experienced by the driver. Such stress can add to fatigue. And if the vehicle is subject to wandering and darting, the required level of vigilance required to drive safely will be higher than for vehicle which did not have the characteristics. These driving demand will lead to an increase in mental fatigu

Summary of impacts of excessiv vibration on fatigue

Ignoring the impacts in the drivers healt of vibration, excessive vibration has othe effects that induce fatigue in driver including:

3. A requirement to increase driving hours by up to 35% to compensate for slower travel speeds and increased downtime, and the increased cost of maintenance and fuel. This increase in driving hours must necessarily impact negatively on fatigue
4. Increased demands in the driving task demand where vehicles wander and "dart". This increased driving task demand necessarily results in an increase in fatigue;
5. Increased stress brought about by either the need for much longer work hours or a significant reduction in taxable income.

Benchmarking In The Management Of Hazardous Chemicals At Work

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Abstract

Benchmarking of the techniques and approaches of other organizations is becoming a popular way of bridging gaps and seeking to achieve high levels of performance. There exist many sources of information in the form of external and internal standards, regulations, codes of practice, publications by professional institutions and similar. However, there are clear shortfalls in terms of tools and processes needed to identify areas of opportunity and to overcome barriers to the efficient transfer of ideas and techniques from one enterprise to another.

This research study was carried out within the mining and mineral processing industry in Western Australia. It has sought to develop and test new tools and processes to make benchmarking activity and the transfer of technology, ideas and approaches more efficient and meaningful. Study outcomes and the new materials that have been generated will assist with the selection of benchmarking partners and help to identify "pockets of excellence" for focused attention. This will encourage and assist organizations to take steps towards identifying and implementing Industry Best Practice in the element of interest.

Introduction

One of the critical performance areas for the modern organization is environment, health and safety (EHS). For some, this is a priority area to rank with production, quality and cost. A select few have an approach that transcends this - EHS is embedded in their values. Since safety is a natural, shared value, progress in safety points to a learning organization capable of achieving its wider commercial goals (Mussett, 2000).

Within the EHS area, there are numerous physical, chemical and biological agents that are capable of impacting on the workforce, the community or the wider environment. Hazardous chemicals represent one area under the EHS umbrella. The World Health Organization (1998) estimates that the total number of chemicals in the market

place is currently about 100,000 and that the value of total global annual production is about 1.5 trillion US dollars. The International Labour Organization (cited in Chamber of Commerce and Industry of WA, 1999) claims that each year there are more than 1.1 million deaths around the world that arise from workplace activities. Of these deaths, one-quarter result from exposure to hazardous substances that give rise to disabling illnesses such as cancer and cardiovascular, respiratory and nervous system disorders.

Health risks have a number of features that distinguish them from those in the safety area. The Health and Safety Executive (1992, p. 38) suggests the following:

- Ill health often results from complex biological processes, such as the repair of repeated damage (irritant dermatitis), immune responses (asthma), or abnormal cell behavior (cancers) - as distinct from immediate injury.
- These processes may take place over extended periods. Thus, hazards may only become apparent after many people have been put at risk. Cases of disease may continue for decades after exposure has been controlled.
- The same disease may have both occupational and non-occupational causes. Asthma, back pain and lung cancer are examples of this.
- Exposure to disease risks is not always apparent and a measurement of the risk factors is often required.

Generally, substances that may be described as toxic, corrosive, explosive, reactive, radioactive, flammable and similar should be considered hazardous substances (Malachowski, 1995). The hazard presented by a substance has two components - firstly, the inherent ability of the substance to do harm and, secondly, the ease by which the substance can come in contact with the body (Malachowski, 1995).

Some organizations have excellent systems in place to manage chemicals and prevent any deleterious effects on people or the environment. Others fail to address hazardous materials in a satisfactory way. For these organizations, a poor chemical safety record has an impact on overall performance and can severely limit an organization's productivity (Winder, 1995).

This research study has drawn heavily from models, processes and tools that have come from the quality management area. It has sought to develop and test new benchmarking tools and processes within the province of hazardous materials management. Hazardous materials management is arguably the most complex element to master under the occupational safety and health umbrella. Its importance has been well recognized by the industrial partners responsible for tripartite development of occupational safety and health policy and legislation in Australia.

Chemicals have potential to impact on the workforce, on the public and on the environment. At a State level, several government departments have statutory responsibilities in regard to control of hazardous materials and in the responses that may be necessary when there is an emergency situation.

This research study focused on approaches that apply to hazardous substances in the workplace. It has dealt with materials in general, rather than with specific chemicals or groups of chemicals. The research has attempted to simplify and demystify some aspects of the complex world of hazardous materials.

Benchmarking practices around the world vary from simple, informal site visits (often little more than a tour, supplemented by a few unstructured questions) to the very complex and formal variety, involving months or years of preparation, teams of people and extensive documentation (N.W.H. Ormonde, personal communication, September 17, 1999). Unfortunately there appears to be very little between these two extremes. In the first instance, potentially transferable ideas or innovations may be overlooked because the approach is too cursory and is not systematic. In the second, the complexity tends to confine the approach to very big, well-resourced organizations.

Benchmarking is widely regarded as an important process in bridging the gap that separates an organization from best practice, whether that be best in the world, best in the nation or state, best in the industry, best in the locality or, even, best in the street.

There is a need to develop materials that accommodate the three elements that impact on occupational safety and health outcomes, namely, organization of work, the workplace environment and the people factor. Furthermore, these materials need to be flexible, simple to apply, but of sufficient depth and effectiveness to make the time and effort worthwhile. This research addressed these issues.

Research findings

The research study set out to develop effective tools and processes for the benchmarking of hazardous materials management practices at medium and large enterprises. While there exist many sources of guidance and direction in terms of how occupational safety and health should be managed at a facility, there are clear shortfalls in terms of the tools and processes needed to identify areas of opportunity and to overcome barriers to the efficient transfer of ideas and techniques.

The principal findings from the study were as follows:

- The study generated evidence that the tools and processes are transferable to other critical elements of occupational safety and health management.
- There appears to be a relationship between "innovation scores", as developed by the study and Lost Time Injury Frequency Rate (LTIFR), the lagging indicator of OHS performance that is widely used across Australian industry.
- There were marked differences from site-to-site in terms of management style, employee ownership of occupational safety and health, program sophistication, access to professional resources, level of use of chemicals and similar factors. Nevertheless, all sites had something to offer in terms of innovations. These took many forms - variously as a product, service, tool, resource, system, concept or an approach.

There was little evidence of formalized occupational safety and health benchmarking activity in Australia so it was difficult to draw comparisons with other work. The National Occupational Health and Safety Commission (1996) benchmarking kit provided a few examples of organizations that have set up teams and have attempted to benchmark subjects that fall under the occupational safety and health umbrella, but these appear to be scant in number. It is more likely that there is a degree of less formal contact being made between clusters of organizations from time-to-time and on quite specific items of interest. However, rarely do the outcomes of such contact find expression in the published literature.

Recommendations

This study is novel in that it was the first formalized, occupational safety and health-related, multi-site benchmarking effort in Western Australia. It was unique in that it addressed compliance issues, together with "beyond compliance" efforts that fall under the headings of organization of work, the workplace environment and people factors.

The research study taped into current thinking and practice with respect to quality management and continuous improvement, organizational effectiveness, change management, behavioral safety, risk management, performance measurement, reporting and review, management systems, compliance, standards, auditing, benchmarking and technology transfer. The study used a set of questionnaire booklets to provide for a structured coverage of the elements that fall under the occupational safety and health (general) and chemical safety headings.

The view by Walleck, O'Halloran and Leader (1991) was that the use of benchmarking as a business improvement tool has been impeded by three obstacles, namely, the supposed superiority of invention over copying, the "we are unique" syndrome, and moral and legal sanctions against "industrial espionage". Successful benchmarking experiences of the kind described in this research study should help to overcome these prejudices and encourage a lot more bench marking activity within industrial groups of like mind.

While some benchmarking opportunities may become readily apparent in "statements of pride" in Company reports, presentations and the like, as asserted by Tucker, Zivan and Camp (1987, p. 9), others may only come to light as "pockets of excellence" that are identified during more formal proceedings of the kind described in this work.

The information in this study and the tools and processes that have emanated from it should be of interest to:

- Private organizations that wish to better understand their internal processes and to fast track their improvement efforts in occupational safety and health.
- Regulatory agencies that wish to promote the pursuit of Best Practice in occupational safety and health and who are seeking some evidence of a commitment to that objective by operations that are within their jurisdiction.
- Employees and employee representatives seeking reassurance that employers and employer organizations are vigorously seeking to improve the workplace environment and reduce the incidence of injury and disease.

Materials and approaches described in this research study should encourage organizations to seek out benchmarking partners and to extract the benefits that go with understanding internal business processes, sharing of ideas and fast-tracking of improvements. As occupational safety and health benchmarking in Western Australia becomes a more entrenched and recognized business practice the very processes and tools themselves will evolve to a new level of effectiveness.

Conclusions

This research study focused on creating a means to better identify benchmarking opportunities in occupational safety and health (general) and in chemical safety. There appears to be considerable scope to further develop the tools and processes that have been described - with a view to application in other areas of occupational safety and health, such as electrical safety, machinery safety, confined space work, mobile equipment operation, work at heights and similar. Benchmarking techniques and processes are powerful aids in the pursuit of best practice and in the continuous improvement efforts being applied by many businesses around the world. Hopefully, the research work described in this document will stimulate greater and more meaningful application of benchmarking to health and safety in the workplace.

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Preparing For A Clinical Dose of Y-90 TheraSphere™
A HazMat Tech's Perspective

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Abstract

Y-90 TheraSphere is used to effectively target and destroy tumors in patients with cancer. While this treatment is very beneficial to the patient, it can hold considerable HazMat consequences. This article describes the procedures that are used at the University of Louisville Hospital to prevent unwanted Y-90 TheraSphere spillage occurring during the use of this product in the hospital's operating suite.

Introduction

The University of Louisville Hospital is a 400+ bed facility that provides a full range of diagnostic, therapeutic, emergency and surgical services, including the region's only Level I Adult Trauma Center. Their knowledge of the latest medical treatments and techniques means a patient at the University of Louisville Hospital will receive the most up-to-date treatment in the region. One such treatment is TheraSphere™.

TheraSphere™ is a therapeutic treatment that delivers radiation directly to tumors in the liver using glass Micro-Spheres. The tiny beads (or intra-hepatic micro-spheres) measure one third the diameter of a human hair, and are embedded with a radioactive element called Yttrium90 (Y-90), a Beta emitter. Millions of these micro-spheres are injected into the blood stream through a guided catheter into the hepatic artery, the liver's main blood supply. When they arrive in the liver, the radiation-laden spheres get lodged within the smaller blood capillaries that sustain tumors. Because they are lodged in the tumor, the spheres Y-90 component radioactively decays within the tumor mass. This feature allows for a much more targeted treatment of the tumor and significantly reduces damage to the surrounding tissue.

While this treatment is very beneficial to the patient, it can hold considerable HazMat consequences. From the HazMat Tech's perspective, extra caution is warranted in the set up of the operating suite and the delivery device due to the EXTREME contamination problems facing personnel and the facility if the product gets loose.

Safety Precautions used during the administration of TheraSphere™

The vial containing the spheres is infused with IV saline under pressure during the delivery of the treatment. The delivery pressure varies, but our Radiation Safety Office uses 12 to 20 psi. If a leak occurs during the procedure, the radioactive micro-sphere saline solution may be sprayed about in any direction and the evaporation of the saline will cause the micro-spheres to have the ability to become airborne and readily distributed in air currents. They may then become lodged in small cracks, floor seams, clothing, and may possibly be inhaled.

The consequences of a leak consist of contamination of personnel and the closure of the procedure room for decontamination. Most hospitals have 1 to 3 Cardiac Catheter or Interventional Radiology suites. Therefore, the revenue loss from having to close the suite while the decontamination is underway could be enormous.

Y-90 is a pure Beta emitter with an average energy of 0.94 MeV and has a half-life of 64.1 hours. The average number of micro-spheres per dose is seen in the following table.

Table 1. Average number of micro-spheres per dose.

DOSE ACTIVITY (GBq ± 10%)	(mCi)	MASS IN MILLIGRAMS	MILLIONS OF SPHERES
3	81	27	1.2
5	135	45	2.0
7	189	63	2.8
10	270	90	4.0
15	405	135	6.0
20	540	180	8.0

* Provided by MDS Nordian

The first step in contamination control is to prepare the room. Our staff start by removing all unnecessary tables, carts, equipment and any other items that may become contaminated if a spill occurs on the floor. Next we completely cover an approximately 6 foot area on the floor around the operating table with a textured absorbent paper with a polyethylene backing. The paper is duct taped in place and all overlapping seams are taped. This type of paper has proven to hold up under the foot traffic and cart traffic of the operating suite. Also, due to the texture of the paper, if a spill were to occur it would absorb the liquid and keep the micro-spheres contained in the textures.

The TheraSphere™ equipment set consist of the delivery device, administration tubing, needles, meters, waste vial, dose vial, waste container, and setup directions / procedures. This equipment is arranged on a separate table

from the operating equipment. Both tables are draped with sterile sheets and several sterile absorbent towels are placed on each for use during the procedure. We ensure the table used is sturdy enough to handle the equipment and the pressure of the dose delivery. The delivery device is then assembled in consultation with the detailed instructions. The first possible leak or spill could occur during this procedure. To prevent contamination of personnel during this step, lab coats, shoe covers, and gloves are mandated and worn.

The delivery fixture consists of four main components, a stainless steel base, 2 Rad60R dosimeters, a lower acrylic box, and an upper acrylic shield. Other parts include an IV bag post, wrench, locking pin and supplied waste container. Once this system is assembled the administration tubing is ready to be connected and the dose vial is ready for infusion. The next step involves connecting the tubing from the IV bag to the syringe, and then to the red stopcock which controls the saline into the inlet line. The dosimeters are placed in their holders at the dose vial and the blue stopcock. The dosimeters allow the flow of the micro-spheres to be followed.

The tamper seal is removed from the dose vial and the plug is removed by applying surgical tape to it and lifting it out. The dose vial septum is cleaned with an alcohol swab using long forceps or tweezers. Then needle guides are placed on the septum and the inlet and outlet needles are placed into the guides, piercing the septum. Extra care is taken when piercing the septum due to the possible release of the micro-spheres. An additional line from the blue stopcock is then placed into the waste vial.

Once this procedure is complete, the lines to the blue stopcock, and only to the blue stopcock, are primed. The technician watches for leaks at each of the Luer lock hubs, inlet and outlet needle connections, and septum. A reading on both dosimeters should now be present. If there is leaking or the pressure reading on the syringe exceeds 30psi, then the procedure is aborted. The administration tubing set-up as a whole unit is then disposed of into the waste container. The needle guides are now removed and the needles are inserted the rest of the way into the dose vial. Careful attention is required not to dislodge the needles from the lines and from the septum causing a spill. The needle hubs are taped down to the vial. The tape holds the needles in place under the pressure of the delivery and helps to prevent them from coming out of the septum.

Once all of these procedures are completed, the device is ready to be hooked up to the patient. Before connecting the line to the patient, a sterile towel is placed under the catheter connection and in the space between the patient and the delivery device. This helps catch any possible leakage. Once the catheter is connected, the position of the catheter is once again verified and the administration of the dose can begin.

During the administration we check for leaks at each Luer lock hub, the vial septum, and needle connections. If a leak occurs, the procedure is aborted. After the first flush, most of the spheres are delivered and the reading on the dosimeter next to the vial is close to the background. The dosimeter near the blue stopcock may have a reading due to spheres lodged in the connection fittings or due to the close proximity to the patient. Additional flushes and light tapping on the fittings are used to remove all spheres and bring this reading down. Tapping is light as if the fittings come loose this will cause a leak.

Once the dose has been delivered, the doctor removes the catheter and places it in the waste jar. There may be some residual spheres in the end of the catheter. We inform the doctor not to pull the catheter out in such a motion that will cause slinging of blood or excessive dripping off the protected areas. The residual spheres at the end of the catheter are still a contamination hazard. The delivery device table is now moved away from the patient and the clean up can begin.

The tubing is not disconnected. The IV bag, tubing, and both vials are placed as a whole unit into the waste jar. The towels, draping, and any surgical supplies used are checked for contamination with a survey instrument. If these are determined to be contaminated, they are placed in the jar as well. Someone is posted at the entry and exit point of the room with a survey instrument to ensure all personnel involved with the procedure are not contaminated. For extra precaution we place a sticky mat at the door to catch any possible shoe covering contamination. In addition, the wheels of the bed are checked for contamination before they role the patient out. Finally, the floor covering and remaining areas are monitored to ensure no residual contamination is present.

If the procedure was a success, only the catheter, the delivery device tubing unit, doctor's gloves and the towel underneath the connection would be required to be placed in the jar. The lid should be placed on the waste jar and the recommended checks per MDS Nordian should be completed. The waste jar is then ready to be moved to a radioactive waste accumulation area. The floor covering paper and remaining supplies are disposed of in the normal refuse and the room can be turned back over to the operating suite staff.

If the procedure was not a success and a spill occurred, a decontamination kit should be located nearby. Our kit consists of a garbage can with a liner to hold all the towels, sheets and floor coverings that would be contaminated. If the contamination was not contained and it reached the unprotected floor, our staff would use a Swiffer Wet Jet™. This system sprays a liquid cleaner that would keep the spheres from becoming dry and the absorbent pad would contain the suspended spheres. All personnel involved would be thoroughly checked with a survey instrument and a complete decontamination of the room would be done. Additional equipment in our kit consists of gloves, tyvex suits, absorbent paper, tape, and various survey instruments. The room can not be returned to service until it is thoroughly surveyed and decontaminated.

Conclusion

As you can see, there are many steps involved with the TheraSphere treatment that could cause a possible HazMat incident. But, with the proper training

provided by MDS Nordian, the standard and effective operating procedures, and a prepared HazMat Tech on staff, the risk can be greatly minimized.

Prevention Of Cumulative Trauma Disorder In Office Workers Who Use Visual Display Unit Work Stations

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Abstract

In this computer age it is important for Safety Professionals to be aware of the impact that Cumulative Trauma Disorder can cause to employees and their employer and ways that it can be prevented from occurring in employees in their workplace. This article describes what Cumulative Trauma Disorder is. It reviews current published literature about Cumulative Trauma Disorder and makes recommendations for safe work practices to minimize or eliminate the incidences of Cumulative Trauma Disorder occurring to office workers who use visual display units for their work.

Introduction

Cumulative Trauma Disorder (CTD) is a disorder of the musculoskeletal system that results from the prolonged and gradual build up of tiny amounts of damage or micro traumas. Cumulative Trauma Disorders are part of a larger group of Musculoskeletal Disorders (MSDs) and are particularly concerned with damage to the neck, upper back and upper limbs including hands and wrists. The damage occurs to tendons, bones, muscles, nerves and other soft body tissues. Frequent exposure to repetitive motions, sustained or awkward postures, static muscle loading, forceful exertions or vibration can lead to the tissues becoming irritated and inflamed.

Tissue inflammation and the subsequent reduction in blood circulation may eventually overwhelm the body's capacity to heal itself. In extreme cases there may be permanent tissue damage and disability (Feinberg, 2004). The modern workplace includes many clerical and desk based jobs that involve the use of visual display units (VDU). These jobs demand only minimal, physical effort per task, however they often require the worker to remain in unchanging sitting postures while engaging in highly repetitive tasks for extended periods of time. The combination of sustained postures and repetitive motion is the major contributing factor to Cumulative Trauma Disorder problems.

The term Cumulative Trauma Disorder has emerged over the past decade and includes disorders such as repetitive strain injuries (RSI), carpel tunnel syndrome (CTS) and occupational overuse syndrome (OOS). RSI in particular was an epidemic of 1980's and coincided with the growth of computer based and automated occupations. It follows on however, from its historical predecessors telegraphist's wrist and writer's cramp (Ireland, 1998). RSI, CTS and OOS focus on repetitive motions as the key factor in the onset of tissue damage. However, the human body is made for movement so repetitive motions themselves are not necessarily injurious. Sustained or awkward postures that interrupt blood supply to tissues and stop the removal of waste products, such as the lactic acid produced by muscle cell work, are far more stressful to the body.

Whilst there is no one universally accepted definition of Cumulative Trauma Disorder in the medical literature, it is generally recognized that a combination of repeated motions and/or sustained postures are the main contributors to the condition (Feinberg, 2004; OSHA, 2001; Harrington, 1998; PEOSH, 1997). The cost of Cumulative Trauma Disorders to companies and individuals is significant in terms of injuries, lost workdays and worker compensation claims. Direct and indirect costs of Cumulative Trauma Disorders were estimated by OSHA in 2001 to exceed $US100 billion annually. These disorders represent a significant and growing number of claims and costs for worker compensation (OSHA, 2001).

As workplaces continue to become more and more computerized, as schools invest more and more in computers for students and as computers play an increasing role in our leisure time activities, the impact of Cumulative Trauma Disorders in the workplace will continue to grow (Berner & Jacob, 2002). Appropriate and effective prevention and intervention strategies are needed by companies in order to reduce the direct and indirect costs related to Cumulative Trauma Disorders in the workplace and to promote an injury free, productive and motivated workforce.

Published Cumulative Trauma Disorder Research Findings

With the increased computerization of the workplace in the past 3 decades workplace injuries related to musculoskeletal disorders, including Cumulative Trauma Disorders and Repetitive Strain Injuries have been the topic of much recently published literature (Awerbuch, 2004; Feinberg, 2004; Helliwell & Taylor, 2004; Shuttleworth, 2004; Berner & Jacobs, 2002; Richardson, 2002; Nainzadeh & Malantic-Lin, 1998; Ireland, 1998;PEOSH, 1997; NIOSH, 1997; Millender, 1996; Webster and Snook, 1994).

Most researchers agree that these injuries are a cumulative effect of micro traumas to soft body tissue that occurs to such a degree it overwhelms the body's natural capacity to heal itself (Feinberg, 2004; OSHA, 2001; Harrington, 1998; PEOSH, 1997). Two published definitions of Cumulative Trauma Disorder are as

follows. "Cumulative Trauma Disorders are injuries of the musculoskeletal and nervous systems that may be caused by repetitive tasks, forceful exertions, vibrations, mechanical compressions (pressing against hard surfaces) or sustained and awkward positions" (PEOSH, 1997). "Cumulative Trauma Disorders are disorders of the musculoskeletal and nervous systems that may be caused or aggravated by repetitive motions, forceful exertions, vibrations, mechanical compression, sustained or awkward postures, all occurring over extended periods of time" (Feinberg, 2004).

The most common published symptoms of Cumulative Trauma Disorder are non-specific or diffuse arm or upper limb pain, with or without associated neck pain (Awerbuch, 2004; OSHA, 2001; Harrington, 1998; Millender 1996; PEOSH, 1997). As there is no obvious injury, broken bone or bleeding, nor a single accident or always a single event that can be found as contributing to the symptoms of Cumulative Trauma Disorder there is some dispute as to whether in fact it is a medical phenomenon at all (Awerbuch, 2004; Ireland, 1998). There are a number of studies (Awerbuch, 2004: Ireland, 1998) that strongly suggest that RSIs and Cumulative Trauma Disorders are in fact non-physical, socio-political phenomena. It should be noted that when Awerbuch's paper was published in the *Internal Medicine Journal, 2004* it was accompanied by an editor's note acknowledging that readers would have varied approaches to managing their cases and that opinion among that paper's referees differed in regard Awerbuch's stance.

The overwhelming majority of literature recognizes that Cumulative Trauma Disorder does exist and that while repetitive motions and sustained postures are key causal factors, there may also be a number of psychosocial factors such as workplace moral, attitude of employers to workers, poor worker self-esteem and lack of mutual loyalty between workers and their employers that play a role in the worker's presentation and perception of the injury (Feinberg, 2004; OSHA, 2001; Helliwell & Taylor, 2004).

The physical discomfort itself is only part of the Cumulative Trauma Disorder phenomenon (Ireland, 1998; Awerbuch, 2004; OSHA, 2001; Etonhand, 2004; Dorto, n.d). As it is an 'invisible' condition the dispute over the existence of RSI or other Cumulative Trauma Disorders can lead to confrontation between workers, employers and medical practitioners. This in turn causes more distress and may delay treatment, recovery and return to work. Ireland (1998) suggests that in the majority of RSI cases during the 1980's "...patients were differentiated from those with genuine work related injuries whose symptoms are reproducible, with physical signs easily defined, disease identifiable, and response to physical treatment predictable." Awerbuch, (2004) in his paper on the Australian epidemic of RSI, quotes Hadler (1996) who describes RSI as "not a clinical event....it is a socio-political phenomenon." Ireland (1998) goes on to describe supposed RSI sufferers as employees who were "highly suggestible and engaged in menial repetitious tasks with little job satisfaction." Ireland does agree that most patients did indeed suffer from the symptoms of which they complained.

This culture of suspicion surrounding those in genuine discomfort and pain can only lead to further psychological distress and further compound the issue. Suspicion that they will not be believed, or that they will loose their employment position if they report have Cumulative Trauma Disorder can promote employees not to report Cumulative Trauma Disorder signs and symptoms to their employer or medical practitioner when they first occurs. Employees with work related Cumulative Trauma Disorder may continue to work until the pain becomes so severe that they can hardly move the affected part of the body and the tissue damage is beyond the stage of the body being able to repair itself, even with considerable rest of the damaged body part. This pain on movement and inability to use the affected part of their body due to Cumulative Trauma Disorder affects not only the injured employees' ability to perform paid work, but also home and leisure activities.

Many workers compensation claims for Cumulative Trauma Disorder were considered to be frivolous and their claimants accused of 'symptom magnification' (OSHA, 2001). Symptom magnification however is not symptom fabrication. Symptom magnification may be due to poorly understood factors such as physical cultural or psychological forces (Etonhand, 2004). Dorto (n.d) states that it is extremely important for treating physicians to understand the difference between 'malingering' and 'symptom magnification' so that treatment for genuine cases is not delayed and recovery time and the extent of recovery is not compromised.

There is some difficulty in estimating the financial cost in the workplace of Cumulative Trauma Disorder (Harrington et al, 1998; Webster & Snook, 1994). This is due in large part to the conflict over definitions (and therefore the classification of the injury) as well as Cumulative Trauma Disorders often being calculated as part of the wider range of muscular skeletal diseases that occur in the workplace (Workcover, 2004; NIOSH, 1997; Nainzadeh & Malantic-Lin, 1998). In 1997 the National Institute for Occupational Safety and Health (NIOSH) reported that calls to its information services regarding work related musculoskeletal problems was second only to questions regarding chemical hazards (NIOSH, 1997). The 'invisible' nature of the injury often leads to confrontation between employees and employers who may challenge the validity of the complaints (OSHA, 2001). Ensuing litigation before resolving of the case adds to the financial and human cost of the injury (OSHA, 2001).

The United States Agency for Health Care Policy and Research reports that muscular skeletal disorders are the country's most costly category of workplace injuries and illnesses and cost $20 billion annually for workers compensation claims with another $100 billion cost to be added for lost productivity, employee turnover and other indirect expenses (Biomorph, 2001). In their paper *'The cost of compensable upper extremity cumulative trauma disorders'*, Webster and Snook (1994) acknowledge the difficulty in determining the costs of Cumulative

Trauma Disorders. They analyzed data collected from the Liberty Mutual Insurance Company and estimated that the total compensable cost for upper extremity Cumulative Trauma Disorders in the United States of America was $US563 million. Nainzadeh & Malantic-Lin (1998) concur with this and also report that workers compensation claims for upper extremity disorders in the US in 1989 were estimated at $563 million.

WorkCover Western Australia (2004) reports in its statistical report on workers compensation claims, that in 2002/2003 musculoskeletal and connective tissue diseases accounted for the highest average days lost for female workers. Adding further to the complexity of dealing with Cumulative Trauma Disorder in the workplace is the question of causality (Millender, 1996). In cases such as Cumulative Trauma Disorder where there is no single 'accident' responsible for an injury it becomes difficult to establish to what degree it is the workplace that is responsible for the injury (Millender, 1996; Awerbuch, 2004, Feinberg, 2004). Millender (1996) in his paper on muscular skeletal disorders in the workplace states that "...causal relationship of disability to employment has become a socio-political issue with decisions based on different state legislation plus legal decisions."

The human cost of any work related injury is difficult to measure (Harrington, 1998). The pain associated with the injury itself can be debilitating but the psychological cost can be equally significant and is often borne not only by the injured party but also by family, friends and work colleagues (Harrington, 1998). The lack of a visible injury can cast doubt on the honesty of the worker, which increases psychological stresses and adds further conflict to the problem (Kirsh, 2003; OSHA, 2001).

There is a considerable amount of published literature available in relation to dealing with Cumulative Trauma Disorder in the workplace (Feinberg, 2004; CDC, 2000; PEOSH, 1997; OSHA, 2001; NIOSH, 1997). With relatively minor variations, the majority of publications focus on the following key elements as crucial in effective prevention and management of Cumulative Trauma Disorder or other muscular skeletal disorders in the workplace. Education of the worker and the employer as to the nature of Cumulative Trauma Disorder. How to recognize the potential for Cumulative Trauma Disorder in the workplace and the early signs of Cumulative Trauma Disorder in a worker. Workers behaviors, employee postures, equipment and workplace design. Workplace factors such as morale, employer attitudes, enjoyment of work etc. The use of rehabilitation programs in chronic cases. (Feinberg, 2004; Richardson, 2002; Berner & Jacobs, 2002; CDC, 2000; PEOSH, 1997; OSHA, 2001; NIOSH, 1997).

Feinberg (2004) suggests the importance of 'participatory' ergonomics in which the workers are involved in developing the ergonomic program. The purpose is to legitimize the ideas to the workers as well as to give them ownership of their recommendations and therefore a more committed approach to prevention strategies developed. In its 'Elements of Ergonomic Programs' primer for workplaces, NIOSH (1997) advocate 'showing management commitment in addressing possible problems and encouraging worker involvement in problem-solving activities'. PEOSH (1997) states that worker involvement is the key to success in any ergonomics program.

Richardson (2002) reports the example of the Visiting Nurse Association of Texas, which implemented a Cumulative Trauma Disorder prevention program in response to the $200,000 per year cost of Cumulative Trauma Disorder injuries in their department. The result was a dramatic decrease in injury and a significant improvement in staff retention. In contrast are the results of a study by Berner and Jacobs (2002) designed to look at the gap between exposure and implementation of computer workstation ergonomics in the workplace. The subjects were university staff and students. Of the 55 respondents, 70% had experienced some symptoms of Cumulative Trauma Disorder associated with excessive computer use, 60% had some exposure to computer workstation ergonomics information but only 10% reported implementing their knowledge in their computer related tasks. Clearly the efficacy of some education programs is in question and the quality of delivery is crucial to the effectiveness of the programs and their subsequent effect in the workplace.

Published literature related to use of laptops in the workplace has increased as their prevalence in the workplace has increased (Hedge, 2004; Berger, 2004; Atic, 2004; UWA, 2001; Fraser, 2002; Ergoindemand, 2004). Whilst some of the material is related to studies specifically on the use of laptops and their effects on the user (Fraser, 2002) care must be taken when considering other material directly related to companies selling 'ergonomically designed' office furniture (Ergoindemand, 2004). Over the past decade there has been a significant increase in the use and ownership of laptop computers in both the work place and in the home (Hedge, 2004; UWA, 2001). There is also a trend towards increased use of laptops for school purposes (Fraser, 2002; Burke & Peper, 2002). The benefits of computer mobility for work and travel are invaluable in today's mobile society but these benefits are offset by the ergonomic challenges that use of a laptop computers present (Hedge, 2004; Berger, 2004; Atic, 2004; UWA, 2001; Fraser, 2002).

Ergonomic problems related to laptop computer use are due to the transport of the computer and the use of the computer (Hedge, 2004; Fraser, 2002; UWA, 2001; Ergoindemand, 2004). In a study of school age children using laptops at school Fraser (2002) discovered that when laptops are combined with lunch boxes, books and other paraphernalia, students were often carrying more than 20% of their body weight in their bags. American Medical Association (AMA) guidelines suggest that no more than 15% of the body weight should be carried for any length of time (Fraser, 2002; Atic, 2004). University of Western Australia policy guidelines suggest that with anything over 5kg in weight alternative methods of transport to personally carrying objects should be

used (UWA, 2001). It is suggested that laptops are carried in specifically designed bags that are worn over the shoulder or as a backpack or, that wheeled trolleys are used to transport laptop computers (UWA, 2001; Fraser, 2002; Berger, 2004; Atic, 2004, Ergoindemand, 2004).

Hedge (2004) states that the laptop computer design is inherently problematic in regard to ergonomic design as when the screen is at a comfortable height and distance the keyboard isn't, and vice versa. In addition, the use of laptops in the field, or on one's lap, or in airplanes, or on the bonnet of the car often means that little effort is made, or can be made, to ensure the usual ergonomic considerations are taken into account (Berger, 2004; UWA, 2001; Ergoindemand, 2004).

If laptops are to be used in a standard office set-up then the literature suggests a number of adaptations should be made to improve the ergonomics related to their use and reduce the likely hood of incurring short or long term physical discomfort or injury (Hedge, 2004; Berger, 2004; Fraser, 2002; Ergoindemand, 2004; Atic, 2004). Recommendations for adaptation include adding an external ergonomically designed keyboard and raising the laptop computer so that the screen is at a comfortable height. Add an external ergonomically designed mouse to the computer so that static muscle loading does not occur. Use a docking station and hook up to a full sized computer screen if working on an office desk. Use a specifically designed carry case or wheeled trolley to transport the lap top computer. If ergonomic factors, (fitting the equipment and task to the person's ability), are not taken into account when using computers this can impact on the computer user's health.

How is work-related computer use currently impacting on health?

Traditional workplace accidents have been mostly falls, manual handling injuries or exposure to hazardous substances (OSHA, 2001; WorkCover, 2004). Whilst these are still major causes of occupational injury, musculoskeletal injuries such as Cumulative Trauma Disorders and Occupational Overuse Syndrome are becoming increasing prevalent in the workplace (WorkCover, 2004; PEOSH, 1997). The cost to organizations is significant in terms of lost productivity, staff turnover and effects on staff morale, medical costs and other indirect costs.

Cumulative Trauma Disorder is a relatively new workplace injury and coincides with the increased computerization of the workplace over the past 3 decades. In developing countries, such as those in the Far East, there has been little evidence of Cumulative Trauma Disorder where as countries such as Australia suffered an epidemic of RSI claims in the 1980's followed by a decline in subsequent years (Awerbuch, 2004; Harrington, 1998). It is possible that the decline was the result of increased awareness and subsequent program development and implementation to prevent such injuries in the workplace, in conjunction with changes in the workers' compensation system.

In the United Kingdom there is a steady stream of cases being reported, not just among office workers but also in the following industries; poultry processing, electronics assemble, telephonists, checkout operators (Harrington, 1998). In the United States of America, NIOSH reported in 1997 that calls to their information services for information on muscular skeletal disorders in the workplace were second only to calls regarding chemical hazards (NIOSH, 1997).

Feinberg, (2004) reports that according to the US Bureau of Labour Statistics, during the 1990s ergonomic-related disorders were the most rapidly growing category of work-related illnesses reported to OSHA (Occupational Safety and Health Administration). Specifically, in the early 1980s, when IBM compatible computers were first coming on the market, less that 20% of all illnesses reported were Cumulative Trauma Disorders, but by the mid 1980s that figure had grown to almost one-third. In the mid 1990s it was almost one-half of all work related illnesses reported and *current estimates are that over two-thirds of all occupational illnesses reported are Cumulative Trauma Disorders.*

WorkCover Western Australia reported that in 2002/03 the most common mechanism for injury resulting in lost-time claims for males and females was body stressing. Body stressing occurs when injuries or disorders result from stress placed on muscle, ligaments tendons and bones and include, lifting, carrying or putting down objects, muscular stress from handling objects, muscular stress when no object being handled and repetitive low muscle loading (WorkCover, 2004). Musculoskeletal and connective tissue injuries account for the highest average days-lost claims for female workers in 2002/03 (WorkCover, 2004).

The effects of Cumulative Trauma Disorder on an individual's health are more difficult to quantify. It is not only the injured worker, but also their family and co-workers who are adversely affected by these disorders. For the injured individual, Cumulative Trauma Disorders can cause severe and debilitating symptoms such as diffuse pain, numbness and tingling in the fingers (Feinberg, 2004; CDC, 1999a). There is also an increased likelihood of lost time from work, temporary or permanent disability, and an inability to perform job tasks (Feinberg, 2004; CDC, 1999b). The 'invisible' nature of the injury often leads to poor treatment and stigmatization of the injured worker (Kirsh, 2003). When this is added to the physical distress of the injury itself individuals may experience ranging levels of anger, frustration, depression and other negative life impacts (Kirsh, 2003).

Statistics indicate that despite our increasing awareness of Cumulative Trauma Disorders in the workforce they are continuing to be a major source of compensable claims under worker compensation legislation (Workcover, 2004; NIOSH, 1997). Studies also support the view that computer use (both desktop and laptop) is no longer being limited to traditional work hours but increasingly becoming part of our leisure time as well as an integral element of

school and tertiary education programs (Fraser, 2001; Feinberg, 2004; UWA, 2001; Shuttleworth, 2004; Berner & Jacobs, 2002). For many people, more time in front of the computer means less time involved in physical activity. Studies suggest that our lack of physical fitness and therefore poor posture and muscle tone, contribute to an individuals propensity to develop musculoskeletal injuries (Feinberg, 2004; OSHA, 2001; Burke & Peper, 2002).

In the long term there is a risk of compromising the physical and psychological health of workers employed primarily to work at computer workstations if it is not recognized that there are significant changes in the contemporary workplace. With foresight and education, employees and employers can work towards ensuring the workplace is a safe one and that, where appropriate, good work practices and ergonomically sound principles are transferred to the home, education and leisure situation.

There are a number of factors, which may have a significant impact, positive or negative, on the long-term health of those who spend a considerable amount of work time at a computer workstation. Many of the following factors, if not managed correctly, have the potential to impact ***negatively*** on the long term health of workers primarily engaged with activities involving significant periods of time using computer workstations and/or laptop computers:

- Increasing computerization and automation of the work place.
- Computerization of 'traditional' design skills – Computer Aided Design (CAD), graphic design.
- Increases in home computer use – both for work related, educational and leisure activities.
- An increasing number of adults and children using computer-based games as a form of leisure. This is of particular significance as studies suggest that children spending more time in front of the computer are also spending less time involved in physical activity.
- As workplaces become more mechanized and computerized we are leading more sedentary lifestyles. Lack of personal physical fitness and the associated lack of conditioning may leave a worker more susceptible to developing musculoskeletal related injuries.
- Technology and computer skills are an increasingly important element of the school curriculum. Ergonomics must play a more consistent and essential role in computer education, as children are particularly vulnerable to forming poor work postures and work behaviors at a time when their bodies are continually growing and changing.
- Schools and tertiary education institutions encouraging students to use laptops for everyday use take on the added responsibility of their safe implementation. Laptops are heavy to transport and are of an inherently poor ergonomic design. The advantages of using a laptop in school may in fact be outweighed by the ergonomic disadvantages that can cause ill health in the user.
- More flexible delivery methods for adult education programs – online external study units require students to spend many hours in front of a computer.
- Generic education programs that do not target the specific needs of the workers they are targeted at.

The ***positive*** and proactive management of Cumulative Trauma Disorders in the workplace can alleviate or mitigate the potential impacts of the factors listed above. For many organizations, work-related injuries such as Cumulative Trauma Disorders are a substantial drain on economic resources, including worker time off, lost productivity, medical treatment, lowering of worker morale and other indirect costs. It is therefore in the best interest of such organizations to approach the issue of occupational injury management with a positive, committed, 'whole company' strategy. As ergonomics and human factors are principal contributory factors to the causes of Cumulative Trauma Disorders, they then present a viable means of prevention and management of the disorder.

Recommendations for minimizing cumulative trauma disorder occurrence

Published literature offers a wide range of ergonomic programs designed to deal with work-related musculoskeletal injuries and their management (Hedge, 2004; Feinberg, 2004; CEP, 1996; OSHA, 2001; NIOSH, 1997; PEOSH, 1997; UWA, 2001; CDC, 2000; Fraser, 2002: Breust, S., OHS Rehabilitation Consultant, personal communication, October, 2004). In addition, many government agencies provide guidelines for use by organizations. Some examples are the National Code of Practice for the Prevention of Occupational Overuse Syndrome (NOHSC, 1994) and the Office Ergonomics Consensus Guidelines (Oregon Government, 2004).

Every work situation is different but the following elements present a practical way to identify and evaluate ergonomic hazards and to begin efforts to improve workplace design. In conjunction with attention safe work processes and to sound ergonomic workstation set up it is important to address the psychosocial factors that may play a role in the perception and presentation of Cumulative Trauma Disorders in the workplace. Key elements in designing strategies for Cumulative Trauma Disorder prevention in the workplace are education, prevention and rehabilitation.

Education

Education of employers and employees is the single most important aspect in regard to prevention of Cumulative Trauma Disorder in the workplace. Forward planning and education is essential to minimize the risk to those workers whose job tasks or work environments put them at increased likelihood of developing musculoskeletal disorders or Cumulative Trauma Disorders. There also needs to be awareness of Cumulative Trauma Disorder, its contributing causes and ways of mitigating those risk factors. This can lead to the development of strategies aimed at providing a safer, more productive workplace. All parties need to identify their Cumulative Trauma Disorder prevention responsibilities and develop the necessary skills and knowledge to implement corrections to any unsafe work processes (OSHA, 2004).

As Berner & Jacobs (2002) concluded in

their study '*The gap between exposure and implementation of computer workstation ergonomics in the workplace*' the quality of the education program will largely determine how effective it will be in the longer term. Generic programs are of limited value, as they do not take into account the wide variation between workplaces and workstation set-ups. Education programs need to be tailored to produce positive effects for the workers in specific situations.

As with any quality education program, the employer and the employees themselves need to be positively and actively engaged in understanding how the concepts of good ergonomic set up and having safe work processes applies to them. The involving of workers in the management of their own well being in the workplace can have positive flow on effects for staff moral as they feel 'valued' by their employer. This in turn addresses some of the perceived psychosocial aspects of Cumulative Trauma Disorders in the workplace relating to poor self esteem and lack of trust with employers. Even before education, prevention of Cumulative Trauma Disorder workplace, work process and equipment used strategies should be implemented.

Prevention

The major elements of prevention strategies can be divided into the following key areas. Worksite evaluation, work area, workstation set-up, work posture, work habits and working with laptops. These may be further adapted or expanded on in relation to specific work processes and situations.

Worksite evaluation

When conducting a work site check look for signs indicating a potential for Cumulative Trauma Disorder in the workplace. Signs may include frequent reports by workers of aches and pains, job tasks that involve static or awkward postures for a long period of time, work tasks that involve repetitive motions over a long period of time or employees complaining that they do not have enough time to do their work safely with in employment hours.

Employee factors are important to consider when conducting this evaluation. Employee factors include employee suitability for performing the work tasks, if the employee has been adequately trained for the job that this person is required to do and if there is previous history of Cumulative Trauma Disorder in similar job tasks. The last point in itself is not a reason for denying employment but it may indicate that a job-specific functional capacity evaluation should be conducted.

When performing a work site evaluation it is important to check that the employer and employees are aware of Cumulative Trauma Disorder, its contributing factors and the best ways to prevent its occurrence. Check that employees are aware of whom to go to if they require more help with their station set up or if they are feeling physical discomfort while conducting their job tasks and that they are trained to understand the best ergonomic set up for their workstation.

Job design is an important factor to consider. Check that employees have enough time to complete their work safely, that the work does not involve repeated movements over time or is monotonous and static and check that there scope for moving around and varying job tasks. There must be well documented policies and procedures that are used by employees so that they know how to perform their work safely. Equipment used for each work task should be suitable for the task. For example, are headsets available for employees required to do a lot of telephone work or does the employee use a laptop computer for extended periods of time without a suitable docking station?

Assess if employees know how to adjust the components of their workstation. The work area should be large enough to comfortably accommodate the worker and allow a full range of motion when completing the required tasks. There should be enough room for all the materials and equipment that are needed at the workstation. Frequently used items, such as telephones, should close at hand.

Check the work station set up. For example ideally there should be a desk with adjustable height that is stable and large enough to accommodate all necessary equipment. Chairs should be adjustable without the use of tools, have wide and deep chair pan, waterfall (rounded) edge, be of adjustable height and have an adjustable forward/backward tilt. Office chairs also need to be upholstered (for comfortable sitting), have adjustable lumbar support, 5 legs (for stability) and easily swivel. Footrests should be provided if necessary to prevent short statue employees' feet from dangling above the floor.

Check that work tasks are designed so that employees can take mini breaks in between burst of typing to rest the hands, fingers and wrists. Formal rest breaks from computer work should be organized for every 30 to 40 minutes. These can be active work breaks such as a change of task, for example, photocopying or filing. Exercise breaks that include preventative stretching should be included at least on an hourly basis if there is not task rotation in the work performed. Hours of work should also be checked to ensure that a lot of overtime that involves longer time at the keyboard is avoided.

Some jobs may allow employees to swap roles during the day. For example, librarians may spend some time shelving books then swap over to manning the desk. This allows workers to become involved in a wider range of task requirements. The variety of postures and task demands spreads the load over a wider range of musculoskeletal tissues and reduces net stress to a specific structure or group of body tissues such as hand, wrist or arm muscles.

Check that there is enough light for employees to see clearly to work as unsuitable lighting can contribute to visual discomfort. Check that offices where computers are used have low watt lights so that there is not glare on the computer screen. Observe if curtains or blinds need to be adjusted to minimize glare. Reduce overhead lighting (where possible) and use indirect or shaded lighting where possible. Use a glare shield or computer monitor shield if necessary. As well as ensuring that the lighting is right for the work performed it is also important to check that employees

understand the best work postures to use when working at a computer work station.

Work postures

Check that each employee who uses a computer has their monitor set up directly in front of the person, not to the side or angled, as these positions require neck twisting when looking at the computer screen. The top of each employee's computer screen should be at or just below eye level when this person is seated up right. The computer monitor should be at a comfortable viewing distance which is approximately an arms length away. Another point to check is that the document holder is alongside the monitor and at the same distance away from the operator as the computer screen so that work to be typed is easily read. Employees should be encouraged to have their eye sight checked at least annually to see if they require glasses for reading so that they do not develop eye strain. Many Australian government agencies supply employees with new free reading glasses on an annual basis if the tested employee's eye sight requirements indicate that this is necessary.

When employees are using their computer key board check that they maintain their elbows close to right angles, that their wrists are held as straight and as flat as possible – not angled to the right or left or bent upwards or downwards. Keyboard should be located close to the employee to avoid over reaching. Employees should be positioned in front of the center of the key board. The letter B is at the center of the computer key board and provides an easy reference for this position. The computer mouse should be placed in each employee's reach zone for maximum comfort and hand eye coordination. Employees should keep their wrist in a neutral position when ever possible to rest the wrist muscles. Employees should not rest their wrists or arms while typing, but should rest these in between bouts of typing, even if only briefly.

An interesting fact is that Cumulative Trauma Disorder did not occur in the days when secretaries used type writers. The difference between typing on a type writer and a computer is that with the type writer the typist had to hit the keys quite hard to produce the letter on the paper. This required more muscular action (and consequently produced a better blood flow to the used muscles) than that needed to type using a computer where the keys are taped lightly to produce the letters on the paper. There was also not the static muscle loading due to the need to hold the hand up right when using a computer mouse for long periods of time.

Using good posture and task rotation are some of the best ways to prevent computer work-related injury. When performing the work site assessment check that employees are sitting in a comfortable position such as sitting back in the chair so that the spine is supported with their feet flat on the floor or a foot rest. Employees should have a gap of several centimeters between the edge of the chair and the back of legs to avoid loss of circulation to the legs. Employees should avoid the sitting in the same position for too long and be encouraged to shift positions at least every 15 minutes to ease muscle tension. Employees need to feel relaxed while typing.

Telephone work

Continuous telephone work can also be a cause of Cumulative Trauma Disorder particularly if the employee cradles the telephone between their head and neck. If telephone work is a frequent job task then arrange for the use of a headset. Encourage employees to use telephone work as an opportunity to change positions at the desk and stretch their working muscles.

Laptops

Laptop computers are not recommended as being used as the primary computers in the office or at home. Laptop computers are ideal for traveling, taking into the field, allowing mobility between job sites and working from home - but should only be used for short periods of time. If a job task regularly involves the use of a laptop for more than one hour at a time then the following guidelines should be taken into account.

- Employ all of the ergonomic guidelines associated with traditional computer set up.
- Attach a full size monitor.
- Attach an external keyboard. This is particularly important if traveling and using multiple work sites. Raise the laptop to the level that a traditional monitor screen would be set at.
- Use an external mouse.
- Use a docking station. Particularly if the laptop is used regularly in the field and in the office this will allow the laptop to be more easily hooked into monitors, keyboards, CD ROMs, printers and other peripherals.

When transporting a laptop computer ensure that employees keep the total weight of objects being carried to less than 15% of their body weight or to no more than 5 kilograms. Ensure that they carry only the essential laptop accessories and consider what other paraphernalia they may have to carry with them. Provide employees with a specifically designed backpack with wide straps and preferably chest straps or provide them with a rolling carry case if this is possible to Cumulative Trauma Disorder. If, however, employees do develop Cumulative Trauma Disorder at work it is important for the workplace to have a good rehabilitation program.

Rehabilitation

Employees should be encouraged to report any signs of Cumulative Trauma Disorder as early recognition, evaluation and treatment of Cumulative Trauma Disorders can stop this injury from becoming a major problem with permanent damage to body tissues. As soon as an injury is reported an investigation needs to be conducted and work processes must be evaluated and changed to improve occupational safety. There is little health benefits after rehabilitation in sending employees who have suffered Cumulative Trauma Disorder back to do the same unsafe work processes that caused their injury. Having safe work practices is important also to prevent other employees being injured due to the same work related causes.

Early rehabilitation of an injured employee reduces the human costs involved in a workplace injury as well as the company costs involved in an occupational injury. Rehabilitation for

Cumulative Trauma Disorder involves appropriate treatment by a qualified occupational health oriented physician and/or rehabilitation consultant. The medical management of an injured worker is largely dependent on the compensation system and legal organization of local or national government agencies. Rehabilitation cases may be managed through liaison between the caseworker assigned to the injured individual, the treating physician, and the employer. Return to Work programs will be managed as seen appropriate by the caseworker.

An expectation should be created of an early return to work during early discussions on work capacity. As tendons or muscles that have been injured by unsafe work practices should be given time to heal alternative work which does not stress the injured tissue should be found for the employee until the damage has been repaired by their body. The role of alterative, modified or selected duties (and steering clear of terms such as "light" duties) should be explained as this helps the worker to focus on a return to normal work duties goal rather than the negatives of their situation. This approach is particularly important when dealing with workers older than 40 years as many of them will only know of the "bed rest" approach to any injury and would find the current approach that focuses on function within pain limits quite foreign. For those employees whose tissue damage is so bad that they do not respond to treatment, vocational rehabilitation may be recommended.

Conclusions

In today's computer age where work, education and leisure activities can involve using computers for many hours a day, preventing Cumulative Trauma Disorder for office workers who use visual display unit work stations is important for the Safety and Health Professional. A review of published literature has indicated that the key strategies to use to achieve this are to provide employees with enough time to do their work safely, have safe work processes and provide both the employer and relevant employees with education on specific strategies to use to prevent Cumulative Trauma Disorder in their workplace. If any employees do develop Cumulative Trauma Disorder it is important to implement proactive rehabilitation practices as soon as any employee shows any signs of Cumulative Trauma Disorder. However prevention of Cumulative Trauma Disorder should be aimed for rather than rehabilitation. To help evaluate work there is a useful ergonomic checklist for prevention Cumulative Trauma Disorder for office workers who use visual display units included as Appendix A.

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Appendix A

An Ergonomic Checklist For Preventing Cumulative Trauma Disorder For Office Workers Who Use Visual Display Units

	Yes	No
WORK SYSTEMS	☐	☐
Are your keying and mouse activities interspersed with a variety of other work tasks?	☐	☐
Do you have a variety of jobs to do each day?	☐	☐
Are your work rates within your capacity?	☐	☐
Is your workload reasonably constant?	☐	☐
Do you include micro-pauses in your work (e.g. resting your hands on your lap whilst waiting for a document to load or be saved)?	☐	☐
CHAIR SET UP	☐	☐
Does your chair have fully adjustable height, back tilt and back rest positions?	☐	☐
Is your chair correctly adjusted: -	☐	☐
Are your elbows level with or slightly higher than your keyboard when you type?	☐	☐
Is the lumbar support of the chair in the small of your back?	☐	☐
Is your sitting posture upright?	☐	☐
Are your feet flat on the floor or on a footrest?	☐	☐
Are your knees at approximately 90°?		
COMPUTER SET UP	☐	☐
Are your monitor and keyboard positioned directly in front of you?	☐	☐
Is your monitor positioned at arm's length?	☐	☐
Is your keyboard located close to your body to avoid over reaching?	☐	☐
Are your eyes level with the top line of characters?	☐	☐
Is your mouse located close to the keyboard?		
Are your shoulders relaxed when the hands are resting on the keys with the upper arms hanging naturally and the lower arms at approximately 90°?	☐	☐
WORKSTATION LAYOUT	☐	☐
Are all frequently used items at arm's reach?	☐	☐
Do you have a document holder in line with or close to your monitor?	☐	☐
Can you view source documents without excessive turning or looking down?	☐	☐
Are frequently used books/files stored in filing cabinets or shelving between mid-thigh and chest height?	☐	☐
Is there a telephone headset available for use?		
WORK POSTURES	☐	☐
Is your chin tucked in towards the chest and aligned with the spine rather than poking forward or upwards?	☐	☐
Are you altering your seated posture regularly throughout the day, e.g. reclining whilst on the phone, sitting upright to key?	☐	☐
Are your wrists straight and in line with the forearm whilst keying or using the mouse, in order to avoid excessive bending to the side or upwards?	☐	☐
Do you perform your work break exercises once or twice a day?	☐	☐

*****Did you answer NO to any of the questions? Please discuss these questions with your Supervisor or Occupational Safety Representative*****

SARS...The Story So Far: Public Health And Safety Implications

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Abstract

SARS was the first global health emergency of the 21st Century. The volume of international air travel allowed SARS to spread around the world with unprecedented speed. The full political, economic and social impacts of SARS are only just starting to be measured and reported on. The close interdependence of economies and markets certainly appeared to amplify the economic impact of SARS considerably. The airlines and travel industry were hit very hard, especially in Asia, where they had already suffered severely from terrorism and the Iraq war. SARS emphasized the nature of the global village where an outbreak of a disease in one country can lead to an outbreak in another country. In the case of SARS, it will be important to aim for elimination of the source of the virus. The question is, can this be achieved?

Introduction

The outbreak of a severe atypical pneumonia, termed Severe Acute Respiratory Syndrome or SARS, in a Vietnamese hospital led to the World Health Organization (WHO) issuing a global alert on SARS on 12 March 2003. On this day, 55 SARS cases were recognized in hospitals in Hong Kong Hanoi and Singapore (WHO, 2003b). The resultant investigation revealed that an epidemic of this mysterious disease had been ongoing in southern China since November 2002. In a story in Time Asia (Unmasking a crisis, 2003, p. 1) a Shanghai-based respiratory specialist was reported as stating that "Our primary concern is social stability, and if a few people's deaths are kept secret, it's worth it to keep things stable." In the early stages of the epidemic, there were genuine concerns that this may be the "super bug" that would end the human race.

Initial response

By 15 March 2003, the WHO had begun to issue a series of unprecedented travel alerts and recommendations. Governments and the press, especially in non-SARS affected countries, were thought to have been slow to strike the right balance between timely and frequent risk communication and placing the risk in the proper context. A further press release by the WHO had worse news:

On 29 March 2003, the World Health Organization doctor who first identified the fast-spreading pneumonia that has killed 54 people worldwide has himself died of the disease. "Dr. Carlo Urbani, an expert on communicable diseases, died today of Severe Acute Respiratory Syndrome", the Geneva-based UN health agency said in a statement, using the provisional name that doctors have given to the illness (Thomson, 2003, p. 1). Needless to say, instantaneous communications elevated public concern often to the point of panic and this added to social and economic disruption.

Effects on the airlines industries

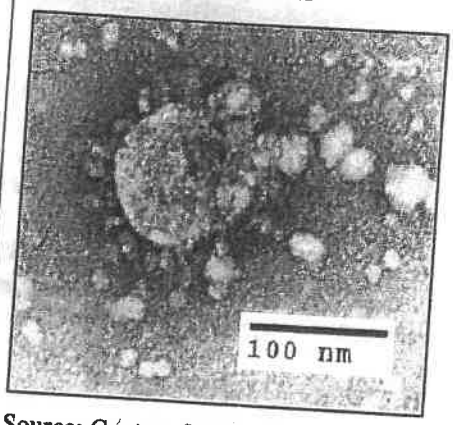
Airline staff concerns escalated and crew took to wearing masks and gloves. Hot towels were generally removed. During aircraft cleaning, masks and eye protection were used; however the usual agents that were used to disinfect again such viruses, such as Sodium hypochlorite, could not be used on aircraft without risking damage to the aircraft frame. The travel industry was one of the first casualties and the impact could be seen in areas such as Hong Kong (Wilder-Smith, 2005).

Cathay Airline passenger numbers dropped from more than 30,000 passengers per day to less than 7,000 passengers per day. Losses were in the order of USD $3,000,000 per day. More than 16 aircraft were parked and forced leave and pay cuts for staff ensued. The outbreak had exploded within a month to cause some 3000 cases and more than 100 deaths in 20 countries on all continents.

Global response

In the meantime, the global disease response had moved into high gear. Rapid communications and international technical co-operation led to the discovery of the infectious agent, its genome and candidate tests for the new virus. On 17 April 2003, a causative agent, a Coronavirus, was conclusively identified (WHO, 2003a, WHO, 2003b). This type of virus was already known to cause some milder forms of respiratory illness (see Figure 1).

Figure 1. Electronmicrograph of SARS Coronavirus



Source: Centers for Disease Control and Prevention, USA. (2005, p. 1)

There was still however no vaccine and no effective treatment, with a case fatality ratio of 15% and many unexplained features. People had spread the disease around the world by traveling home carrying the SARS in their respiratory tract. The important question of disease transmission remained largely unanswered. None-the-less, the public face of SARS had come to be symbolized by a mask - an appropriate image for a disease still shrouded in mystery.

Disease surveillance moved very quickly into high gear. The main tools for public health were:

- Surveillance and screening, with the humble thermometer becoming a key tool in the battle against SARS
- Isolation
- Contact tracing and follow-up
- Quarantine and travel restrictions (WHO, 2003b).

The risk of getting SARS on planes was very low, but sophisticated imaging and screening procedures instituted at airports had made the risk virtually zero although protection could not be 100%

guaranteed (Freedman, 2003; Wilder-Smith, Goh & Paton, 2003).

Other successful measures instituted against SARS included:

- SARS-dedicated hospitals, which were rapidly built in China
- Mass media campaigns.

Spread of SARS

Public health experts and epidemiologists, examining the SARS epidemic, expended a great deal of "shoe leather" to try to resolve the mode of transmission of the virus. Airborne transmission appeared unlikely. It seemed more likely that transmission was:

- mainly person to person
- through direct respiratory droplets
- hand contamination
- fomites
- possibly also fecal-oral transmission (WHO, 2003b).

The bottom line was that this new emerging virus was sufficiently transmissible to cause a very large epidemic if unchecked. But it was not so contagious as to be uncontrollable with good basic public health measures.

Specific recommendations

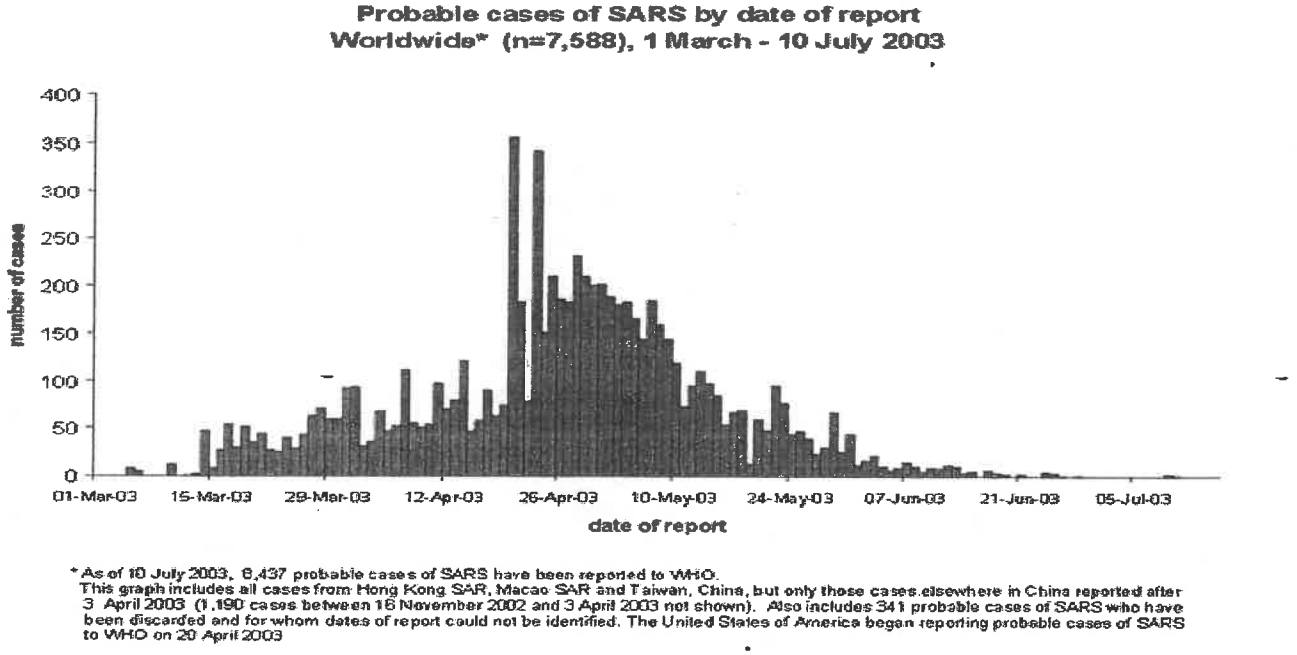
Public health officials announced a number of measures to be used against SARS in light of their investigations, namely:

- Education about recognition of SARS symptoms and early health seeking
- Vaccination against influenza, as influenza symptoms mimic those of SARS
- Education on droplet precautions
- No one who had been in contact with a known SARS case, whether in SARS-affected area or elsewhere, should cross an international border for 10 days after the last contact (assuming they remained asymptomatic) (WHO, 2003b).

By June 2003, there had been a dramatic reduction in SARS cases notified (see Figure 2).

Figure 2.

Source: World Health Organization (2003c, p. 1).



Aftermath

It appeared that the epidemic had been controlled by these simple measures, but it required large efforts by Governments and health care staff, especially in China where most of its public health staff moved to combat SARS. A well-informed and cooperative public supported their work. None-the-less, from 1 November 2002 to 7 August 2003, there had been:

- 8422 cases in 30 countries
- 7442 recovered
- 916 deaths
- Case fatality ratio of 11%
- 20% were health care workers (1725)
- In Australia 6 cases, no deaths (WHO 2003d).

There is a need for continued vigilance and surveillance for cases (Freedman, 2003). There is also a need for continuing testing of point of care diagnostic tests. The origins of this emerging infectious disease also need further investigation, particularly the possibility of one or more animal reservoir, which will also need to be investigated and addressed with ongoing surveillance.

Conclusion

SARS was the first global health emergency of the 21st Century. The volume of international air travel allowed SARS to spread around the world with unprecedented speed. The full political, economic and social impacts of SARS are only just starting to be measured and reported on. The close interdependence of economies and markets certainly appeared to amplify the economic impact

of SARS considerably. The airlines and travel industry were hit very hard, especially in Asia, where they had already suffered severely from terrorism (World Trade Center on September 11, 2001, Kuta in Bali, October 12, 2002) and the Iraq war. SARS emphasized the nature of the global village where an outbreak of a disease in one country can lead to an outbreak in another country. In the case of SARS, it will be important to aim for elimination of the source of the virus. The question is, can this be achieved?

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Health Effects Of Over Exposure To The Sun

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Abstract

Over exposure to the sun can cause many health problems including, sun burn, heat stress, heat stroke, damage to the immune system, allergic reactions, keratosis, photokeratitis, photo conjunctivitis, pytergium, basal cell carcinoma, squamous cell carcinoma, malignant melanoma and death. As well as discussing the health effects caused by over exposure to the sun this article makes recommendations for interventions to be implemented to prevent these health effect, particularly for our door workers.

Introduction

Until recent years a sun tan had been regarded by a vast majority of people as something to be admired and envied. Exposure to the sun in Australia is accepted as part of the daily environment. Over the last 21 years the Cancer Council Australia's education campaigns like 'Seagull Sid" and his "Slip, Slop, Slap" ingle, "SunSmart" school programs and he promotion of "SunSmart" workplaces ave encouraged more people to apply unscreens and wear hats, suitable lothing and sunglasses as a means of otection (The Cancer Council ustralia, 2003a; 2004b; The Cancer ouncil of Western Australia, n.d.). Prior this many children, and adults, in stralia would lie on the beach, or in their backyard, to get sun tanned as this was thought to make them look beautiful and to boost their intake of natural Vitamin D. As a result of this Australia now has the distinction of having a population with the highest incidence of skin cancer in the world.

Australia offers unlimited outdoor sports activities all year round, with the focus on family outings and the opportunity to get outdoors to soak up the fresh air after being cooped up in the home, office or factory during the week. Activities such as netball, soccer and football in winter, relaxing days pottering in the garden during springtime, surfing, boating and other water activities in hot summer weather and lazy days around the barbeque or leisurely walks in the cool autumn days all contribute to exposure to the sun on a recreational basis. The promise of cooler temperatures at the beach on days where the thermometer can sore to above 35 degrees Celsius for some people is too hard to resist.

With recent health campaigns in Australia to "Take 30 minutes" for physical activity more and more people have adopted a regime of daily walks either before or after work, or during their lunch break, with the objective of attaining a healthier mind and body. Individually people have a choice of what sort of recreational activities they engage in, but what of those people such as farm workers, construction workers,

gardeners, sea divers and outdoor activity workers whose job opportunities and livelihood are dependant upon their ability to work outdoors for prolonged periods of time.

Some self employed people who work outdoors have the option of flexible working hours – starting at daybreak and finishing before mid-day, or they are able to work shorter hours during the extreme heat of summer, opting for less pay rather than struggle through working in extreme temperatures. However not all outdoor workers are afforded this luxury. Not only do outdoor workers spend long periods exposed to the sun whilst carrying out their daily business, but they face further exposure when they join their families and many other Australians in outdoor leisure activities. It is no wonder then that out door workers are placed high ranking in the risk groupings of a nation that has the highest incidence of skin cancer in the world (The Cancer Council of Australia, 2003b; 2004a).

Ultraviolet Radiation

Through the electromagnetic radiation spectrum (EMR) the sun emits heat via infrared rays; light and sunlight through radiation and ultraviolet radiation (UVR). Electromagnetic radiation spectrum is characterized by wavelength. The wavelength measurement for ultra violet radiation is 1,000,000,000th of a meter and is known as the nanometer (nn) (National Health & Safety Commission [NOHSC], 1991). Ultra violet radiation is present in different forms and is affected by sunlight passing through the atmosphere (WHO, 2004a). Vacuum ultra violet radiation is very dangerous but, like Ultra Violet-C, is absorbed through the atmosphere and does not reach the earth ([NOHSC], 1991). Ultra Violet-A is least affected by the atmosphere and has the highest presence in sunlight, causes damage to the skin and eye and increases the risks of skin cancer and melanoma (WHO, 2004a;. [NOHSC], 1991; The Cancer Council Australia, 2003a).

Ultra Violet-B is the most damaging form of ultra violet radiation even though it has a lower presence due to the fact that approximately 90% of it is absorbed by ozone, carbon dioxide, oxygen and water vapor when sunlight passes through the atmosphere (WHO, 2004a). UV-B causes sunburn, suntan, eye damage, skin ageing and skin cancer (The Cancer Council Australia, 2003a).

A slight benefit of ultraviolet radiation lies in the fact that it acts as a stimulant for Vitamin D which is essential to the body's absorption of calcium and phosphorous assisting essential skeletal development, blood cell formation and functions of the immune system. However, only 5 to 15 minutes of sunlight exposure to the face, arms and hands just 2 to 3 times a week in the summer months is required to maintain sufficient levels of Vitamin D. Whilst some health benefits in treating certain illnesses caused by Vitamin D deficiency can be realized, over exposure can have short and long term damaging effects which cannot be negated by the perceived immediate benefits (WHO, 2004e).

Environmental Factors

Stratospheric ozone absorbs Ultra Violet Radiation by blocking the output of Ultra Violet-C and Ultra Violet-B from the sun, but depletion of the ozone layer has reduced the protection once offered by this natural filter. Decreased atmospheric ozone has exposed both the environment and human beings to greater levels of ultra violet radiation; the most hazardous form being Ultra Violet-B. As well as being affected by the global depletion of ozone, absorption of ultra violet radiation by ozone can be affected by time of day and time of year WHO, 2004e).

In *"The Sun and Outdoor Workers - a workplace hazard"* the Cancer Council Western Australia (CCWA) warns workers that in Western Australia levels of ultra violet radiation are the most intense between 10am to 3pm and are generally highest in the summer months of November through to February when the skies are clear. The southern region of Western Australia experiences the highest levels of ultra violet radiation in January. This is six times higher than ultra violet radiation received in July. In the far north of Western Australia all year round ultra violet radiation levels remain high to extreme (The Cancer Council Western Australia, 2004a, April). Ultra violet radiation is reduced in winter when the sun is lower in the sky ([NOHSC, 1991]).

Some people believe that if the sun isn't visible in the sky then they won't get sunburnt – this is not true. In its information sheet *"About ultraviolet radiation"* the Bureau of Meteorology (BoM) advises that cloud cover reduces intensity but the extent of cover is dependant on the amount and type of cloud (Bureau of Meteorology, 2004). Even on a cloudy day water molecules and fine particles in the earth's atmosphere can act as a dispersant to scatter high levels of ultra violet radiation throughout the earth's atmosphere (WHO, 2004a). The Bureau of Meteorology reports that on a cloudy day a small break in the clouds can cause a short but very intense burst of radiation to reach the ground. By reflecting and refracting the rays emitted from the sun, some clouds can even increase the intensity of the ultra violet radiation (Bureau of Meteorology, 2004). In addition, Altitude, Latitude, Ozone, and ground reflection all impact on the level of exposure (WHO, 2004a).

According to the World Health Organization (WHO) UV levels increase by 4% with every 300 meters above sea level. This is because the higher the altitude the thinner the atmosphere and the less natural filter of ultra violet radiation, hence the perception by many Australians "it's much cooler at the beach" (sea level). Even at the water depth of a half meter ultra violet radiation intensity is still 40% of surface levels. Ultra violet radiation also increases the closer people are to the equator (WHO, 2004a).

Some surfaces act as a reflector causing ultra violet radiation to bounce off the surface and scatter through the atmosphere. Man made surfaces such as corrugated steel, reflective building glass, aluminum, light colored concrete and other shiny surfaces contribute to varying degrees, as do some soils and even grass (The Cancer Council Western Australia, 2004a). Natural surfaces such as snow, water, rock, and sand contribute to varying degrees (National Occupational Health & Safety Council, 1991).

According to the WHO snow can reflect

as much as 80% of ultra violet radiation, dry beach sand about 15% and sea foam about 25% (WHO, 2004a). For example, those employed in the Australian snow fields in winter can face just as much exposure as what is experienced at sea levels during summer months. Shade can offer reduced exposure to the heat radiated from the sun but it does not remove the risk of substantial exposure to solar ultra violet radiation. This is because half to two-thirds of solar ultra violet radiation is scattered from the sky (National Occupational Health & Safety, Council, 1991).

Health effects of over exposure to the sun

Workers of all skin types are affected by ultra violet radiation although dark skinned people normally don't need to use sun screens to protect their skin. They have more melanin in their skin which provides a higher resistance to ultra violet radiation levels. Dark skinned people have a much lower risk of developing skin cancers but the dangers to the immune system and the eye still affect all workers, regardless of skin color (WHO, 2004d). The Health Department of Western Australia reports no incidence of melanoma amongst indigenous Australians in Western Australia (Health Department of Western Australia, 2004).

The Cancer Council Australia reports in "*What causes skin cancer?*" that the number of Australians being treated for sunburn each summer still exceeds 5 million. This is not caused by the heat emitted from the sun (through infrared rays) but by ultra violet radiation which cannot be felt nor seen. Even on overcast days it is easy to burn because ultra violet radiation rays are able to penetrate clouds. It is claimed that most people who get sunburnt do so when the temperature is between 18-27 degrees Celsius, mistakenly believing that if the sun is not strong they will not get burnt (The Cancer Council Australia, 2003a).

For outdoor workers, skin cancers are more likely to develop on the parts of the body that are more often exposed to the sun with shoulders, legs, arms, head, ears, lips and neck being at risk. Individual body factors such as skin type, previous exposure, reaction to certain chemicals, drugs and plants all have a bearing on the extent of damage caused (The Cancer Council Western Australia, 2004a).

It should be remembered that because of its intensity the Australian sun puts every outdoor worker at risk, irrespective of where they work or what time of the year it is. This immediate risk may appear to be slight, especially if the body outwardly seems to have repaired itself but any damage caused by over exposure can have devastating long term effects in later years. Simply put, the longer a person remains exposed to the sun the greater the risk of heat stress, sunburn, skin damage, lip cancer, suppression of the body's immune system, photosensitivity, damage to the eyes and skin cancer. The effects of this damage manifests in the following forms.

Heat Stress

Outdoor workers can suffer heat stress of differing degrees when the body looses its ability to maintain normal body temperature. When temperatures soar the rate of blood flow to the skin increases to allow the body to release heat. This ability to release heat is reduced when increased physical activity causes the body's system to divert blood to the muscles instead of the skin.

High humidity levels, heat radiated from surroundings, airflow, type of clothing being worn and the level of manual activity required to complete the task have a direct impact on a person's ability to disperse metabolic heat by sweating. Personal fitness levels and amount of fluid intake also contribute. Mild heat stress manifests when a person becomes weak or dizzy and is easily rectified by moving to a cool spot and drinking cool, but not cold, fluids.

If left unattended the symptoms can increase to heat exhaustion causing the body to dehydrate and overload the cardiovascular system. Indicators are headache, nausea, a sense of clamminess, painful muscle cramps, lethargy, low blood pressure, pale or flushed skin. To relieve the symptoms the person should be removed to a cool place, heavy clothing removed and body fluids replaced by frequent intake of cool drinks. If these symptoms are not identified and corrected, permanent brain damage, or even death, can result through heat stroke.

Victims of heat stroke require urgent treatment. Symptoms of heat stroke to watch for include irritability, signs of disorientation or confusion, inability to speak coherently, skin that is hot, dry or flushed, body temperature in excess of 40 degrees centigrade, no sweating, loss of consciousness, convulsions and at worst, cardiac arrest. In the case of heat stroke the worker must be hospitalized. Immediate first aid must be applied to make the worker more comfortable and reduce body temperature whilst waiting for the affected person to be transferred to hospital care. While waiting it is important to move the person to a cool place, remove heavy restrictive clothing, soak the remaining clothing in cold water, sponge the worker with water and provide vigorous fanning to increase the movement of air (WorkCover Corporation of South Australia, 2002, WorkSafe Western Australia, 2003b).

Sunburn

Erythema is the medical term for sunburn, which is the most immediate and obvious effect of over exposure to ultra violet radiation. Sunburn is caused when cells in the upper skin are damaged or, depending on level of exposure, killed. In its mildest form it is revealed in redness of the skin. At worse it can cause painful blistering and peeling of the skin. Although visual effects may disappear after a few days the long term effects may result in skin cancer. The new skin is unprotected and risk of further damage is increased because the body has not yet had time to build up a resistance. Sunburn increases the likelihood of developing skin cancer (WHO, 2004c).

Skin Damage

Firm, dry rough spots on the skin are known as sunspots or keratosis and are a result of long term exposure to the sun (National Occupational Health & safety Council, 1991). They appear on parts of the body not covered by clothing, mainly the forearms, hands, eyes, face and neck. Whilst painless they can develop into squamous cell carcinoma if not treated

(The Cancer Council of Western Australia, 2003).

Melanin is a dark colored pigment present in the upper cells of the skin. When the skin is exposed to ultra violet-A this pigment is activated. Exposure to ultra violet-B stimulates the production of new melanin pigment. It also causes the skin to produce more and more cells, resulting in a thicker, darker epidermis. When the skin is over exposed to the sun it reacts by producing a dark colored shield known as "tan", which, far from being healthy, is nothing more than an indication that the skin has been over exposed and is trying to protect itself from further damage. Ultra violet-A radiation damage causes the skin to slowly loose its elasticity, resulting in premature ageing of the skin with sagging and wrinkles. This is caused when the ultra violet-A radiation penetrates deep into the skins layers and disturbs connective tissues and blood cells (WHO, 2004e).

Damage to the Immune System and Lip Cancer

Recent research indicates that ultra violet-B radiation may not only damage the DNA system, but it appears also to be detrimental to the body's immune system. In some cases high levels can impair the effectiveness of vaccinations and reduce the body's defenses against skin cancer. The cold sore syndrome known as Herpes simplex virus is a good example where studies in the United States have discovered an increase in recurrence of the virus when participants were exposed to ultra violet radiation (WHO, 2004f).

The National Occupational Health and Safety Commission reports that lip cancer is most common in outdoor workers exposed to sunlight over prolonged periods because the lips do not contain the natural protection of melanin (NOHSC, 1991).

Photosensitivity

Some workers may suffer from a condition that makes even a mild exposure to ultra violet radiation bring on an allergic reaction. Inhalation or dermal exposure to certain chlorinated hydrocarbons, industrial chemicals and their fumes, particularly coal tar and its by products; the application or ingestion of certain medications, such as non-steroidal anti-inflammatory drugs, painkillers, oral anti-diabetics, antibiotics, tranquillizers and antidepressants can induce irritation to the skin and eyes, as can certain dyes, foods and fruits, cosmetic products (fragrances and soaps) and exposure to certain plants (WHO, 2004c; NOHSC, 1991; The Cancer Council Western Australia, 2004a).

Eye Damage

Melanoma is the most common form of eye cancer and basal cell carcinoma is often found on the eyelids. The eyeball and eyelids are made up of very sensitive skin like tissues (WHO, 2004h). If you have ever stood on a sunny day talking to someone who is not wearing sunglasses you will probably have noticed that they tend to squint, and try to shade their eyes by angling their hand over their forehead, or move away from direct sunlight. This is because the body's natural defenses are acting to block the penetration of the sun's rays into our eyes. This defense offers little protection against ultra violet radiation, even on a cloudy day, and exposure can result in any of the following diseases.

Photokeratitis and *photoconjunctives* are an inflammation of the cornea and conjunctiva and can be best described as sunburn to these tissues. Symptoms can be experienced after just a few hours exposure. Whilst the disease can be very painful, symptoms are usually reversible and generally do not appear to cause any long term damage. Some ski workers and mountain climbers wear eye goggles to protect their eyes from airborne pollutants, from damage from falls or collision, and to protect their eyes from snow blindness. The term "snow blindness" is given to severe forms of photokeratitis where extreme ultra violet radiation levels are experienced at high altitude and high reflection levels contribute to kill the outer cells of the eyeball. The shedding of the dead cells is a very painful process but regrowth usually takes place in 3-4 days, although severe cases can result in tearing or chronic irritations (WHO, 2004h).

Pytergium is a common cosmetic blemish which can be linked to long term exposure to UVR, where a growth appears on the surface of the eye. This growth can extend over the cornea, reducing vision. The growth tends to become inflamed and, although removable by surgery, regrowth normally occurs (WHO, 2004h).

Cataracts can eventually cause blindness. Cataracts occur when proteins which have become unraveled accumulate pigments and tangle causing the lens of the eye to cloud thus impairing vision (WHO, 2004h). Most people experience growing eye cataracts in differing degrees as they become older, however exposure to UVR increases the damage (Royal Victorian Institute for the Blind, 2003; Prevent Blindness Foundation, n.d.; my Dr from MIMS, 2001; 2004).

Skin Cancers

There are two types of skin cancer, *non-melanoma* and *melanoma.* The most common form of non-melanoma skin cancer is the basal cell carcinomas (around 70-80%). *Basal cell carcinomas* initially appear in the form of a red lump or scaly area which grows slowly over months or years. Although this cancer rarely spreads, it can invade underlying tissue if neglected. This form of cancer can be removed surgically (The Cancer Council Western Australia, 2003).

More dangerous, and the second most common form of cancer (around 15-20% of cancers), is the *squamous cell carcinoma* which appears as a thickened red scaly spot. Despite the fact that squamous cell carcinoma grows slowly this cancer must be surgically removed before it spreads to other parts of the body and presents a serious risk to life (The Cancer Council Western Australia, 2003).

Malignant melanoma, although the most dangerous of all skin cancers, is also the rarest. Malignant melanoma presents itself either as a new mole with patchy colors and irregular outline or in changes to the shape, size and sensation, including itchiness of an existing freckle, spot or mole. If untreated, cancer cells can spread to other parts of the body from the developing tumor (WHO, 2004c).

More than 5 million Australians still

suffer from sunburn each summer. Doctors in Australia remove around 720,000 lesions because they are suspected of being cancerous. In Australia 1.9% of the population each year is diagnosed with skin cancer, contributing to about 80% of the total new cancers diagnosed each year. Of the 374,000 cases of non melanoma skin cancers diagnosed in 2003, some 360 resulted in death. Of the 8,500 cases of melanoma diagnosed in 2003 almost 1000 people died (The Cancer Council Australia, 2003a; 2003b). All of these figures apply on an annual basis. This is a frightening thought considering that protection from over exposure to the sun could significantly reduce, or in most cases even eliminate, these figures.

In its National Cancer Prevention Policy (2004-2006) The Cancer Council Australia reported that exposure to UVR is the major factor in the development of melanoma. Its incidence is now equal to that of lung cancer and it is ranked fourth and third amongst the most common cancers in Australian men and women respectively. Professor Coates, the Council's CEO, reports that this disease is the most costly in the nation's health system. Skin cancer costs the Australian nation some $420 million dollars each year (The Cancer Council Australia, 2004a; 2004c).

Summary of appraisal of published research

Common facts that have emerged from critically reviewing published research on the health effects of over exposure to the sun are summarized as follows.

- More than a short exposure to the sun and UVR puts the person's health and body at risk of damage;
- Damages could be prevented;
- protection is paramount to prevention;
- most damage occur in younger years but may not manifest until later in life;
- outdoor workers are at a higher risk because of their continued over exposure to the sun;
- overall no statistics were found on the effects of over exposure to the sun that specifically related to outdoor workers;
- diet plays an important part in prevention of skin cancers and cataracts, in particular is the amount of alcohol consumed;
- the adoption of the Global Solar UV Index of the World Health Organization for the reporting of solar UV danger in Australia should be used by employers and employees.

The consistency of these themes shown in the literature reviewed (see end text reference list), and the time frame to which they are applicable, strengthen the reliability of the information.

In its *Annual Report 2002-2003* The Cancer Council Western Australia commented on its survey of 459 construction workers to determine their attitude towards sun protection. In this Annual Report there was no information about the survey findings, nor did the survey extend to evaluating the health impacts of using, or not using, sun protection for construction workers (The Cancer Council Western Australia, nd).

In *State of the Work Environment* WorkSafe Western Australia (2004) reported statistics in accordance with the Australian & New Zealand Standard Industrial Classification Coding System on a broad base and frequency rate indicated by year, industry and occupation. The reported statistics did not differentiate between indoor and outdoor workers, nor did they take account of self employed workers. The WorkSafe Western Australia statistics did not include any information about the incidence of heat stress, cataracts or skin cancers that were work related. The reported statistics appeared to be restricted to the four most common type of injury, namely manual handling, slips, trips and falls, being hit and hitting objects (WorkSafe Western Australia, 2004).

Various foundations like The Cancer Council Australia (2003b, November) and the Prevent Blindness Foundation (nd) in presenting statistics do not differentiate between outdoor workers and the general community, nor does *The Western Australian Cancer Registry* produced by the Department of Health, Western Australia (2004) when it reports statistics on the incidences of different forms of cancer by incidence, mortality, by age, sex, Perth metropolitan area, and by country areas.

The World Health Organization (2004i) in Protecting Children from Ultraviolet Radiation states that one in two Australians will suffer from some sort of skin cancer in their lifetime. The *Guidance Note for the Protection of Workers from the Ultraviolet Radiation in Sunlight* advises that skin cancer is expected to develop in 2 out of 3 Australians up to 75 years old (NOHSC, 1991).

In *Ultraviolet Radiation – What is it?* The Cancer Council of Western Australia (2000b, October) reports that ozone depletion results in small increases in ultra violet-B radiation levels while in *All about Skin Cancer* The Cancer Council of Australia (2003a, November) advises that it is not yet known how the incidence of skin cancer will be affected by the thinning of the ozone layer. The Cancer Council of Western Australia (2003) notes that depletion of the stratospheric ozone will increase the ultra violet-B radiation levels more than ozone depletion.

WHO (2004a) in *Ultraviolet radiation and health* reports a 10% decrease in stratospheric ozone based on computational models, would create an increase of some 4500 melanoma and 300,000 non melanoma skin cancers, and some 1.6-1.75 million additional cases of cataracts every year world wide. It is of great concern then that the predicted figures for skin cancers world wide are relatively close to the annual incidences currently being experienced in Australia as reported by The Cancer Council Australia (2004a), the Bureau of Meteorology (2004) and the World Health Organization (2004i).

Recommendations for Interventions to be implemented

The sunburn or "tan" of today may be the skin cancers, melanomas and cataracts of tomorrow. All of the effects of over exposure to the sun can be avoided through prevention and protection, and whilst the old adage *"prevention is better than cure"* certainly applies, early detection and correct medical attention plays a vital part in the recovery rate.

It must be remembered that not all

outdoor workers are always able to protect themselves fully from the sun in carrying out their duties. Quite a few at best can only hope to eliminate as much of the ultra violet radiation as the use of protective clothing and sunscreens can allow without restricting their daily work activities. In promoting *SunSmart Workplaces*, The Cancer Council of Western Australia (2004) warns of the increasing likelihood of workers being successful in claiming compensation for the development of skin cancers. The Cancer Council of Western Australia (2002) cites the ruling by the Australian Taxation Office (ATO) to allow sunscreen and sun protection equipment to be claimed as a work related expense. It would be hoped that this allowance will encourage outdoor workers to make use of protective equipment and sunscreen products.

In its *Media Release of May 14, 2002* the Cancer Foundation of Western Australia reported that the ruling was the result of a test case brought about by The Cancer Council New South Wales (The CCNSW) representing a range of workers from a school teacher, sports umpire, tax auditor, groundsman, farm manager, captain of a cruise boat and a builder. Estimated to affect up to one million workers the ruling overturned previous Australian Tax Office policy whereby deductions for purchases to "protect against the natural environment" were not allowed. The CCNSW had argued that sunscreen, sunhats and sunglasses were essential if outdoor workers were to be able to perform their duties (The Cancer Council Western Australia, 2002).

WHO (2004a) reports that with the anticipated further depletion of the ozone layer ultra violet radiation is likely to be increased world wide resulting in increased rates of melanoma, non-melanoma skin cancers, and cataracts as well as increasing the dangers to the immune system. In "The known health effects of ultra violet radiation" WHO (2004h) claims over exposure to ultra violet radiation may be the cause of almost 20% of the 16 million cases of people suffering cataracts world wide. According to WHO, studies prove that accumulated life-time exposure to ultra violet radiation plays a major role in the development of non-melanoma skin cancers, and that whilst over the past twenty years the incidence of skin cancers world wide has increased, the most significant increase has been that of melanoma (WHO, 2004c).

On a more encouraging note, The Cancer Council of Australia (CCA) reports that the rate of survival in Australia (90% for males and 95% for females) has risen significantly over the same period through early detection and an improved means of treatment (The Cancer Council Australia, 2003a). Professor Coates, CEO of the Cancer Council of Australia reports in the Cancer Council of Australia's National Cancer Prevention Policy (2004-2006) that the majority of melanoma cases could be avoided, and the incidence significantly reduced, by the implementation of a national campaign on improved sun protection. He states that it would take only a fraction of the four hundred and twenty million dollars that this disease costs the nation annually each year to fund such a campaign (The Cancer Council Australia, 2004c).

It is a well known fact that there is a world wide shortage of tradespeople at the moment, not the least in the construction industry. For example, recently there has developed a trend to train bricklayers in a relatively short period of time. The objective of this bricklaying training has been to get trainees out on the building sites as quickly as possible to ease the strain on an already depleted work force. Most of these people have come from backgrounds where their past working environment has not exposed them to excessive ultra violet radiation.

Similarly, new immigrants or backpackers eager to earn some sort of income, be it in the construction industry, fruit picking industry, farming or other outdoor position face a high level risk of exposure as do people who are returning to outdoor work after a long holiday break. With the onslaught of the Australian summer it is even more imperative that these workers need to be given sufficient education and training to ensure they are aware of, and able to recognize, the dangers of over exposure to solar radiation, including information outlining the levels of intensity and the daily and seasonal risks as well as the total and long term effects of solar ultra violet radiation. They need to be educated on how to put control strategies into practice from day one on the job so that protection becomes second nature. It is imperative that they are made aware of potential allergies that can induce photosensitizing, and the need for self screening and immediate medical advice on suspected skin cancers.

Provision of literature produced by local Cancer Foundations, the NOHSC's "*Guidance Note for the protection of workers from the ultraviolet radiation in sunlight* (NOHSC, 1991) or the WorkSafe Western Australian (2003a) publication *Working Safely in Hot Weather - Construction Industry* are effective means of communicating hazards and controls to prevent over exposure to the sun. It should be made a standard industry practice for employers and principal contractors to make these detailed guidance notes available either on induction or with first pay slips or invoice payments. More often than not the majority of outdoor workers are self employed or left in a "work alone" situation which does not afford sufficient supervision to ensure that workplace sun control measures are being utilized fully.

It has been noted that a lot of out door workers tend to believe that their bodies have been exposed to the sun for so long now that they have somehow miraculously developed an inbuilt shield during working hours, probably stemming from the portrayal of a "tan" as the skins defense against the sun. This can lead out door workers to believe that they are immune to the risks of body damage from the sun. Long sleeved shirts and long trousers are regarded as "too restrictive". Many construction workers, concrete workers and the like turn up to work wearing sleeveless shirts and shorts. In days gone by not only was sunscreen regarded as "too messy" or "too oily" or "attracts the flies" but its use was more often than not outwardly frowned upon as "squeamish" and not conducive to the traditional "macho" image of construction workers. In the

open spaces of a new housing development it is difficult to find shade, or stop the glare from surrounding sand and concrete house pads. However, with education campaigns introduced since the 1980's attitudes are changing; but there is still a long way to go.

In *All about skin cancer* The Cancer Council Australia (2003a) states that by not applying enough sunscreen most Australians are depriving their bodies of 50-80% of the available SPF as they are not following manufacturers instruction which is to apply 2mg of sun screen to each centimetre^2 as necessary for protection. As many outdoor workers would have their car radio switched on whilst traveling to and from work, or a portable radio transistor playing at their work site, perhaps advertising on radio, as well as evening television could be an effective medium to launch a new, and intensify existing, campaigns.

As today's school children will become tomorrow's workers there should be a much stronger school based education awareness program that would instil in children from a very young age a more effective awareness of not only the immediate, but also the long term dangers from our unique climate. In its Media Release of the 6th of October 2004, The Cancer Council Australia reports fears of a "prolonged national skin cancer epidemic". Reporting on the findings, the Council's CEO, Professor Alan Coates commented that results were "disturbing" and it had been hoped that education programs introduced in the 1980's would have resulted in a much clearer understanding of sun exposure dangers. With half of the national population still of the opinion that a tan is healthy, it is obvious that a stronger national education campaign aimed particularly at youth is necessary.

The use of personal protective equipment, broad brimmed hats, not just visors, sunglasses that offer sufficient protection against ultra violet radiation and application of sunscreens and lip protectors, together with frequent intake of water are the most immediate means of protection available to outdoor workers. These workers need to apply sunscreens at least 20 minutes before going outdoors and re-apply every 2 hours or more often if they are involved in water activities or are sweating. A sunscreen with SPF30+ is recommended and any products that have past the use by date should be discarded. Wrap around sunglasses offer more protection than standard sunglasses and should be worn wherever possible to provide additional protection.

Employer based controls that should be put in place at the workplace include use of natural and artificial shade, rescheduling of duties so that they are not performed during the two hours before and after solar noon and rostering of duties to prevent excessive physical stress by any one person or group. Employers could also provide broad spectrum SPF30+ sunscreen for employees to apply. The development of a health promotion sun protection program for all employees would be most beneficial and easy to implement and can be assisted, in Australia, by including presentations by The Cancer Council Western Australia for a minimum donation.

Self employed workers who are involved in the construction or sub contract industries usually only get paid for the actual work that they perform and they must, by necessity, be their own policemen. It is up to each of these individuals to determine whether the inconvenience of protective clothing or stopping work to apply sunscreen and the loss of a few dollars through reduced production today is worth more or less than a healthier body in years to come.

Conclusions

Over exposure to the sun can cause many adverse health effects, many of which are preventable by limiting exposure to ultra violet radiation. In this case the dose makes the difference. Exposure to small amounts of sunlight (5 to 15 minutes, 2 to 3 times a week in Western Australia in summer) provides enough stimulant to produce enough Vitamin D for the human body's absorption of calcium and phosphorous for assisting skeletal development, blood cell formation and functions of the immune system. For longer exposure times it is essential to provide skin, eye and heat protection. Community education, in the home, at school and in the workplace needs to be provided to ensure that everyone is educated to be "sun smart." In workplaces the system of work needs to be made as safe as practicable.

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Diary Of Events

NIOSH + The American Psychology Association + The National Institute of Justice of the U.S. Department of Justice + The National Institution On Disability and Rehabilitation Research of the U.S. Department of Education + The U.S. Department of Labor.
Title: World Stress & Health 2006: Making a Difference in the Workplace
Venue: Hyatt Regency Miami Hotel, Miami, Florida USA
Dates: 2nd - 4th of March 2006

World Safety Organization
Title: WSO-s 19th International Environmental Occupational Safety & Health Professional Development Conference
Venue: Ramada Inn-On-The-Bay, Belleville, Ontario, Canada
Dates: 15th - 17th May 2006
Costs: $600.00 (U.S. funds)
Contact: Debbie Burgess, debbie_burgess@worldsafety.org telephone (660) 747-3132 fax: (660) 747-2647, www.worldsafety.org

The Ramada Inn on the Bay; sits by the Bay of Quinte by the intersection of Highway 401 and Highway 62. ***A Little About Belleville on the Bay of Quinte;*** it is one of those places that remains unspoiled in spite of growing to over 46,000 population, and attracting major industry to locate there. In fact you will discover small town charm combined with city amenities like accommodations, shopping, dining and entertainment. The Bay of Quinte is at your doorstep with sailing, kayaking, fishing, cruising and windsurfing. Visit Glanmore National Historic Site, or bag some fresh produce at the Farmers Market behind City Hall on the Civic Square. Play a round of golf at any of the 15 area golf courses, or enjoy a cruise on the Bay. Belleville is a great place for a walk with the Bayshore Trail and the new Riverfront Rail inviting you to stroll, skate or cycle for your health. Some of the many attractions of Belleville and the surrounding area are Studios & Galleries; Antiques & Crafts; Restaurants & Pubs; the 1000 Islands Charity Casino; Cheese Manufacturing; Theaters; Prince Edward County's Wine Region (lots of Wineries); Chocolate Shops and Bakeries; Textile Mills; Fishing; Hunting; Camping; Hiking; Caves; Horseback Riding.

Note: SafeStart SafeTrack/Electrolab - will be sponsoring and arranging transportation from the Toronto Airport to the Ramada Inn on the Bay:

Some of the courses that will be offered during the Conference: WSO's XI Global Safety Roundtable ❖ New IAQ Guidelines - "Triggers of" & "How To Avoid" Lawsuits ❖ WSO Certified Safety Specialist (Transportation) training program and exam (must be pre-approved for this certification) ❖ WSO Safety Certified Construction Supervisor training program and exam (must be pre-approved for this certification) ❖ Behavior-Based Safety ❖ Realities of Today's Business Climate ❖ Teaching Supervisors to Be Safety Coaches ❖ A Balance Scorecard for Safety ❖ Using Perception Tools For Safety ❖ Accident Investigation ❖ Highway and Aviation Safety ❖ Occupational Safety & Health ❖ Safety Leadership ❖ Safestart - Safetrack ❖ Hazard Recognition ❖ Intro to Security For The Safety Professional ❖ Improvised Explosive Devices, etc.

WSO Code of Ethics

Members of the WSO, by virtue of their acceptance of membership into the WSO, are bound to the following Code of Ethics regarding their activities associated with the WSO:

1. Members must be responsible for ethical and professional conduct in relationships with clients, employers, associates and public.

2. Members must be responsible for professional competence in performance of all their professional activities.

3. Members must be responsible for the protection of professional interest, reputation and good name of any deserving WSO member of member of other professional organization involved in safety or associated disciplines.

4. Members must be dedicated to professional development of new members in the safety profession and associated disciplines.

5. Members must be responsible for their complete sincerity in professional services in the world.

6. Members must be responsible for continuing improvement and development of professional competencies in safety and associated disciplines.

7. Members must be responsible for their professional efforts to support the WSO motto "Making Safety A Way Of Life...Worldwide".

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