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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"**.

World Safety Organization Activities

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.
- Develops and accredits educational programs essential to national and international safety and establishes centers to support these programs.
- 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.
- Organizes and provides professional support for international and national groups of experts on all continents who are available to provide expertise and immediate help in times of emergencies.

Membership Benefits

The World Safety Organization:

- Publishes the "WSO Consultants Directory" as a service to its Members and to the Professional Community. Only WSO Certified Members may be listed.
- Collects data on the professional skills, expertise and experience of its Members in the WSO Expertise Bank for a reference when a request is received for professional expertise, skill, experience.
- Provides a network system to its Members whereby professional assistance may be requested by an individual, organization, state or country on a personal basis. Members needing assistance may write to the WSO with a specific request and the WSO, through its Membership and other professional resources, will try to link the requester with a person, organization or resource which may be of assistance.
- Provides all Members with a Membership Certificate for display on their office wall and with a WSO Membership Identification Card.
- Awards a certificate of Honorary Membership to the corporations, companies and other entities paying the WSO Membership and/or WSO certification fees for their employees.
- Members receive WSO Newsletters, and other membership publications of the WSO.
- Members are entitled to reduced fees at seminars, conferences and classes, given by the WSO. This includes local, regional and international programs. When continuing Educational Units are applicable, an appropriate certificate is issued.
- Members who attend conferences, seminars and classes receive a Certificate of Attendance from the WSO. For individuals attending courses sponsored by the WSO, a Certificate of Completion is issues upon completion of each course.
- Members receive special hotel rates when attending safety programs, conferences etc., sponsored by the WSO.

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Editorial

By: Lon S. McDaniel, CEO
World Safety Organization

Dear Colleagues;

It is pleasure to touch base with you, and let you know some of the changes that the World Safety Organization is doing.

The WSO Board of Directors, has done a review of our worlds economy and the income of the people that would like to be members of the World Safety Organization and adjusted the membership and certification fees accordingly. So if you wish to become a member and pursue one of the WSO's certifications, please check with our office, they will let you know what the new prices are for your particular country. You could be pleasantly surprised on the new fees.

The World Safety Organization is diligently working on getting further accreditation through the ANSI's program "Personnel Certification Standards ISO/IEC 17024. One of the pre-requisites for this is that we have a signed code of ethics form in every members file. We are still missing quite a few of these forms in WSO members files. So if you are a WSO member and have not filled this form out, please contact the World Management Center and make arrangements for one of the forms to be sent to you.

The World Safety Organization is looking into a program that would allow us to start putting the WSO News Letters onto our Web Site. So start checking on our web site www.worldsafety.org to see the current News Letters as they are published. Also on our web site there have been a few updates. For example, there is a page of web links for organizations; universities, companies, colleges etc. that are working with the WSO, and have given us permission to put their links on our site.

The World Safety Organizations Conference Planning committee have started the planning and organization of the WSO's 21st International Environmental and Occupational Safety and Health Professional Development Conference 2008. This conference will be June 9 - 11, 2008 at the Tuscany Suites and Casino in Las Vegas Nevada USA. If you would like to make reservations at the Hotel please call (877) 887-2261. There is an early bird special going now through the end of February 2008. If you register before this date registration fee is only $350.^{00}$ (U.S. funds). If you have any questions or if you would be interested in being one of the presenters at this conference, please send a short abstract of your paper, to info@worldsafety.org , please indicate how much time you will need for this presentation.

The World Safety Organization is currently accepting nominations for WSO Awards. If you know a company, a corporation, educational facility, an individual etc., that have set new records in safety, or have made outstanding progress in the safety field or research, why not nominate them for one of the WSO Awards. If you would like one of the WSO Awards Nomination forms, please contact the World Management center at info@worldsafety.org or (660) 747-3132.

The World Safety Organization, has implemented the Re-Certification form this year. Most all of the certification organizations have some form of re-certification process now. This is also one of the requirements for accreditation through ISO/IEC 17024. If you would like one of these forms to review, please contact our office.

As you can tell by the above, we are making improvements to the World Safety Organization. As always if you have any question, or suggestions, please let us know.

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.

Author. (Year of publication). *Title of publication.* Place of Publication: Publisher.

Articles are referenced as follows.

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].

Submissions should be sent to:

Debbie Burgess
World Safety Organization
106 W Young Avenue, Suite G, PO Box 518
Warrensburg Missouri, 64093, United States of America
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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Membership: The World Safety Organization has members that are full time professionals, executives, directors, etc., working in the safety and accident prevention fields and include university professors, private consultants, expert witnesses, researchers, safety managers, directors of training, etc. They are employees of multinational corporations, local industries, private enterprises, governments and educational institutions. Membership in the World Safety Organization is open to all individuals and entities involved in the safety and accident prevention field. Regardless of race, color, creed, ideology, religion, social status, sex or political beliefs.

International Occupational Safety and Health
Japanese Journals in the Field of Occupational Safety and Health

*By: **Dr. Derek R. Smith**, Researcher, International Center for Research Promotion and Informatics, National Institute of Occupational Safety and Health, Kawasaki, JAPAN; and **Dr. Shin-ichi Sawada**, Director, International Center for Research Promotion and Informatics, National Institute of Occupational Safety and Health, Kawasaki, JAPAN. **Correspondence:** Dr. Derek R. Smith, International Center for Research Promotion and Informatics, National Institute of Occupational Safety and Health, 6-21-1 Nagao, Tama-Ku, Kawasaki 214-8585 J E-mail: smith@h.jniosh.go.jp*

Biographies: Derek R. Smith is a researcher at the National Institute of Occupational Safety and Health in Kawasaki, Japan, and a project leader with the World Health Organization Collaborating Center on Occupational Health at the same institute. He is also an Adjunct Associate Professor at the Mie University Graduate School of Medicine in Japan and an Adjunct Senior Principal Research Fellow at James Cook University in Australia. Dr. Smith holds the degrees of Doctor of Medical Science, Doctor of Philosophy, Master of Public Health, Master of Health Sciences (Occupational Health), Bachelor of Education and Bachelor of Science, from various universities in Australia and Japan. His major fields of interest are occupational epidemiology, ergonomics and workplace hazard prevention. **Shin-ichi Sawada** is Director of the International Center for Research Promotion and Informatics at the National Institute of Occupational Safety and Health in Kawasaki, Japan; a World Health Organization Collaborating Center on Occupational Health. He is also an adjunct faculty member at Tokyo University (lecturer), Mie University (professor) and Nagasaki University (lecturer), as well as being a managing editor of the international scientific journal, Industrial Health. Dr. Sawada previously graduated with Bachelor of Health Science and Doctor of Medical Science degrees from the Graduate School of Medicine at Tokyo University in Japan. His major fields of interest are thermal physiology, work environment, thermal stress assessment and prevention.

Background: Japan's rapid industrial recovery following the Second World War and its subsequent rise as a world economic power is well known. Steel production, shipbuilding and other heavy industries predominated during the 1950s, being superseded by chemical, manufacturing and automobile production in the 1960s, and then by high-technology manufacturing in the 1970s and beyond (Reich & Frumkin, 1988). Occupational hazards and industrial safety awareness evolved alongside the changing workforce, prompting the *Trade Union Law* of 1945 and the *Labour Standards Law* of 1947, among others (Smith & Fujishiro, 2001). Although mining had been an important industry in both the pre and post-war eras, most of the major Japanese mines were closed by 1965 (Okubo, 1997). Rapid industrial and social development also influenced the nature of scientific research during this time, with academic interest being increasing directed towards the goal of achieving safer workplaces. As a result, numerous academic and practical journals focusing on Occupational Safety and Health (OS&H) emerged during the post-war period in Japan.

Professional Journals: From a conceptual perspective, it has been suggested that the ideal goal of science is to record and share all useful research findings with others (Seringhaus & Gerstein, 2007). Publication of research findings in academic journals facilitates the dissemination of knowledge in general, while for specialty areas, professional journals also help serve the needs of people working in the field (Smith, Sawada & Araki, 2007). Due to their ubiquity and relevance, most of the major occupational safety and health journals from the United States, United Kingdom and Europe are already well known to the safety professional. Despite being an established discipline from both a practical and research point of view, many Japanese periodicals on this topic are, however, relatively unfamiliar to individuals outside North Asia. While part of the reason no doubt reflects a language barrier, many English language manuscripts have been published in Japanese occupational safety and health journals. Unfamiliarity with their content and a general lack of awareness regarding these publications however, has resulted in many key articles being missed at an international level. Furthermore, as many Japanese periodicals are only listed on domestic websites and search engines, even finding them can be a complicated, if not impossible, endeavor for the international safety professional.

Purpose of this Article: For these reasons, the current article provides a comprehensive listing and description of all Japanese journals in the field of occupational safety and health. All information provided was up-to-date at the time of writing, and it is hoped that our article will benefit all professionals who are seeking relevant information in this field. Journals are divided into three categories, corresponding to those that are published by academic societies or associations (Figure 1), research institutes or universities (Figure 2), and professional associations or organizations (Figure 3). An overview of Japanese journals and the languages they publish in is listed in Table 1. The Japanese title, publisher and Editor-in-Chief of each periodical is translated into English, and the main details such as ISSN number, volume number and web domain are also listed in Tables 3-24. Where possible, the specific English language website is provided for each particular journal, although some publishers also have a more general English language page which can still be fairly easily navigated by the non-Japanese reader.

Results: As summarized in Table 1, there are currently twenty two Japanese journals which publish material in the field of occupational safety and health. While some are exclusively English language periodicals and others Japanese language only, the majority publish in both languages, particularly with regard to abstracts. Among them, six journals are currently listed in the US National Library of Medicine's *PubMed / Medline* database. Only two Japanese periodicals in the field of occupational safety and health currently have impact factors: the *Journal of Occupational Health* (ISSN: 1341-9145) and *INDUSTRIAL HEALTH* (ISSN: 0019-8366). Refer to Table 2 for further details.

TABLE 1 **Japanese Journals in the Field of Occupational Safety and Health**

	Abstracts		Main Text	
	English	Japanese	English	Japanese
Journals Published by Academic Societies or Associations				
Journal of Occupational Health	✓	✗	✓	✗
Journal of Human Ergology	✓	✗	✓	✗
Japanese Journal of Occupational Medicine and Traumatology	✓	✓	✓	✓
Sangyo Eiseigaku Zasshi (Occupational Health Journal)	✓	✓	✗	✓
Anzen Kogaku (Journal of Japan Society for Safety Engineering)	✗	✓	✗	✓
Ningen Kogaku (The Japanese Journal of Ergonomics)	✓	✓	✓	✓
Sangyo Seishin Hoken (Occupational Mental Health)	✓	✓	✓	✓
Sangyo Sutoresu Kenkyu (Job Stress Research)	✓	✓	✗	✓
Journals Published by Research Institutes or Universities				
INDUSTRIAL HEALTH	✓	✗	✓	✗
Research Reports of the National Institute of Industrial Safety	✓	✓	✓	✓
The Journal of Science of Labour	✓	✓	✓	✓
Rodo no Kagaku (Digest of Science of Labour)	✗	✓	✗	✓
Journal of the University of Occupational and Environmental Health	✓	✓	✓	✓
Journals Published by Professional Associations or Organizations				
Sangyo Igaku Rebyu (Occupational Health Review)	✗	✓	✗	✓
Sefuti Daijesto (Safety and Health Digest)	✗	✓	✗	✓
Sangyo Igaku Janaru (Occupational Health Journal)	✗	✓	✗	✓
Sagyo Kankyo (Journal of Working Environment)	✓	✓	✗	✓
Sangyo Eisei Consarutanto (Occupational Health Consultant)	✗	✓	✗	✓
Anzen to Kenko (Industrial Safety and Health)	✗	✓	✗	✓
Sangyo Igaku Puraza (Occupational Medicine Plaza)	✗	✓	✗	✓
Anzen Eisei no Hiroba (Safety Hygiene Plaza)	✗	✓	✗	✓
Sangyo Hoken 21 (Occupational Health 21)	✗	✓	✗	✓

TABLE 2 **Indexing Systems for Japanese Journals**

	PubMed / Medline	Impact Factor
Journal of Occupational Health	✓	✓
Journal of Human Ergology	✓	✗
Sangyo Eiseigaku Zasshi (Occupational Health Journal)	✓	✗
INDUSTRIAL HEALTH	✓	✓
The Journal of Science of Labour	✓	✗
Journal of the University of Occupational and Environmental Health	✓	✗

Journals Published by Academic Societies or Associations

There are currently eight Japanese journals in the field of occupational safety and health that are published by academic societies or associations, as shown in Figure 1.

FIGURE 1 Journals Published by Academic Societies or Associations

- Journal of Occupational Health
- Journal of Human Ergology
- Japanese Journal of Occupational Medicine and Traumatology
- Sangyo Eiseigaku Zasshi (Occupational Health Journal)
- Anzen Kogaku (Journal of Japan Society for Safety Engineering)
- Ningen Kogaku (The Japanese Journal of Ergonomics)
- Sangyo Seishin Hoken (Occupational Mental Health)
- Sangyo Sutoresu Kenkyu (Job Stress Research)

The *Journal of Occupational Health* is an English language periodical published bimonthly by the Japan Society for Occupational Health. The *Journal of Human Ergology* is also an English language periodical published biannually by the Human Ergology Society and the South-East Asian Ergonomics Society. According to the Human Ergology Society Website (Accessed July 2007), the discipline of Human Ergology" itself, is one that studies interactions between human nature, daily work and living behavior within changing environments. The domain of the *Japanese Journal of Occupational Medicine and Traumatology* on the other hand, is a little more self-explanatory, and is published bimonthly in English and Japanese by the Japanese Society of Occupational Medicine and Traumatology. *Sangyo Eiseigaku Zasshi* (Occupational Health Journal) is published bimonthly and includes both original articles and reviews with an English language summary of each paper. This journal is, in essence, the Japanese language version of the previously mentioned Journal of Occupational Health, both of which are published by the Japan Society for Occupational Health.

Anzen Kogaku (Journal of Japan Society for Safety Engineering) is a bimonthly periodical, published entirely in Japanese language by the Japan Society for Safety Engineering. *Ningen Kogaku* (The Japanese Journal of Ergonomics) is published bimonthly in English and Japanese by the Japan Ergonomics Society. *Sangyo Seishin Hoken* (Occupational Mental Health) is published quarterly by the Japan Society for Occupational Mental Health. *Sangyo Sutoresu Kenkyu* (Job Stress Research) is published quarterly by the Japan Association of Job Stress Research. More detailed information on these journals is displayed in Tables 3-10.

Journals Published by Research Institutes or Universities

There are currently five Japanese journals in the field of occupational safety and health that are published by research institutes or universities, as shown in Figure 2.

FIGURE 2 Journals Published by Research Institutes or Universities

- INDUSTRIAL HEALTH
- Research Reports of the National Institute of Industrial Safety
- The Journal of Science of Labour
- Rodo no Kagaku (Digest of Science of Labour)
- Journal of the University of Occupational and Environmental Health

INDUSTRIAL HEALTH is published bimonthly in English by the National Institute of Occupational Safety and Health in Japan. *Research Reports of the National Institute of Industrial Safety* is published annually in English and Japanese by the aforementioned National Institute of Occupational Safety and Health. The *Journal of Science of Labour* is published quarterly in English and Japanese by the Institute for Science of Labor. Similar to its counterpart described above, *Rodo no Kagaku* is also published by the Institute for Science of Labor, although the latter periodical is entirely in Japanese. The *Journal of the University of Occupational and Environmental Health* is published quarterly in English and Japanese by the University of Occupational and Environmental Health. More detailed information on these journals is displayed in Tables 11-15.

Journals Published by Professional Associations or Organizations

There are currently nine Japanese journals in the field of occupational safety and health that are published by professional associations or organizations, as shown in Figure 3.

FIGURE 3 Journals Published by Professional Associations or Organizations

- Sangyo Igaku Rebyu (Occupational Health Review)
- Sefuti Daijesto (Safety and Health Digest)
- Sangyo Igaku Janaru (Occupational Health Journal)
- Sagyo Kankyo (Journal of Working Environment)
- Sangyo Eisei Consarutanto (Occupational Health Consultant)
- Anzen to Kenko (Industrial Safety and Health)
- Sangyo Igaku Puraza (Occupational Medicine Plaza)
- Anzen Eisei no Hiroba (Safety Hygiene Plaza)
- Sangyo Hoken 21 (Occupational Health 21)

Sangyo Igaku Rebyu is published quarterly in Japanese by the Occupational Health Promotion Foundation of Japan. *Sefuti Daijesto* is published monthly in Japanese by the Japan Safety Appliances Association. *Sangyo Igaku Janaru* is issued bimonthly in Japanese by the Occupational Health Promotion Foundation of Japan. *Sagyo Kankyo* is a bimonthly periodical from the Japan Association for Working Environment Measurement that is published in Japanese with English language abstracts. *Sangyo Eisei Consarutanto* is published in Japanese by the Japan Association of Safety and Health Consultants on a quarterly basis. *Anzen to Kenko* is published monthly in Japanese by the Japan Industrial Safety and Health Association. *Sangyo Igaku Puraza* is published biannually in Japanese by the Occupational Health Promotion Foundation of Japan. *Anzen Eisei no Hiroba* is published monthly in Japanese by the Japan Industrial Safety and Health Association. *Sangyo Hoken 21* (Occupational Health 21) is published biannually by the Japan Labor Health and Welfare Organization. Please refer to Tables 16-24 for further details on these journals.

Conclusion

Much can be learned about the occupational safety and health issues of a particular area by reading its academic journals. Despite the fact that many Japanese periodicals in this field are largely unknown outside the country, they nevertheless represent an important vehicle for the ongoing dissemination of Japanese occupational health research to

the international community. The evolution and content contained within Japan's main journals in occupational safety and health provides an interesting insight into the development and internationalization of the discipline within this region. For occupational safety and health professionals wishing to seek up-to-date information on Japanese workplaces, health trends and associated topics, the twenty two journals described in this article represent a good starting point to begin one's literature searches.

References

Human Ergology Society Website. (2007) Available online at: http://www.humanergology.com/english%20home.htm (Accessed 11 July 2007)

Okubo, T. (1997) The present state of occupational health in Japan. *International Archives of Occupational and Environmental Health* **70**, 148-152.

Reich, M.R. & Frumkin, H. (1988) An overview of Japanese occupational health. *American Journal of Public Health* **78**, 809-816.

Seringhaus, M.R. & Gerstein, M.B. (2007) Publishing perishing? Towards tomorrow's information architecture. *BMC Bioinformatics* **8**, 17.

Smith, D.R., Sawada, S. & Araki, S. (2007) Forty five years of INDUSTRIAL HEALTH. *Industrial Health* **45**, 187-189.

Smith, D.R. & Fujishiro, K. (2001) Occupational health and safety in Japan. *Journal of Occupational Health and Safety (Australia and New Zealand)* **17**, 499-502.

TABLE 3 **Journal of Occupational Health**

Japanese Title:	Journal of Occupational Health
English Title:	Journal of Occupational Health
ISSN:	1341-9145
Abstracts:	English Only
Main Text:	English Only
Current Volume:	49
Publisher:	Japan Society for Occupational Health
Editor-in-Chief:	Tatsuya TAKESHITA
Frequency:	Bimonthly
Homepage:	http://joh.med.uoeh-u.ac.jp/

TABLE 4 **Journal of Human Ergology**

Japanese Title:	Journal of Human Ergology
English Title:	Journal of Human Ergology
ISSN:	0913-7785
Abstracts:	English Only
Main Text:	English Only
Current Volume:	36
Publisher:	Human Ergology Society / South-East Asian Ergonomics Society
Editor-in-Chief:	Not Stated
Frequency:	Biannually
Homepage:	http://www.humanergology.com/english%20home.htm

TABLE 5 **Japanese Journal of Occupational Medicine and Traumatology**

Japanese Title:	Nihon Shokugyo Saigai Igakai Kaiishi
English Title:	Japanese Journal of Occupational Medicine and Traumatology
ISSN:	1345-2592
Abstracts:	Japanese and English
Main Text:	Japanese and English
Current Volume:	55
Publisher:	Japanese Society of Occupational Medicine and Traumatology
Editor-in-Chief:	Hiroyuki CHOSHO
Frequency:	Bimonthly
Homepage:	http://www.rofuku.go.jp/kenkyuseika/index.html

TABLE 6 **Sangyo Eiseigaku Zasshi (Occupational Health Journal)**

Japanese Title:	Sangyo Eiseigaku Zasshi
English Title:	Occupational Health Journal
ISSN:	1341-0725
Abstracts:	Japanese and English
Main Text:	Japanese Only

Current Volume:	49
Publisher:	Japan Society for Occupational Health
Editor-in-Chief:	Tatsuya TAKESHITA
Frequency:	Bimonthly
Homepage:	http://joh.med.uoeh-u.ac.jp/j/index.html

TABLE 7 Anzen Kogaku (Journal of Japan Society for Safety Engineering)

Japanese Title:	Anzen Kogaku
English Title:	Journal of Japan Society for Safety Engineering
ISSN:	0570-4480
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	46
Publisher:	The Japan Society for Safety Engineering
Editor-in-Chief:	Hideo OTANI
Frequency:	Bimonthly
Homepage:	http://wwwsoc.nii.ac.jp/jsse3/publish/journal.shtml

TABLE 8 Ningen Kogaku (The Japanese Journal of Ergonomics)

Japanese Title:	Ningen Kogaku
English Title:	The Japanese Journal of Ergonomics
ISSN:	0549-4974
Abstracts:	Japanese and English
Main Text:	Japanese and English
Current Volume:	43
Publisher:	The Japan Ergonomics Society
Editor-in-Chief:	Shojiro KATO
Frequency:	Bimonthly
Homepage:	http://www.ergonomics.jp/index_e.html

TABLE 9 Sangyo Seishin Hoken (Occupational Mental Health)

Japanese Title:	Sangyo Seishin Hoken
English Title:	Occupational Mental Health
ISSN:	1340-2862
Abstracts:	Japanese and English
Main Text:	Japanese and English
Current Volume:	15
Publisher:	Japan Society for Occupational Mental Health
Editor-in-Chief:	Mamoru ONISHI
Frequency:	Quarterly
Homepage:	http://jsomh.umin.jp/transaction.html

TABLE 10 Sangyo Sutoresu Kenkyu (Job Stress Research)

Japanese Title:	Sangyo Sutoresu Kenkyu
English Title:	Job Stress Research
ISSN:	1340-7724
Abstracts:	Japanese and English
Main Text:	Japanese Only
Current Volume:	14
Publisher:	The Japan Association of Job Stress Research
Editor-in-Chief:	Fumio KOBAYASHI
Frequency:	Quarterly
Homepage:	http://jajsr.umin.ac.jp/

TABLE 11 INDUSTRIAL HEALTH

Japanese Title:	INDUSTRIAL HEALTH
English Title:	INDUSTRIAL HEALTH
ISSN:	0019-8366
Abstracts:	English Only
Main Text:	English Only
Current Volume:	45
Publisher:	National Institute of Occupational Safety and Health
Editor-in-Chief:	Shunichi ARAKI
Frequency:	Bimonthly
Homepage:	http://www.jniosh.go.jp/indu_hel/index.html

TABLE 12 Research Reports of the National Institute of Industrial Safety

Japanese Title:	Sangyo Anzen Kenkyujo Kenkyu Kohoku
English Title:	Research Reports of the National Institute of Industrial Safety
ISSN:	0911-6923
Abstracts:	Japanese and English
Main Text:	Japanese and English
Current Volume:	43
Publisher:	National Institute of Industrial Safety
Editor-in-Chief:	Not Stated
Frequency:	Annually
Homepage:	http://www.jniosh.go.jp/old/anken/english/top.html

TABLE 13Rodo Kagaku (The Journal of Science of Labour)

Japanese Title:	Rodo Kagagku
English Title:	The Journal of Science of Labour
ISSN:	0022-443X
Abstracts:	Japanese and English
Main Text:	Japanese and English
Current Volume:	83
Publisher:	The Institute for Science of Labour
Editor-in-Chief:	Naoki MAEBARA
Frequency:	Quarterly
Homepage:	http://www.isl.or.jp/top.html

TABLE 14 Rodo no Kagaku (Digest of Science of Labour)

Japanese Title:	Rodo no Kagagku
English Title:	Digest of Science of Labour
ISSN:	0035-7774
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	62
Publisher:	The Institute for Science of Labour
Editor-in-Chief:	Naoki MAEBARA
Frequency:	Monthly
Homepage:	http://www.isl.or.jp/top.html

TABLE 15 Journal of the University of Occupational and Environmental Health

Japanese Title:	Journal of the University of Occupational and Environmental Health
English Title:	Journal of the University of Occupational and Environmental Health
ISSN:	0387-821X
Abstracts:	Japanese and English
Main Text:	Japanese and English
Current Volume:	29

Publisher:	The University of Occupational and Environmental Health
Editor-in-Chief:	Uki YAMASHITA
Frequency:	Quarterly
Homepage:	http://www.uoeh-u.ac.jp/journal/intro_e.html

TABLE 16 Sangyo Igaku Rebyu (Occupational Health Review)

Japanese Title:	Sangyo Igaku Rebyu
English Title:	Occupational Health Review
ISSN:	1343-6805
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	20
Publisher:	The Occupational Health Promotion Foundation
Editor-in-Chief:	Not Stated
Frequency:	Quarterly
Homepage:	http://www.zsisz.or.jp/shuppan/teikisi_03.html

TABLE 17 Seifuti Daijesto (Safety and Health Digest)

Japanese Title:	Seifuti Daijesto
English Title:	Safety and Health Digest
ISSN:	0582-4133
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	53
Publisher:	The Japan Safety Appliances Association
Editor-in-Chief:	Minoru UMEZU
Frequency:	Monthly
Homepage:	http://www.jsaa.or.jp/2_0.html#tokushu

TABLE 18 Sangyo Igaku Janaru (Occupational Health Journal)

Japanese Title:	Sangyo Igaku Janaru
English Title:	Occupational Health Journal
ISSN:	0388-337X
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	30
Publisher:	The Occupational Health Promotion Foundation
Editor-in-Chief:	Tsutomu TAKADA
Frequency:	Bimonthly
Homepage:	http://www.zsisz.or.jp/shuppan/teikisi_01.html

TABLE 19 Sagyo Kankyo (Journal of Working Environment)

Japanese Title:	Sagyo Kankyo
English Title:	Journal of Working Environment
ISSN:	0389-5173
Abstracts:	Japanese and English
Main Text:	Japanese Only
Current Volume:	28
Publisher:	Japan Association for Working Environment Measurement
Editor-in-Chief:	Shunji NAGOYA
Frequency:	Bimonthly
Homepage:	http://www.jawe.or.jp/

TABLE 20 Anzen Eisei Consarutanto (Safety and Health Consultant)

Japanese Title:	Anzen Eisei Consarutanto
English Title:	Safety and Health Consultant
ISSN:	0582-4133

Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	27
Publisher:	Japan Association of Safety and Health Consultants
Editor-in-Chief:	Yuzo FUJITA
Frequency:	Quarterly
Homepage:	http://www.jashcon.or.jp/

TABLE 21 Anzen to Kenko (Industrial Safety and Health)

Japanese Title:	Anzen to Kenko
English Title:	Industrial Safety and Health
ISSN:	1881-0462
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	58
Publisher:	Japan Industrial Safety and Health Association
Editor-in-Chief:	Not Stated
Frequency:	Monthly
Homepage:	http://www.jisha.or.jp/english/corner/public.html

TABLE 22 Sangyo Igaku Puraza (Occupational Medicine Plaza)

Japanese Title:	Sangyo Igaku Puraza
English Title:	Occupational Medicine Plaza
ISSN:	1346-7808
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	13
Publisher:	The Occupational Health Promotion Foundation
Editor-in-Chief:	Not Stated
Frequency:	Biannually
Homepage:	http://www.zsisz.or.jp/shuppan/teikisi_02.html

TABLE 23 Anzen Eisei no Hiroba (Safety Hygiene Plaza)

Japanese Title:	Anzen Eisei no Hiroba
English Title:	Safety Hygiene Plaza
ISSN:	0911-0011
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	48
Publisher:	The Japan Industrial Safety and Health Association
Editor-in-Chief:	Not Stated
Frequency:	Monthly
Homepage:	http://www.jisha.or.jp/english/index.html

TABLE 24 Sangyo Hoken 21 (Occupational Health 21)

Japanese Title:	Sangyo Hoken 21
English Title:	Occupational Health 21
ISSN:	Not Stated
Abstracts:	Japanese Only
Main Text:	Japanese Only
Current Volume:	12
Publisher:	Japan Labour Health and Welfare Organization
Editor-in-Chief:	Tsutomu TAKADA
Frequency:	Biannually
Homepage:	http://www.rofuku.go.jp/sanpo/sanpo21/ms_sanpo21.html

Why Are People Who Work In Some Companies Unreliable?

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Abstract

Some organizations are not user centered and have work processes in which employees are set up for failure in using safe work practices. Situations in which this has happened are examined. Physical ergonomics, cognitive ergonomics, organizational ergonomics and environmental ergonomics are considered as ways to increase the reliability of the actions of people at work.

Introduction

Some organizations are not user centered and have work processes in which employees are set up for failure in using safe work practices. The way to get reliability out of people is to understand how people work.

There is a story in Greek mythology about an Innkeeper called Procrustes. His Inn had only one bed and he insisted that his guests fit perfectly into this bed. If Procrustes's guest was a little short he stretched this guest with ropes and pulleys until the guest's head and feet were exactly flush with the head and foot of the bed.

If the guest was longer than the bed Procrustes pulled out his sword and chopped the guest's legs off so that the end of the guest's legs were exactly flush with the end of the bed when the top of this person was touching the head of the bed. In the workplace today some employers still want everyone to be the same. However people are different in their physical features, abilities, personality, knowledge, and in so many other ways. People also have common requirements, like needing unpolluted air to breathe.

In 1857 Wojciech Jastrzebowski, in *Nature and Industry*, which was a weekly newspaper published in Poznan in Poland, had an article published which was titled: An outline of **Ergonomics**, or the Science of Work.

Polish people claim that Wojciech Jastrzebowski "was the first person in the world to use and define the concept of ergonomics" (Karwowski & Koradecka, 1997, p. 6). The term Ergonomics was used by Wojciech to define the Science of Work and the Science of People's Needs at Work that together he claimed formed the Science of Work Life.

Ergonomics

There are four main areas of ergonomics, which Pheasant (1991, p4) defined as "the science of matching the job to the worker and the product to the user". These areas are physical ergonomics, cognitive ergonomics, organizational ergonomics and environmental ergonomics.

Physical Ergonomics

To get reliability out of people you need to consider their anatomical shape. This part of ergonomics is called anthropometry. There are 2 branches of anthropometry. One is static anthropometry where body measurements are made when the person is in a rigid, standardized position. The other is dynamic anthropometry where the body dimensions are measured in various working positions. If a person's anthropometric measurements are not considered a small person may not be able to reach far enough to work safely, or a tall fat person may injure himself because he has to work in a crouched position with not enough room to move safely. Part of physical ergonomics is considering the workplace layout and the equipment used. If people have enough room to move safely, and are able to reach the things that they need to reach, they are more reliable and less likely to be injured.

A person's bio-mechanical characteristics that are related to the person's physical activity must also be considered if people reliability is required. This includes looking at the body in working postures and the person's physical strength. For example does the work cause static muscle loading or cramps because there is no body movement to keep the blood circulating? Is a manual handling task, such as lifting a bag weighing 40 kilograms, too heavy for the person to safely lift without causing muscle damage? In Perth on 27th March 2007 a 43 year old laborer was crushed to death when a 300kg stone that he was helping to move at a stone work company in Wangara fell on him (AAP, 2007). The weight of this stone was more than the man could safely handle. To have reliable people the work that they are given to do must be within their capabilities and some work, such as moving a 300kg slab of stone, should be done by a machine, rather than by a person.

When allowing for bio-mechanical characteristics it should be considered if the work requires frequent repetitive actions as this can damage the worker's tendons and cause repetitive strain injury? People, such as those who spend 12 hours a day entering data into a computer, who develop repetitive strain injury, often cannot use the affected part of their body. Pheasant (1991, p2) describes people with repetitive strain injury as "like a broken office machine" and of little use in the workplace. As well as matching work tasks to a person's physical ability to ensure person reliability it is important to consider each person's cognitive functions.

Cognitive ergonomics

Cognitive ergonomics is concerned with the way that people think. It includes humans' ability to memorize information, how long they can remain vigilant and alert before becoming fatigued and unable to function reliably, how people make decisions, what motivates people and how people interpret and understand information.

Employers not considering cognitive ergonomics can be a cause of many human failures, as is demonstrated in the following medication error case study from the National Health Service in England that was described by James Reason in 2005.

> *The incident.* During a syringe change-over, a nurse incorrectly re-calibrated a syringe pump delivering a morphine infusion to a patient with stomach cancer, resulting in a fatal overdose.
>
> *The response.* Institution suspended the nurse pending an investigation. She was subsequently given a formal written warning, reinstated and retrained in the use of syringe pumps.
>
> Incident investigation. Showed that a Grasby MS26 syringe driver was being used. Whereas this pump is calibrated in mm per hour, a second

widely used pump, the Grasby MS16A, is calibrated in mm per day. During the syringe change-over, the nurse applied the calibration principles for the MS16A pump to a MS26 pump.

Early warning signs. Two similar errors had recently been reported. Both errors were detected before harm was done

Recommendation. Chief Pharmacist and two consultants wrote to management requesting that a single pump be used throughout the Trust.

Management response. Suggestion rejected because cost would make it impossible for the institution to stay within the budget limits set by the regional health authority.

Recurrent system problem. In all 3 cases nurses had been working on under-staffed wards. Sisters had complained about not having enough staff to be able to provide a safe level of patient care, but management accepted this as a "*sad fact of life*" and did not act.

Key situational factors. Equipment design, workloads, etc, were not thought relevant. Sole focus was on nurses involved: naming, blaming, retraining (pp 12-13).

"*Managing the manageable.* Fallibility is part of the human condition. We are not going to change the human condition, but we can change the conditions under which people work" (Reason, 2005, p. 20). To increase human reliability it is important to understand how the average person thinks. If the Chief Pharmacist's recommendation to have a single pump had been implemented there would not have been confusion in how to calibrate the pump, and the patient would have been given the correct dose of medication. A confounding factor in this story was the fact that there was not enough staff on the ward to be able to provide the help and supervision that this nurse required. The way that work is organized needs to consider organizational ergonomic factors.

Organizational ergonomics

For an organization to have highly reliable people the organization needs to be user centered. Being user centered means considering internal and external customer needs. Internal customers are the organization's employees. Employees are affected by the organizational structure, policies, documented work procedures, hours of work, time allocated to perform the work, team-work, social factors, training provided, communication practices and other organizational factors.

How organizational ergonomics affects people's reliability is shown in the sinking of the ship *Herald of Free Enterprise.* WorkSafe Western Australia (2007, p.1) reports this story as follows.

> At about 6.00 p.m. on 6 March 1987 the English cross-channel car ferry *Herald of Free Enterprise* capsized and sank just after leaving Zeebrugge harbor. Of the 459 or more people on board 189 died. The ferry had sailed with her bow doors open and as she passed the Outer Mole and increased speed, water came over the bow sill and flooded the lower car deck. The inrush of water destabilized her causing her to capsize. She sank in 2 minutes. Had she not come to rest on a sandbank the resulting loss of life would probably have been greater.
>
> The most important factor was that roll-on roll-off car ferries, with their large open decks, are inherently unstable. A small amount of water pouring in the open deck area will swill from side to side and cause the ship to capsize very quickly even in a gentle swell.

Pheasant (1991, p.186) has written about the organizational ergonomic factors that were not user centered and which contributed to this accident as being the following.

1. Absence of critical information displays
2. Procedural vagueness
3. Time stress
4. Shift system
5. Accessibility and usability of life jackets
6. Lack of emergency lighting, etc
7. Pressure for fastest possible turn around
8. Management failure to heed warnings given by serving officers.

On the first point WorkSafe Western Australia (2007, p.1) wrote that "there was no information display (not even a single warning light) to tell the captain if the bow doors were open. Two years earlier, the captain of a similar vessel owned by the same company had requested that a warning light should be installed, following a similar incident when he had gone to sea with his bow doors open. Company management had treated his request with derision." The reliability of people at work is increased when they have the information required to be able to make sound decisions.

The written procedures on closing the door were unclear (WorkSafe Western Australia, 2007). As well as having no warning lights it was no one's duty to let Captain Kirk know if the doors were closed or open. The Captain just had to presume that the car entry doors of the ferry were closed unless he was told other wise. Organizational procedures did not provide the Captain with clear instructions on which to make a reliable decision. Captain Kirk had no means of knowing whether his ferry was safe to leave port or not.

The crew on this car ferry had a roster of working for 24 hours at a stretch. They then had 48 hours off duty before returning to work another 24 hour shift. The Assistant Bosun, who was supposed to have closed the car doors, had fallen asleep in his cabin for a few minutes after completing his maintenance and cleaning duties. To achieve a high level of reliability the human body is designed to work shorter shifts of work than 24 hours of continuous work. Grandjean (1988) conducted research that showed that after 4 hours of work if employees had a 15 minute break for food, drink and relaxation their work productivity and the reliability of the decisions made improved.

The Captain and crew of this ferry were under pressure from the company management to achieve the fastest turn around time in port that was possible to achieve. The Chief Officer, who was responsible for ensuring that the doors were closed, had to be on the ferry's bridge 15 minutes before sailing time. The company work procedure requirements did not allow enough time for the Chief Officer to be able to check that the Assistant Bosun had closed the doors. The Bosun had noticed that the car doors were open, but did not close them, as it was not in his job description to do this and he had many other tasks to perform before the ferry left port. To achieve high human reliability the organization needs to allow employees to have enough time to perform their employment responsibilities safely.

The organization should have had a foolproof system that ensured that the

doors were closed before the ferry was able to depart the port. An example of this is that the 2006 Camry Altise car has a warning sound that goes continuously once the car engine is turned on until the car driver puts on the seat belt. Car drivers quickly learn to put on the seat belt before starting the car engine. This warning sound increases human reliability in wearing a seat belt when driving the car. For this automatic car the key cannot be taken out of the ignition unless the car is in the parking gear and the hand brake is on. Using this principle the ignition for the ferry could be made so that the motor could not be turned on to run the ferry unless the ferry car doors were closed.

As well as human reliability being responsible for this disaster there were problems with the design of the ferry (it was top heavy), the loading ramp (that had been designed for a single deck ferry. The Herald of Free Enterprise had 2 car decks) and the ballast pumping system (the pumps were not powerful enough to pump the ballast forward so that the ferry's bow would lie low in the water). These engineering factors all contributed to causing this disaster.

The final area of ergonomics that affects the reliability of people is environmental ergonomics.

Environmental ergonomics

Environmental ergonomics is concerned with the physical factors in the workplace that can affect people physically and/or mentally. They include climate (air temperature, humidity), radiant heat, air movement, ventilation, noise, lighting and vibration. Environmental ergonomic factors affect comfort, reliability of work performance and the health of people.

For example, people can only work reliably in an environment that keeps their body temperature within the 33° C to 40° C range. Outside this range, if it is too hot or too cold, they are less likely to function reliably, can become sick and can die. To have people work with reliability their body temperature needs to be kept within this range either through the use of clothing, air conditioning or other environmental modifiers.

An example of increasing human reliability is when fire fighters wear thick reflective clothing to protect them against radiant heat exposure when they are fighting a fire. This improvement in thermal comfort enables the people fighting the fire to work more reliably both physically and mentally. However, wearing thick personal protective clothing and performing heavy physical work, such as lifting heavy fire hoses and carrying people from burning buildings, can generate a high level of body heat and fatigue which can affect decision making and human reliability. For this reason fire fighters wearing thick reflective clothing should only work short periods of time (such as 30 minutes) without a break so that they have time to cool their body and are able to deal effectively with performing physically and mentally demanding tasks in very dangerous situations.

Human reliability

Human reliability is affected by physical and mental factors, by society expectations, the government regulatory system, company and organizational factors and engineering factors. The following case study by Andrew Hopkins (2000) of the ESSO Longford Gas Plant explosion that occurred on 25th September in 1998 that killed 2 men, injured 8 other employees, cut Melbourne, Victoria's gas supply off for 2 weeks and caused ESSO Australia Pty Ltd to be fined $2,000,000 for 11 offences (Hopkins, 2002) illustrates this.

Hopkins (2000) when investigating this accident attributed the cause of the accident to society because the general public wanted to pay the lowest price possible for their gas supply. To help achieve this the government had allowed private enterprise to supply the gas to the people of Victoria at the cheapest price economically possible. In a cost cutting effort the Victorian government had merged the occupational safety, health and compensation agencies to form the Victorian WorkCover Authority. The Inspectors in this agency did not have the technical expertise to identify hazards in the technically complex Longford Gas Plant. Because of the self-regulatory nature of the occupational safety and health legislation, with a general duty of care rather than prescriptive rules, ESSO had not implemented best practice in occupational safety and health management. Rather ESSO had looked at cost cutting to save money and increase company profits.

The parent company, Exxon, and the company directors of ESSO had cut the cost of producing gas at Longford by removing the engineers (with their technical knowledge) from working at the gas plant, reduced spending on maintenance and failed to carry out a hazard and operability (HAZOP) study of gas plant 1 to identify all hazards, the risk of these hazards causing harm and to implement hazard control strategies where appropriate. There were poor communication practices between the operators who identified safety problems and the company management who had the resources available and decision-making power to be able to fix the problems.

What had happened at society, government and company management level then led to the problems that were the active causes of the explosion. These were as follows. The night before the accident there was a strong flow of liquid gas from the offshore production platforms that caused a raise in the level of condensate in the absorber. The TRC3B valve that should have controlled the temperature was not working. The condensate overflowed into the rich oil stream causing the oil to become colder than normal. This led to an automatic shut down of the pumps that maintained the lean oil flow. The two heat exchangers' temperature dropped to -50° C. The metal was so cold that it became brittle. When the operators succeeded in restarting the pump and reintroduced the warm oil the metal fractured allowing the volatile liquid and gas to escape and be ignited by a nearby ignition source.

The cause of the active failures was unreliable people.

1. An alarm sounded when the condensate was at the 85% level. The operator ignored this alarm. Operators frequently operated the plant in alarm mode to meet production targets and sales orders. The operator had to deal with about 8,500 alarms in a 12 hour shift. This is information overload. If *cognitive ergonomic factors* had been considered there would only be alarms for safety critical causes. If there were only a few causes of alarms operators would have the time to act on the information provided by the alarm.

2. The heat exchanger was very cold (-50° C) when the lean oil stopped circulating due to an automatic shut down of the plant when there was a process upset. The supervisor did not know that if warm oil was reintroduced into these cold pipes, without allowing these pipes to thaw out, there would be brittle metal fracture and the pipes would rupture. All

that the operators and their supervisor knew was that they had to get production restarted as soon as possible. There was inadequate education on the dangers of cold metal embrittlement. If *organization ergonomic factors* had been considered there would have been clear and understood procedures for what to do if the lean oil stopped circulating and the metal became very cold.

3. Maintenance. The TRC3B valve (which, had it been working would have kept the oil at the correct temperature and prevented the process upset caused by the increased condensate) had a work order for repair 2 weeks before the disaster occurred. The maintenance people had too much work to do and not enough time to do all of the work required, so at the time of the explosion they had not yet had time to repair this valve. If *organizational ergonomic factors* had been considered the maintenance workers would have had enough time to be able to repair the valve when it broke.

Conclusion

This last accident case study was included to demonstrate that it is important to have human reliability, but that having unreliable people is not the only cause of accidents and disasters. There are society causes, government causes, company management practices and decisions, engineering causes and other causes. Most of theses causes result in latent conditions that are error producing. Reason (1997) defines latent conditions as factors that produce error likelihood conditions that are out side the control of the individual who makes the error. These latent conditions can include government decisions, undetected manufacturing defects, inadequate job related training or supervision, management decisions and a variety of other factors such as those that were present at the Longford Gas Plant.

Organizations must be user centered and have work processes in which employees' physical and cognitive abilities are considered. IF the work environment, work processes, management factors, equipment and products used are safe, and IF ergonomic factors that affect people's ability to work safely are considered and implemented to promote the occupational safety and health of employees, THEN humans are able to act more reliably at work.

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Skip's Corner

Housekeeping - Every One's Job

Housekeeping, it's a word that makes us think of keeping house or cleaning up at home. Actually, housekeeping is even more important in running a factory, making a product, or performing services of any kind. Messes and clutter are dangerous, especially in the work place.

You might say to yourself that we have maintenance and custodial people to clean up after us, but that can't be the whole story. Even though we have people who are paid to do the big cleaning jobs, each of us must do his part in keeping his or her own work area in good order. Here is an example of what can happen when someone forgets the importance of "housekeeping":

A maintenance person was using a ladder to do some overhead work. The area in which the work was being done was pretty cluttered, but the maintenance person did not think to much of it. After all, the assigned work was not cleanup. When the job was finished, the maintenance person came down the ladder and stepped on a piece of paper on the ground. What he didn't see was a broken drill bit hidden by the paper, his foot slipped and he fell, twisting his back. He was off work for several days due to the back strain.

This incident brings up a lot of questions. Was he justified in feeling that it wasn't his job to clean up? Would you ever suspect that something might be hiding under a piece of paper? Wouldn't most people expect to have a safe area to work in, without having to think of hidden hazards?

Everyone has a part in good housekeeping. The work place doesn't have to look beautiful but it should be safe. Make it your business to practice good housekeeping as you go about your work. You may save yourself or your fellow worker from a serious injury.

Lost Time Injury Frequency Rates; Their Limitations and Benefits In Measuring The Occupational Health and Safety Practices Of An Organization

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Abstract

Lost time injury statistics are used through out industry to identify what incidents have happened in the past and what improvements can be made to prevent future occurrence. But more and more these statistics, a victim to manipulation, are used to try and capture how safe an organization is. Many hazardous industries such as coal, oil and gas still use this data as a gauge of the safety of its workforce but catastrophic events such as the Esso Gas Plant Explosion and the Moura Coal Mine Disaster dismiss Lost Time Injury Statistics as a preventative tool in averting disasters.

Introduction

Industry in Australia has strived to reduce the number and rate of injuries and fatalities. Many large organizations use the lost time injury frequency rate (LTIFR) as a benchmark in determining if the injury rates amongst the workforce are in decline or increasing. They then use this statistic as a comparison of safety with other similar companies. The LTIFR measures the number of lost-time injuries per million hours worked. In the mining industry LTIFR has been steadily reducing over the last ten years, however, the Fatal Injury Frequency Rate measured as the number of fatalities per 1000 employees, usually over 12 months, has remained relatively stable over the same time (Mineral Council, 2002). In America particularly in the construction industry, there has also been a marked decline in injury rates, however fatalities amongst construction workers remained an all time high (Welch, Dong, Carre & Ringen, 2007). This shows that this correlation between lost time injuries and deaths cannot be compared, bringing to light the question, is Lost Time Injury statistics a true indication of the safeness of an organization?

Lost time injury frequency rates and catastrophic risks

Paul Jeans, former chair of the Health and Safety Committee for the Mineral Council of Australia was adamant in the fact that there should be zero harm in the workplace with zero fatalities and injuries. He acknowledged that the fatality rates in the mining industry were unacceptably high and showed no signs of improving but he still believes that a reduction in the LTIFR is related to reductions in fatalities. In his speech to the New South Wales Mining and Quarrying Industry he mentions ways individuals can help reduce injuries and fatalities. These include wearing personal protective equipment, zero tolerance to unsafe acts or conditions, never turning a blind eye to these acts and rewarding safe acts (Jeans 2000). This behavioral based methodology may help prevent injuries, and some hazards that may cause fatalities, but does little in tackling the major catastrophic events that go unnoticed when the safety focus is on preventing individual injuries.

Chris Towsey, Manager of Charters Towers gold mine in Queensland concluded that looking at reducing lost time injuries(LTI) has shifted the focus away from catastrophic risk, and instead under-reporting of lost time injuries deludes senior management into believing safety has improved (Towsey 2003). The Journal for Professional Safety (Cooper, 2001) mentions that organizations should no longer rely on lost-time accidents as the principal measure of safety performance. These statistics are collected primarily to ensure compliance and not a true measure of a firm's safety performance (Cooper 2001).

Hopkins (2000) in his book, Lessons from Longford, explores Esso's approach to safety. Esso considered itself to be very mindful on safety. Its principle measure was using lost time injury frequency rates. In 1997, the year before the fateful explosion, Esso had successfully recorded a full year without a lost time injury and for the last decade had maintained its LTIFR well below the industry average. Esso having no lost time injuries after a long period of time was put under great pressure not to report one. Therefore Esso's management went to great lengths to handle injuries so that they did not become LTI's. For example an offshore employee was injured falling down steps and suffered bruising ligament damage and concussion. He was medivaced to the hospital but no lost time was recorded for this injury. This example shows that the statistic of LTI's can be subject to manipulation and not a true indication of injuries sustained at work.

Lost time injury frequency rates and their effectiveness

Trethewy (2002) concluded that the lost time injury frequency rate alone is inadequate in providing any meaningful information to help reduce the causes of workplace injury. Using the LTIFR system can fuel the under reporting of accidents due to the fact that this is a negative measure of performance (a lag indicator). This manipulation of lost time injuries is mentioned by Hopkins (1995) in his book, Making Safety Work, where Hopkins condemns using loss time injury frequency rates as a indicator of an organizations safety performance. Hopkins explains that these figures are susceptible to manipulation, because these injuries occur randomly from year to year and are the result of chance so that lost time injury frequency rates may provide an inaccurate guide to changes in the level of safety. Lost time injuries tell nothing about how the more serious hazards are managed.

Lost time injuries measure smaller accidents that occur in the workplace, such as slips, trips and falls that happen to individuals, but fails to manage the more serious hazards that exist in an organization. Hopkins (2000) believed that Esso had tunnel vision when dealing with hazards, focusing on LTI's and neglecting to identify and manage major hazards. Similarly, a mine having a low LTI may not necessarily be a safe place to work.

The lost time injury rates for the Australian mining industry has dropped markedly in the last ten years, partly due to a genuine improvement in work practices and the way such injuries are reported and managed. Hopkins (2000) examined the Moura coal mine disaster, and discovered their Lost Time Injury

Rate halved from 153 to 71 in the four years prior to its disaster. Using these figures, Moura coal presented itself as one of the safest coal mines in Australia. However a major disaster occurred in which 11 people died. This clearly illustrates that its use of the lost time injury frequency rate as its measure of safety did little to show the safeness of this organization. The Airline industry would never use lost time injury figures of employees as a measure of how safe it is to fly (Hopkins 2000) so why is it acceptable to other industries?

The Australian Standards AS 1885.1—1990 was developed to provide workplaces with a guide on how to establish a method of recording information on work injury and disease and to develop methods of prevention. Some organizations seized this standard and used it as a tool for safety performance measurement. Powell in his reading, Measuring Safety Performance, explores the use of LTI's and why its practice is so widespread. He believes that Lost Time Injuries are something that can be comfortably measured, an easy statistic, and are commonly used as performance indicators that can have a dollar amounts attached to them. An accident is a measurable event where as safety is not always so easy to measure (Powell 2006).

Benefits of using lost time injury frequency rates

There are many benefits of using loss time injury frequency rates. Government bodies can highlight areas of high injury occurrences where occupational safety and health promotion is needed such as mobile plant, guarding and working at heights. WorkSafe Western Australia even presents certificates to reward companies with lower than average lost time injury rates and a reduction in workers compensation claims (WorkSafe Western Australia, 2007).

Some organizations use loss time injuries as a means of investigating the causes of the injury, and compile reports on how the accident occurred in order to prevent its future reoccurrence. Reid (2006) explains the benefits of using LTIFR in his reading, Accident Recording and Analysis, by stating that these statistics are undertaken to provide a broad picture of events by establishing a data base of the details of accidents, establishing the most common types and causes of these accidents and by enabling organizations to develop preventative strategies to combat these incidents (Reid 2006). Unfortunately some organizations twist this statistic around and instead of using lost time injury figures as small tool in accident prevention, they use it to preach a safe workplace and try to make LTI figures as attractive as possible. This detracts from the control of other major hazards that exist undetected in an organization.

Alternative safety effective measurements

Some possible solutions in measuring the safety culture of an organization is to travel down the path of the American Nuclear Industry. This industry doesn't look at lost time injury rates to see how they compare with other power stations, instead they use a method of hazard and near miss reporting of process related incidents. For example the number of forced shutdowns, unplanned trips of the plant, activation of critical safety systems such as gas detectors and smoke alarms (Rees 1994). The Nuclear Industry does not wait for a Loss time injury to happen to tell them how safe they are, but instead look for the warning signs of a catastrophic incident that may occur.

Hopkins (2000) highlighted this in his examination of the Longford Gas Plant explosion. If Esso took similar measures at the Longford Gas Plant on safety instead of only focusing on loss time injuries this would have helped prevent the explosion. Lost time injury figures could be used to compare a multitude of different organizations but the number of times a nuclear reactor tripped will only be of interest to other power stations. Therefore these figures can only be compared with other similar organizations. The nuclear industry uses the reporting of process upsets and safety systems as a guide in the safety of the facility but in 2000 no other trials had been put into place to see if this method will work in other hazardous organizations (Hopkins 2000). The American Nuclear Industry's methodology of observing the warning signs indicating that something is not right is a far better method than waiting for a lost time injury to happen. This way of developing indicators of an organization's safety would only be useful to industries that face major hazards such as Refineries, Power Stations, Gas Plants, Offshore Production Facilities, Underground Coal Mines and some sectors of the mining industry. This would only be of use if collective comparable data was available.

Conclusion

Lost time injury rates have been used successfully in organizations for mapping injury statistics and comparing their results with other companies. These rates can guide government departments in highlighting problem areas with high rates of lost time injuries and use worksite promotions to combat them. Useful investigations from a lost time injury can also stimulate changes to the way a work place manages its people and work processes.

Unfortunately this statistic, once a tool of accident prevention and statistical data, is now used by a great number of organizations to promote a self-satisfaction belief that their organization is a safe place of work. Lost time injury rates should still be used as a reporting tool and a way of placing a cost value of workers compensation claims but as recent events such as the Moura coal mine and the Esso Longford Gas Plant explosion shows emphasis needs to shift away from using these figures as a performance based measure and instead use other indicators as well to prevent catastrophic events form occurring.

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The WSO's 21st International Environmental and Occupational Safety & Health Professional Development Conference 2008

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If you would be interested in **presenting** a paper at this conference, please send or email your abstract to the WSO's office. You can reach us at info@worldsafety.org, (660) 747-3132 or fax (660) 747-2647. We look forward to hearing from you.

The annual **WSO's President's Reception** will be Sunday evening, June 8, 2008. This reception is an excellent time to get re-acquainted with old friends, to make new friends and new contacts. It will be an excellent time for networking and meeting with some of the WSO's Board Members. There will be a cash bar and hors d'oeuvres will be served.

We are accepting **WSO Award** Nominations. If you know a company, a corporation, educational facility, an individual etc., that have set new records in safety, or have made outstanding progress in the safety field or research, why not nominate them for one of the WSO's Awards. If you would like one of the WSO Awards Nomination forms, please contact our office or see page 7 of this WSO News Letter. The Awards Banquet will be held June 9, 2008, the award winners will be presented their awards.

For your information, attending conferences is a way of meeting your **certification renewal requirements** for your certification(s). As you know almost all of the certification programs require that you keep current and up to date. One of these requirements is attending conferences. Continuing Education Units (CEU) will be available. The CEU Certificate will be issued through Texas State Technical College.

The WSO's Board of Directors Meeting will be Sunday June 8, 2008 at 1:00 p.m. If you are a WSO Board Member, please try to make this meeting.

We are inviting you to attend the WSO's conference. Since the conference is being held in the beginning of the summer holidays, why not make it a family vacation. Las Vegas offers many events for the entire family - from amusement parks, shopping, displays, shows and golf courses, and for the evening there are casinos, lights and more shows.

See you in Vegas!!!!!

Fire and Explosion Prevention - Hidden Hazards

*By: **Dr. Milos Nedved**, MSc(Eng)., PhD., FSIA, Associate Professor, Edith Cowan University, Perth, Western Australia. Assistant Director, World Safety Organization International Office for Australia. Contact: m.nedved@ecu.edu.au*

Abstract

A summary of the causes, effects of spontaneous combustion, of dust explosions and secondary dust explosions is explained. An effective checklist for controlling and for preventing fire and explosion hazards is developed and included.

Introduction

Fires continue to kill people and to cause enormous economic damage. Recently quoted British statistics (Thomson, 2002) reveal that fires kill more than 30 people per year and injure around 3000 people. Fire damage in workplaces average around £10 million per week.

A frequent scenario is a fire breaking out at night in an industrial enterprise such as an engineering plant or a maintenance workshop, apparently without any cause, without any obvious ignition source. Accident investigation then reveals a culprit - a pile of oily rags forgotten somewhere out of sight.

This is a typical example of a spontaneous heating phenomenon, one of a hidden and frequently not very well understood fire hazards.

Another not very widely understood fire and explosion hazard is the existence of materials, which as distinct from very obvious fire risks such as flammable liquids and flammable vapors, would not be usually suspected of being dangerous at all. Examples could be metals (who would suspect metals being fire hazards) or often materials handled both in industry and in households. Examples are aluminum, cork, rubber, flour and sugar, all of them, if present in a finely powdered state, could give rise to very severe dust explosions with catastrophic consequences.

The spontaneous heating phenomenon

The hardening of paint, which takes place after all the volatile solvents have evaporated is due to oxidation by air oxygen. There are oils in the paint that are accepting oxygen atoms and then polymerizing. A certain amount of heat is released during this process, but this is quickly lost due to the surrounding atmosphere, so the temperature increase is negligible. However, if we use some rags to wipe up spilled paint or to clean up the brushes, and then throw the rags into a heap of rubbish, the situation is quite different. A piece of rag is a good thermal insulator. A thin layer of paint in the rag reacts with oxygen, the heat is released and cannot easily escape. The temperature begins to rise and may continue to rise until the material in the middle of the heap begins to smoulder. This process is called spontaneous heating, which will raise the temperature of a solid material to its autoignition temperature and the flaming combustion takes place. The whole process is then called spontaneous ignition.

Hay provides another example of the same phenomenon. The temperature is raised by the action of micro-organisms and in the well insulated interior of a haystack the temperature continues to rise up to spontaneous ignition. Some spontaneous ignition temperatures are listed in the table below

Spontaneous Ignition Temperature for some Common Materials

Material	Spontaneous Ignition Temperature °C
Coal	125
Hay	170
Newspaper	185
Sawdust	195
Cotton	225

The materials frequently involved in spontaneous heating.

Almost all combustible materials are capable of spontaneous heating when their temperatures have been increased near to the autoignition temperature. An example of this phenomena, well known in industry is a lagging fire. Some pipelines in chemical plants are lagged, or insulated to prevent heat losses. If a spilled combustible liquid, like fuel oil, penetrates into the lagging, it is quite possible that after a delay of perhaps several hours or days, the contaminated lagging will be smouldering. This represents a serious hazard in the areas where special care has been taken to eliminate all ignition sources. From the case histories we can see that this is one of the commonest causes of fire in the chemical and petrochemical industries. Other hazardous materials, subject to spontaneous heating are coal, charcoal, fish meals, fish oils, linseed oil, soya bean oil, soap powers etc. All of these can ignite spontaneously if the right precautions are not taken.

From the fires initiated by spontaneous heating of susceptible materials we can learn a lesson, that ignition sources of this kind might be present in spite of our best effort to eliminate all more obvious ignition sources. We can, therefore, modify the fire triangle model by saying that: the presence of fuel and air can frequently lead to a fire, since ignition sources might be present, even if we are not always aware of their existence.

Dust explosions and their prevention

Every year industrial dust explosions cause injury and death and damage or destroy plants and buildings. Such explosions often start and spread fires. A dust explosion is the rapid combustion of particles of dust suspended in air. The heat produced by the combustion of these suspended particles causes a rapid expansion of the surrounding gas which in turn produces an increase in pressure at the walls of the vessel containing the dust cloud.

How can we assess if a dust explosion in our premises is likely?

We need to know:

a) If we process a dust that is explosible

b)The minimum concentration of dust that will support an explosion

c) The temperature at which the dust will ignite

d)The minimum ignition energy that will initiate an explosion.

Nearly all carbonaceous materials, if they are in a sufficiently fine state, can give rise to a dust explosion. Also certain metals can give rise to this phenomenon and generally metal dust explosions are much more violent than other dust explosions.

In general, the finer the dust the greater its explosability. It means the ease with which it is ignited is enhanced and also the rate at which pressure rises in a confined explosion increases as the particle size decreases and similarly the maximum pressure produced increases.

The list of some substances and processes subject to dust explosion are listed in the table below:

Some substances and processes subject to dust explosions

Substance	Examples of processes, plant and premises
Aluminium	Milled powder production: ball mills. Metal spraying: dust collectors and workrooms.
Cotton seed Feeding stuffs Sunflower seed cake	Milling machines, disintegrators, bucket elevators, cyclones and bag filter units; a rotary drum dryer, storage bins and silos and workrooms.
Coal	Milling machines, classifiers, cyclones, ducting and bag filter units in the production of pulverised fuel.
Cork	Milling machines, conveyors, screens, cyclones, bag filter units and workrooms.
Magnesium	Hammer mills, ball mills, conveyors, screens, cyclones and settling chambers associated with pulverising processes.
Malt	Mills and bucket elevators in distilleries; less serious explosions in breweries.
Phenol-formaldehyde resins	Mills, cyclones and settling chambers.
Polystyrene	Extruding machines, a pneumatic dryer, cyclones, bag filter units, storage bins and workrooms.
Rubber	Dust chambers and collecting plant associated with abrasive machines used for tyre treading and retreading operations.
Starch	Starch powder production: disintegrators, cyclones, bag filter units, bucket elevators and pneumatic dryers. Starch moulding of sugar confectionery.
Wood flour	Milling plant, cyclones, screens and storage bins, associated with pulverising operations.

Dust clouds do exhibit the phenomena of explosion limits. In most cases the lower explosive limit is clearly defined whereas the upper explosive limit is not so accurately defined.

The greater the moisture content of the dust the lower its explosability. However, the effect of moisture is not as great as it is often assumed and we have had cases where starch dust containing as much as 17% moisture has been involved in an explosion. An inert material present in a dust will prevent an explosion and there is an ample experimental evidence of this.

Reducing the amount of oxygen to prevent the ignition of a dust cloud is sometimes used in industry. Experimental tests to discover the limit at which propagation does not occur, in various percentages of oxygen, have shown that for the most carbonaceous dusts this figure is roughly half the normal oxygen content in the air. The use of inert gas for certain industrial processes does give very effective safety but this kind of application is usually limited to firms and processes where a large supply of inert gas is readily available.

The ignition sources causing dust explosions can be grouped into four categories:

1. Ignition by Flames and Hot Surfaces: the flame or hot surface may have been produced by a welder or by a person bringing an open source of ignition into contact with a plant handling a combustible dust cloud.

2. Spontaneous heating: this has been discussed previously.

3. Frictional sparks: most industrial dusts are produced by mechanical action. The dust may be the main product of, for example, grinding operations, as in the case of wheat flour or it may be an unwanted by-product, as in the case of wood dust produced during woodworking operations. In both cases the dust is, at one point, in contact with machinery which can be the cause of ignition. In grinders, a frequent cause of overheating is the inclusion of foreign materials or tramp metal in the feed to the machine.

This produces a hot spot during the grinding process which ignites the combustible dust.

4. Electrical sources of ignition: totally enclosed motors or dust-tight apparatus reduce the amount of dust that can penetrate into the equipment and should be used where dust is handled. Lights should be dust-tight so as to prevent the penetration of dust into the fitting and also the position of the lights should be such that they can't become covered with dust which may then begin to smoulder because of the excess heat produced by the light fittings.

In dealing with the explosion protection necessary for the items of plants, one or more of the following methods may be used:

1. Avoidance of flammable concentrations: it is necessary to avoid the formation of a flammable concentration. For instance, in the pneumatic conveying field it is possible to select an air : material ratio below the explosive limit.

2. Enclosure of plant, processes and equipment to prevent dust escaping and reaching ignition sources.

3. Removal or protection of ignition sources.

4. Dust extraction to prevent explosible dust accumulating.

5. Working under an inert atmosphere or under liquid.

Secondary dust explosions

The worst disasters that have occurred with dust explosions have always been associated with a secondary dust explosion occurring within the factory buildings. The sequence of events is usually a primary explosion in some part of the plant which causes dust lying on beam fittings within the building to be dislodged and so producing a dust cloud of explosion concentration within the building. The dust cloud then becomes ignited and produces explosion pressure on the walls of the factory, causing their collapse. To prevent a disaster of this type, the following precautions have to be taken.

1. Good Housekeeping: regular cleaning (preferably vacuum) of the floors, walls, fittings of the workroom and so on, so as to prevent the accumulation of dusts.

2. Exhaust ventilation: dusty processes should b carried out under local exhaust ventilation so as to prevent dust escaping into the factory buildings.

3. Building design: the design of the building is important in the prevention of secondary dust explosions. Dusty operations should be separated from non-dusty processes by partition walls of fire-resisting structures.

Fires involving dust clouds are particularly hazardous if they are not tackled in the proper way. Fatal accidents have been caused when people have attempted to extinguish a dust fire by turning a water hose on it. The water hose caused dust to be thrown into suspension in the air and an explosion followed. Sprinkler and spray systems should be used, jets of water should be avoided.

More information about dust explosions can be found in literature eg K.N Palmer, *Dust Explosions and Fires*, John Willey and Sons (1973), or Barknecht,W.(1989),Dust Explosions, New York, Springer Verlag.

Checklist for Controlling Fire an Explosion Hazards

1. Are we handling materials that are flammable?
2. What are
   a) the limits of flammability?
   b) the flash points?
   c) autoignition temperatures?
   of the above materials?
3. What is the minimum spark ignition energy that would initiate an explosion?
4. What is the maximum pressure that would build up in an explosion?
5. Have all the people working in our workplace been adequately trained in Fire Prevention and Fire Protection?

Fires and explosions can be prevented or controlled in the following ways:

Prevention	**Control**
Enclosure of plants, processes and equipment to prevent flammable vapours escaping and reaching ignition sources.	Isolating and segregating the explosion risks
Removal or protection of ignition sources.	Sub-dividing the plant
Effective extract ventilation to prevent flammable vapors accumulating.	Making the plant strong enough to withstand explosion

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Something In The Air: A Critical Review Of Literature On The Topic Of Sick Building Syndrome (SBS)

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Abstract

"Sick Building Syndrome" (SBS) is a recognized illness characterized by a collection of non-specific physical symptoms. Studies into the phenomenon have been undertaken over the past twenty years to determine likely causes. At different points in time, research has focused on physical factors such as high levels of mold, bacteria and chemicals, or characteristics such as gender and psycho-social context. The collective body of research now shows that rather than being attributable to a single cause, SBS is more of a biopsychosocial illness, with many contributing factors differing between each sufferer.

Introduction

During the early 1980s, a trend became apparent in the number of people reporting non-specific symptoms such as nausea, headache, fatigue and irritation of the eyes, with no apparent cause. Those reporting the symptoms tended strongly to live or work in particular buildings. The World Health Organization soon came to term the phenomenon "Sick Building Syndrome" (SBS) (WHO). For over 20 years argument has continued as to whether the illness is a result of physical, social or psychological factors, or a combination of all three, or whether it can be seen to exist at all.

At different points in time, different theories on the causes of SBS have been in vogue, with physical factors such as high levels of mold, bacteria and chemicals and characteristics such as gender and psycho-social context considered important at different points. The collective body of research now shows that rather than being attributable to a single cause, SBS is more of a biopsychosocial illness, with many contributing factors differing between each person with sick building syndrome.

The emergence of Sick Building Syndrome in scientific literature

Sick Building Syndrome was first reported in 1982 by Repace, who argued that new approaches to environmental health and building design would be required to combat the reduction in ventilation and the increase in synthetic chemicals used in construction. Repace (1982) described a new trend of workers in office buildings reporting non-specific symptoms, first noted by Kreiss at a conference on epidemics in 1980. Following the initial reports identifying SBS came two decades of intensive study coupled with media interest (Goldberg 2006, Weeks 2005, MacQuarrie 2002), in which the causes and the very existence of SBS were vigorously debated.

Definition

The definition of Sick Building Syndrome has become important over time in order to differentiate it from other, often related, chronic illnesses such as Chronic Fatigue Syndrome (CFS), Multiple Chemical Sensitivity (MCS), and most importantly, Building Related Illness (BRI) (Redlich, Sparer & Cullen, 1997; Wiesmuller, 2003; Meggs, 2002). Sick Building Syndrome refers to a group of non-specific symptoms with a temporal connection to a particular building, but with no specific or obvious cause. BRI refers to a defined illness that is directly linked to a specific factor within a specific building - for example, Legionnaire's disease caused by a specific bacteria harbored in an air-conditioning system (Redlich, Sparer & Cullen, 1997). The border between SBS and BRI has long been blurred because both can refer to symptoms such as asthma or allergic rhino sinusitis, with the difference being that in SBS the cause of the illness is unspecified and uncertain, whereas in BRI there is a particular irritant, such as excessive dust, to blame (Redlich, Sparer & Cullen, 1997).

Symptoms

Physical

The commonly accepted symptoms that are frequently found in cases of Sick Building Syndrome are generally non-specific and include "upper respiratory irritative symptoms, headaches, fatigue and rash" (Redlich, Sparer & Cullen, 1997: 1013). Other symptoms include lack of concentration, eye irritation, abnormal odor perception, visual disturbances, and a wide range of other physical problems generally related to the skin, mucous membranes, and respiratory tract (Redlich et al. 1997: 1013). Initial studies lacked research into the numbers of reports, the physical manifestations of symptoms and the chemical levels in the building in question, and tended toward theoretical argument. Criticism of these studies soon led to a raft of statistical evidence demonstrating how the numbers of reported cases corresponded to particular buildings.

Psycho-social

After initial doubts about the veracity of SBS, in which the illness was often considered psychosomatic, studies such as Brasche, Ballinger, Bronisch & Bichof (2001) have demonstrated that there is in fact a strong correlation between the symptoms perceived by individuals and the actual medical manifestation of these symptoms, suggesting that the illness is not, generally, just in the mind. Further scientific studies have confirmed that in various sick buildings, levels of mold, dust, Volatile Organic Compounds (VOCs) or other harmful substances are considerably higher than in normal buildings (Kostiainen 1995; Wolkoff & Nielsen, 2001; Jones 1999).

Many recent studies, however, have continued to focus on the psychological aspects of SBS. Although some studies continue to assert that attitudes, beliefs and personalities are major influences on the reportage of SBS (Spurgeon et al. 1996: 43), many now accept that psychological aspects of the illness represent symptoms rather than causes (for example, Lundberg, 1996, Spurgeon, Compertz & Harrington, 1996) contend that studies of certain occupations, such as smelting, show a higher correlation between job dissatisfaction and reports of SBS than of reports and the presence of actual physical symptoms upon medical examination. Other studies, however, have shown that the effects of exposure to the toxins that are frequently involved in SBS include psychological symptoms, such as anxiety and "changes in mood, cognition and behavior" (Lundberg 1996, p227). Rather than generating false reports of symptoms and demonstrating psycho-social problems in the workplace, therefore, a prevalence of these psychological states could be considered a good initial indicator of high levels of toxins within certain buildings.

As with many other aspects of SBS, studies of physical and psychological symptoms have demonstrated that the

manifestation of the illness may include either or both, and that the difference depends on the buildings concerned and the individuals.

Susceptibility

Numerous studies undertaken during the 1990's attempted to determine whether a demographic trend in the reporting of SBS could be seen. Initial studies tended toward determining whether buildings harbored toxins by examining thousands of cases across multiple structures (Lenvik, 1993; Brasche, Ballinger, Bronisch & Biscof, 2001). With an increasing understanding of the involvement of psycho-social factors in SBS, studies soon turned toward the individuals reporting the symptoms to decide whether some people were more susceptible than others to indoor air pollution.

Atopy / chronic allergy and illness

Recent studies have identified atopy, or chronic allergy such as asthma or eczema, as a risk factor in SBS (Lenvik 1993). People suffering from atopic allergies are statistically more likely to report symptoms of SBS (Lenvik 1993). The study questions whether those who suffer from atopic allergy may be mistaking their symptoms for those related to SBS; however the authors consider that the number of cases incorrectly reported as a result would have been canceled out by the number of people who were unwittingly suffering from an atopic allergy at the time and did not report their symptoms as SBS (Lenvik 1993:338). It appears at least that sufferers of atopic allergy are more likely to suffer symptoms of SBS, most likely due to hypersensitivity.

A further question relates to whether sufferers of Chronic Fatigue Syndrome are more susceptible to SBS (Chester and Levine, 1997). Studies have shown that SBS can cause CFS, with sufferers improving once no longer inhabiting the offending building (Chester & Levine, 1997). However, it appears that those already inflicted with CFS are not significantly more affected by SBS, in that symptoms do not improve markedly once out of the environment. Although the symptoms are similar, it does not appear that people with CFS are affected any more than those without (Chester & Levine, 1997).

Gender/ ethnicity

Somewhat bravely, a number of studies have sought to determine whether gender is a factor in the reporting of SBS. Almost universally, according to numerous studies, women are more likely than men to report SBS - in some cases, more than three times as likely (Stenberg 1995). Experiments have been conducted to determine the effect of specific VOCs, such as formaldehyde, on female mice in an effort to understand whether female biology plays a part (Sari et al. 2004). It appears that there are some genuine links between the occurrence of SBS and the physical and hormonal differences in women (Sari et al. 2004). Further studies have attempted to determine whether the psychology of women contributes to the higher rate of reporting SBS - in particular, whether women are more comfortable sharing personal information through the interview process often used to identify SBS in a group (Stenberg, 1995). However, the results suggest that men are in fact more likely to 'inflate' their symptoms when quizzed on illness, and that the prevalence of women reporting SBS must relate to other factors (Stenberg 1995). Another suggestion is that women in the workplace are more susceptible to SBS because they are more stressed by the burden of domestic duties in combination with work (Bachmann & Myers, 1995). Further studies may benefit understanding of this imbalance.

A study in Asia (Nakano, Tanabe & Kimura, 2002) sought to determine whether the cultural differences between Japanese and non-Japanese office workers impacted their perceptions of workplace discomfort. The study showed that Japanese women were far more likely to report discomfort than non-Japanese men (Nakano, Tanabe & Kimura, 2002). A temperature difference of 3.1 degrees Celsius was recorded between the working areas of the two groups, with the warmer area being that where the female workers expressed discomfort (Nakano, Tanabe & Kimura, 2002). In this instance, the result referred to an indirect cultural difference between the two groups of workers- the women worked in an office environment in one part of the building, while the non-Japanese men worked on a stock-broking floor elsewhere, thus accounting for the temperature difference (Nakano, Tanabe & Kimura, 2002). So, in this instance, there was no relationship between ethnicity and the reporting of SBS other than that created by the expatriate versus local workers in a particular building.

Pre-existing psychological distress

Although psychological factors are now, as previously discussed, considered a valid part of the diagnosis of SBS, the potential bias in reporting caused by factors such as pre-existing psychological distress is a reminder that individual circumstances should be considered in any study of SBS. A possible avenue for future research is determining what proportion of reports of SBS, regardless of confirmation of physical findings, are made by individuals who are dissatisfied with working conditions or under considerable stress. It is likely that in any sample, some individuals may not self-report accurately due to psycho-social factors such as dissatisfaction (Norback, 1989); while this is unlikely to affect the validity of any study, the potential impact on the data should be considered.

Smoking

A good example of a confirmed case of Sick Building Syndrome in which personal habits contributed to the symptoms of the reporting individuals is that of the Athens Air Traffic Control Tower (Assimakopoulos & Helmis, 2004). Although the building was found to feature inadequate ventilation and high levels of pollution from external sources and office equipment, the smoking habit of the majority of employees had a major impact (Assimakopoulos & Helmis, 2004). The continual smoking that occurred throughout the building contributed significantly to the level of toxins in the air. Once smoking was banned from the building and ventilation improved, the air very quickly returned to an acceptable state (Assimakopoulos & Helmis, 2004). In this instance, smoking contributed directly to the individual's own illness by the effect it had on the atmosphere. Smokers have also been found to be more susceptible to SBS as a group (Lenvik, 1993), potentially because of the impact of the habit on their health.

Causes

Although some individuals may be more susceptible than others to Sick Building Syndrome, the major causes of the illness are now recognized and are quantifiable in sick buildings regardless of whether occupants report health problems or not. The causes, therefore, have always been considered of more value in determining whether SBS exists in a particular building than subjective reports and interviews.

Volatile Organic Compounds (VOCs)

Volatile Organic Compounds (VOCs) include hydrocarbons, formaldehyde, toluene, and a number of other chemical

compounds commonly isolated in cases of SBS (Wolkoff & Nielsen, 2004; Kostiainen, 1994). The initial push to recognize the existence of SBS came as a result of the recognition that, since the 1980's, "the number and amounts of organic compounds have increased with greater use of chemicals and synthetic building materials"(Kostiainen 1994 p 693). There has been a direct correlation between the increase in synthetic building materials and reports of SBS - although it must be acknowledged that prior to the 1980's Sick Building Syndrome may have existed but was not recognized and would therefore not have been reported. However, a large number of studies have found that higher levels of VOCs correlate strongly with reports of SBS. Particular compounds such as formaldehyde and toluene are frequent offenders. The Kostiainen (1994) study in particular flags an important issue in the identification of particular toxins in SBS- that is, assuming that SBS can be attributed to a single factor is nigh on impossible when a number of different toxins, including mold as well as chemicals and bacteria, can be involved. The study inadvertently demonstrated this by the finding that although toxic compounds were found to exceed normal levels more often in sick houses than in normal houses, and that the level never exceeded the normal amount in normal houses, there were a number of sick buildings in which the toxic compounds did not exceed normal levels (Kostiainen, 1994). In these instances it may be a reasonable assumption that the buildings were still "sick", but from a different cause, such as mold or bacteria.

Mold, dust and bacteria

Damp buildings, the types of mold, dust, bacteria and adequacy of ventilation were all found to contribute to the occurrence of sick building syndrome reports (Muhic & Butala, 2004).

Ventilation and ambient temperature

There are two factors that in experiments have led to reports of discomfort and symptoms like those seen in SBS despite the absence of any toxins in the air (Muhic & Butala, 2004). Ventilation and ambient temperature are directly related within many modern buildings, as the movement of air is used to control the temperature (Moritz, Peters, Nipko & Ruden, 2001; Nakano, Tanabe & Kimura, 2002). Studies have shown that reducing the airflow in the workplace has lead to participants reporting discomfort and believing that the building may be "sick" (Nakano, Tanabe & Kimura, 2002). Increasing the temperature leads to the same result. Ironically, as discussed above, the air-conditioning used to combat these two factors often bears the genuine toxins that cause SBS (Wong & Huang, 2004).

Electromagnetic impulses

A possible cause of SBS that has yet to receive a great deal of attention is electromagnetic impulses. Recent theories have suggested that the effect of electromagnetic impulses on the human body may add to the symptoms of SBS by preventing the release of particular hormones from the brain (Saunders 2003). Workers may be susceptible to electromagnetic impulses from electrical equipment found in the ordinary office (Saunders 2003). Further studies into the effects of electromagnetic impulses would be of benefit.

Directions for future research

Cumulative body of information

The number of studies into SBS has reached the thousands over the past twenty years, creating a body of information that is of great use in determining trends, causes and risk factors. Further studies would identify additional causes and risks, as well as consolidating existing knowledge for greater certainty and clarity.

Single building approach

A different direction that may be of use in future research is to consider buildings on an individual basis rather than in groups. The reason why a more focused approach would be useful is that studies are increasingly showing that causes and symptoms of SBS differ markedly between buildings, depending on the circumstances present in each, and that attempting to find a single cause for SBS can only result in skepticism that the illness exists at all. Building-by-building studies are of the most relevance.

Modern solutions

An area of study that has so far been neglected in relation to SBS is that of possible solutions to the problems identified. Individual studies have noted that changes such as improving ventilation or removing the source of toxic emissions can eliminate SBS in some buildings. However recent studies have attempted to determine whether there are potential solutions to the problem of an unknown contaminant. One such example is the use of nanotechnology to remove VOCs from the environment (Luntz, 2006). Another more simple method advocates introducing potted plants to workplaces to remove CO2 (Nelly, 2005). Determining possible solutions is vital, as the impact of SBS includes spiraling costs and reduced workplace efficiency in what is an increasingly competitive marketplace.

Legal implications

Scientific studies into SBS have been conducted in great volume; however, the possible impact of SBS in other fields has barely been considered. For example, SBS represents a possibly significant area of litigation in the future, with numerous cases already likely in the United States [Carlton, 2002). At least two cases in Australia (Janice Mary Gordon v Australian And Overseas Telecommunications Corporation (Q89/521); Milic Milenkovic v Comcare (V91/679)] have already flagged the potential for further litigation[1]; however, at this point no case has been heard in the higher courts, and there are therefore no legal precedents to determine how such claims might be dealt with. The potential legal implications of Sick Building Syndrome could be an important study.

Conclusion

Since being recognized as a valid illness in the 1980s, Sick Building Syndrome has become a much-debated topic, with opinions divided as to symptoms, causes and solutions. Initial studies focused on the theory of SBS. Later studies attempted to determine how much impact psycho-social factors had on the reporting of SBS. Recent studies have begun to focus on solutions to the problems behind the illness. The body of research leads to at least one definite conclusion about Sick Building Syndrome - that the circumstances of each building and its inhabitants will most likely be different, and that in order to combat the situation, each case should be considered separately. It is clear that, despite different manifestations and causes, SBS is a genuine occurrence in the modern workplace, requiring further study and consideration.

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How Do You Transform A Line Manager Into A Safety Excellence Manager?

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Abstract

The article begins with determining the reasons why a manager should be interested in managing safety well, then progresses to explore the influence of leadership and its role in creating a safety culture in order to achieve high standard of occupational safety. Best practices in safety excellence leadership are explored to determine how to motivate a line manager to want to build their skills and develop into an effective safety excellence manager.

Why should a line manager be interested in Managing Safety Well?

The primary reason that a leader should be interested in safety is a moral one - his or her duty to look after the people that he or she is responsible for. Not all leaders feel this duty, particularly if they believe that the business that they operate in is not a business with significant risk in its operation, or if they have not been responsible for someone who has been injured (or worse) at work, or have not been inspired by a strong safety excellence vision. However, there is a degree of safety risk in all business, and if a leader does not feel a compassionate sense of duty to their employees, there are other reasons that should help to motivate the leader to take an interest in safety. The first is legal requirement and personal liability, reinforced by credible enforcement. Loss of credibility and reputation is the next most powerful motivator for leaders to focus on safety. (Comcare, 2004a). From a positive perspective excellence in managing safety tends to positively flow into other aspects of managing a business resulting in improvements in customer satisfaction, staff morale and motivation and a reduction in loss both from reduced injury and waste. "Success in safety correlated to success in business generally" (Krause & Weekley, 2005, p 35) "Loss, cost and expense are the only things a manager can truly manage; and by effectively doing so, transform top dollars (revenue) into bottom dollars (margin)" (Hansen, 2006, 1). "When driven by a sound strategy, safety can become a catalyst for improvement in other performance areas and provide leverage in improving culture, company image and the bottom line" (Krause & Hidley, 2006, p2.)

What are the major influences on good safety performance?

Leadership and culture are the two most important factors in achieving safety excellence (Petersen, 2004). A safety culture is "a system of shared meaning and beliefs held by organizational members that determines, in a large degree, how they act" (Robbins et al 2006, p95) or "What is important...how things work...the way we do things around here" (Reason 1997, p192). Leader can influence safety culture because they have the power to make decisions that drive the direction of the company and it is their decisions and their behaviors that more junior managers and employees will see and emulate. "Managers, designers, instructors and risk analysts are also behaviors. Their decisions, mistakes and risk taking behavior create the underlying risk level in the work situation and together with their behavior set the agenda for the safety culture of the company. Worker behavior is a reflection of this safety culture" (Sundstrom-Frisk, 1999, p37).

Safety culture is positive when workers really believe that safety is a core value. Separate research by Thomas Krause (2004) and Dan Petersen (2004) determined that in order to build a positive safety culture, leaders needed to cultivate confidence and trust and ensure procedural justice. The relationship between leaders and employees is really important and is enhanced by leadership taking a genuine interest in the workforce. Both agree that it is necessary for leadership to provide enough resource to make working safely possible and that management must be approachable to encourage employees to talk upwards about safety concerns. Other important factors raised by Petersen include leaders sharing information, asking employees for their ideas and opinions, providing relevant training, teaching employees how to solve problems instead of providing answers and recognizing excellent safety effort. (Petersen, 2004). Krause included four further factors to predict positive safety outcomes including teamwork, worker relations, feeling able to approach peers about safety concerns and finally the organization's value for safety improvement (Krause, 2004).

After identifying the factors that indicate a positive safety culture, the next step is to determine the qualities and actions that a leader needs to take to build a positive safety culture and achieve excellence in safety performance.

Best Practices in Safety Leadership

"Safety Leadership is multidimensional. On one hand, effective safety leadership requires a rigorous understanding of and attention to the systems that control hazards and exposure reduction. On the other, Safety Leadership is also more personal... It is clear that a specific set of leadership best practices can be identified and defined. This forms the foundation for creating a safety culture in which injuries are unacceptable" (Krause & Weekley, 2005, p40) There has been much research published about best practices in Safety Leadership in recent years.

Research by Krause and Hidley (2004), Grubbs (1999) and Petersen (2004) identified that to create a positive safety culture and achieve safety excellence, the first step a leader should take is to create a vision that describes what safety performance excellence looks like and how the company is going to achieve it. A good safety vision should be strategic and in order to get buy in from the business, ideally explain how safety is integral to achieving business objectives. The vision should be engaging and widely communicated - so that it will excite the organization and the workforce will rally around it. Vision statements, actions and communications about the safety vision should be promoted at every opportunity. The vision should encompass how the organization approaches day to day business as well as how it impacts other parts of the organization. "An effective leader clearly communicates what results s/he wants- as well as what will be done to achieve those results" (Petersen, 2004, p31).

Once the vision has been decided and communicated, a leader needs to have credibility (Krause, 2004) by being consistent, persistent and dependable when it comes to safety management

(Grubbs, 1999). A leader needs to know what s/he is talking about and act by example. Leaders tend to judge themselves by their intentions - but they are judged by their actions and so need to practice observable behaviors that demonstrate their commitment to safety. To build credibility it is important for a leader to really know him/herself and truly understand whether they lead by intention or action - credible safety leaders walk the talk. It is also important for a leader to understand the pressures in the organization and set safety expectations taking other demands into consideration - ensure that there are enough resources for employees to do their jobs safely. To get a deeper understanding of the safety practices and risks the leader should ask questions to involve the workforce and show that s/he cares about them. (Krause & Hidley, 2004). The questions should be effective and avoid the "why" question as this can put employees into defensive mode (McSween, 2000). Asking questions leads to a deeper understanding of what has been done already to assure safety and what still needs to be addressed. Finally, a credible safety leader needs to establish follow up mechanisms and monitor performance and provide both positive and negative feedback to reinforce expected behaviors. Consistency is the key, "credibility is difficult to earn and very easy to lose" (Krause &Hidley, 2004 p2).

Krause (2004) claims that collaboration is the third best practice of a safety leader and means promoting cooperation, working well with the workforce, encouraging their input and helping them to solve safety problems themselves. Participative management that encourages input from the workforce into decision making and management involvement in safety programs assists in achieving successful safety performance (Comcare 2004a). "Participation is closely related to job enrichment...it does always improve attitudes, turnover, morale" (Petersen, 1988, p152). A leader who collaborates and consults with the workforce has the added benefit of getting their "buy in" for the safety program.

The fourth leadership best practice according to Krause (2004) is feedback and recognition to reinforce safety behaviors. Hansen (2006) concurs and builds on this idea by recommending that an excellent safety leader should attach significant consequences both positive and negative to safety performance. As an example, an employee's overall performance rating can be no higher than their rating for safety performance, no matter how well other objectives are achieved (Hansen, 2006).

Accountability is Krause's (2004) fifth safety leadership best practice. Comcare (2004b) and Hansen (2006) agree and both contend that clear accountability means that safety responsibilities and roles need to be well defined to ensure that they are aligned. Safety processes should be integrated into business process "safe is how work is done, not a program" (Hansen, 2006) and should manage risk, audit and continuously improve (Comcare 2004a). Krause (2004) continues to say that a safety leader should provide clear, fair appraisal of safety efforts and results and foster a sense that people are responsible for the level of safety in their unit. Hansen (2006) adds to this by stating that excellent safety leaders ensure that the right things are measured and to pay attention to what really counts.

An excellent safety leader requires excellent communication skills and needs to encourage honest and complete information sharing about safety even if it is unfavorable. (Krause, 2004 p33) S/he must communicate that safe behavior is expected, then monitor and provide timely feedback. Comcare (2004a) claim that frequent and informal communication between employees and their leader on safety is critical for improved safety performance. Hansen (2006) agrees with Krause (2004) and Comcare (2004a) and states that the leader should provide timely information and allow undistorted feedback on safety. The safety leader should also make sure that his/her communications are fit for purpose and relevant to the audience to ensure that they relate and buy in to it. The medium of communication is also an important consideration, particularly when it is necessary to create impact.

Krause's (2004) penultimate best practice is that an excellent safety leader values safety and acts to support safety values and principles. By leading by example the leader clearly communicates that safe behavior is expected. Hansen (2006) supports this view and states that an excellent safety manager will make safety a core value - not a priority. "Priorities can be moved, values are woven into everything you do." (Hansen, 2006, 3). Employees perform safely when they believe that safety is important to the success of the business. This view is also endorsed by (Grubbs, 1999) who states that safety should never be a priority to an organization as priorities will change as operating conditions change. Safety must be a value to the organization that exists no matter what operating conditions arise. "When an organization is staffed with leaders who promote safety values, it becomes an almost invisible function within the organization" (Ibid, p26)

Action Oriented is the final safety best practice identified by Krause (2004) and he states that the leader must be proactive rather than reactive and deal with feedback to safety concerns with a sense of personal urgency and energy to achieve safety results. Action oriented also is performance driven and delivers results with speed and excellence. "A leader who is credible and action oriented and who places a high value on safety not only personally pays more attention to safety improvement mechanisms, but also influences others to do so" (Krause & Weekley, 2005, p 39)

Krause (2004) has identified eight best practices for safety excellence leadership, all of which have been endorsed and even expanded upon by other researchers. However, other practices that a safety leader could adopt to further improve safety performance have also been identified. Hansen (2006) promotes motivation as essential for an excellent safety manager to instil into the workforce around the safety agenda. He believes that recognition and reward should be used to change safety from "gotta" to "wanta" and to set line managers with targets for them to motivate their teams. Comcare (2004b) believe that a safety leader should set incentives such as awards to motivate the management and workforce in health and safety.

Commitment is a key requirement of an excellent safety leader - to be willing to push for safety improvement requires more than meeting compliance requirements, it requires a leader to demonstrate through their actions by setting targets, positive performance indicators and involving all of management into promoting safe behaviors. (Comcare, 2004a). "Employee perception of management commitment correlates strongly to safety performance" (Carillo, 2005, p32).

Leaders need to "get some skin in the game" and demonstrate that safety is important - be a VIP (Visible, Involved, Participative) safety manager. (Hansen, 2006,p3). Visible, felt leadership commitment is a key in driving safety excellence.

Finally leaders must understand relevant regulatory requirements so that they can make an informed contribution to ensure that their safety management system is fit for purpose. The leader needs to understand the health and safety risks in the business and what resource and support is needed from him/her to ensure that safety policies and procedures are current, available and relevant and that the safety system is audited and built to capture learnings and ensure continuous improvement.

How do you transform line managers into safety excellence leaders?

It is clear that in order to create an excellent safety performance within a company it is necessary to define where you are now, understand what a healthy safety culture looks like and create a plan to get to where you want to be. It is also clear that there are leadership best practices that identify what makes an excellent safety leader. However, what is missing is guidance on how to actually go about making a line manager want to be an excellent safety leader. How do you get his/her buy in to work on him/herself to build their competencies and develop the best practices described above? How do you get them to put some "skin in the game"?

If top management is committed to safety excellence they can ensure that their line mangers are also safety excellence leaders by ensuring that:

- Line managers are well informed of their legal responsibilities around duty of care for their employees and understand the risks that they need to manage in their area of influence. In addition that the safety policies and minimum safety behaviors and standards are clearly communicated and explain the context around why the policies and standards need to be lived. This can be done by demonstrating their relevance and importance to the business and will help to foster individual buy in to the policies and standards.
- By setting an excellent safety leadership example to their middle managers, top management's actions demonstrate their commitment to safety excellence. Setting, monitoring and measuring clear accountabilities will also motivate line managers to embrace safety excellence.
- A robust safety system is in place and the business is adequately resourced, (including enough time for people to work safely), priorities are well understood and safety is a core value of the organization. This can be facilitated by incorporating safety procedures into business procedures so that they become the way things are done - and not feel like an extra thing that needs to be done on top of normal operations.
- Empowerment. Middle management must do their own exercise as a team to determine where their team is now, build their own vision of where they need/want to be in order to achieve the company's safety vision and decide their own action plan of how to get there including measures to monitor progress.
- Introduce an element of competition. Set positive performance indicators that are measured and discussed in regular team meetings. Recognize the excellent performers and provide public praise. Privately counsel the poor performers and drill down to understand why their performance is not satisfactory. Look to see if organizational factors contribute to poor safety performance and correct any organisational factors identified as far as practicable. If all work processes, work organization management factors and the work environment are safe and the person's work performance is still unsafe then link the performance of these measures into individual performance contracts and reward mechanisms.
- Finally, make safety performance an integrated element of business performance. Focus on reducing loss and eliminating waste as both of these have a direct impact on the bottom line of a business. Measuring loss for example including cost of incidents and clean ups in a scorecard will highlight their impact on a department's margin - and thus increase motivation to minimize their occurrence.

Conclusion

This research has drilled down and unearthed the qualities and priorities that make a successful safety excellence leader. In subsequent research would be interested in drilling down further and further explore how to motivate a leader to be a safety leader without being pressured into it by performance expectations from upper management, but rather to find that compassion and motivation from inside.

This research has reinforced the importance of top management commitment to creating an inspiring safety vision, building a strong safety culture, a safety management system that is an enabler and support to achieving the safety excellence vision. Management needs to communicate their expectations of their functional managers through actions as well as words and ensure that they are trained and resourced to achieve these expectations. Motivating the middle management layer is key. Many managers follow the law of least resistance - "given the opportunity to do nothing, most will" - this law does not apply in organizations striving for safety excellence" (Hansen, 2006, p7).

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Skip's Corner

Housekeeping and Safety

What do the following three accidents have in common?

A truck driver jumped off the edge of a loading dock to take a short cut instead of using the steps. He jumped onto a discarded pallet that had been tossed on the apron earlier. When he landed on the pallet it broke causing him to lose his balance and fall. He broke his right ankle in the accident and was off work several weeks.

In another incident, a machine operator was going to lunch. He shut off his machine, wiped his hands, and started for the restroom. As he turned around, he slipped in a spot of oil on the floor, striking his head on equipment, sustaining a severe head injury.

Paper and wood refuse from un-crating raw materials was allowed to accumulate on the floor of a warehouse. It was to be removed the day before, but the job was not done. Someone apparently dropped a match or cigarette onto the pile, and a fire started. Fortunately, the fire was spotted and extinguished, but not before causing extensive smoke damage to the materials stored in the warehouse.

These accidents have one important thing in common, **"HOUSEKEEPING!"** The accidents or damage could have been prevented had reasonable housekeeping standards been followed. In far to many accidents, poor housekeeping is cited as being a significant contributing cause.

WHO IS RESPONSIBLE FOR HOUSEKEEPING? That's a good question, especially when you see how some people can create a mess and not make any effort to clean it up. It's true not only on the job, but in our streets, parks, and other public areas.

HOUSEKEEPING IS EVERYONE'S JOB? If we would take a moment to clean up our own mess, there wouldn't be any housekeeping problem. Remember, when it comes to job safety, far too many accidents are caused by poor housekeeping. You may prevent injury to yourself or others by just making a reasonable effort to keep things neat. It doesn't take a great deal of time to keep the place clean, and it is important!

Latex Allergy

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Abstract

This literature review defines what causes latex allergy, what latex allergy is and the prevalence of latex allergy. Current methods used to diagnose latex allergy are examined and the economic and social impacts of latex allergy is explored. Alternatives to using latex gloves are critically scrutinized. Best practice management methods for work and home use of gloves are discussed and further opportunities for research are identified.

Introduction

Natural rubber latex allergy has been a slow progressing occupational health concern. It first appeared in literature around 1979, yet it didn't become a topic of real interest until around 1990 (Toraason et al, 2000). In the years from 1992 to 1997 the use of latex gloves increased from 12 billion pairs to 200 billion pairs (Valliere, 1999). Latex gloves are not only used in the health care arena. Frequently hairdressers, police officers, painters and food service workers are using latex gloves (NIOSH, 1997). It is because of this that alternative options and methods of prevention and treatment of latex allergy must be investigated to avoid a rise in workers compensation claims and lost time due to allergic reactions (Toraason et al, 2000).

Production of Latex

Natural rubber latex is a liquid that is found in tropical rubber trees. It is the milky sap of the *Hevea brasiliensis* tree found in Africa and peninsular Malaysia (Taylor & Erkek, 2004). Once the sap is extracted it is filtered and preserved to alkalinize the pH (Subramaniam, 1995). When the sap has reached this point it is known as field latex and contains between 25% and 45% rubber (Subramaniam, 1995). This product is what is used to make the dipped or dry rubber products that we use everyday (Taylor & Erkek, 2004).

Dipped and Dry Latex

Some examples of dripped products are gloves, urinary catheters, dental dams, tourniquets and some resuscitation equipment (American Academy of Family Physicians, 2005). Natural rubber latex contains approximately 1% total protein, and a small portion of this protein remains in the latex after it has been processed (McFadden, 2002). This protein is extractable and it is this protein that is responsible for the immediate reactions caused by natural rubber latex (Charous et al, 2002).

Dry rubber latex products are made from processed, dried or milled sheets of latex rubber (Taylor & Erkek, 2004). Examples of products made from this type of latex are tires, syringe plungers, vial stoppers and shoe soles (Taylor & Erkek, 2004). Dry rubber latex contains lower residual proteins after processing and these proteins cannot easily be extracted (Charous et al, 2002). Therefore as expected this form of latex is less immunogenic (Charous et al, 2002).

Types of Reaction

There are three main types of reaction associated with latex allergy. These are contact dermatitis, type IV reaction of delayed hypersensitivity and type I of immediate hypersensitivity (Yip, 2003). Of these only type I is a reaction to the latex proteins found in latex products (Yip, 2003). Irritant dermatitis is a reaction to proteinaceous irritants (Yip, 2003). Type IV is an allergy which is a reaction to certain residual chemicals employed during manufacture of medical gloves (Yip, 2003). Of these the type IV reaction is the most likely to occur and is potentially less serious that the other reactions (Yip, 2003).

Irritant contact dermatitis is a non-allergic reaction (Yip, 2003). It usually results from sensitivity to soap, hand cream, powder, disinfectants, temperature and pH extremes (Yip, 2003).

Symptoms that present in a type IV reaction are very similar to those of irritant contact dermatitis (Yip, 2003). These reactions are caused by the presence of residual chemicals (Yip, 2003). Examples of chemicals that can cause such reactions are accelerators, thiuram, thiazoles, and carbonates which are used in the manufacture of both latex and synthetic gloves (Yip, 2003). This reaction is cell mediated and symptoms usually don't present until a few hours after contact with the allergens (Yip, 2003).

To trigger a type I reaction the patient needs to be exposed to particular allergenic proteins (Yip, 2003). In contrast to type IV that is a cell mediated reaction, type I is an IgE mediated reaction, or immunoglobulin E reaction (Yip, 2003). This means that it is medicated by IgE antibodies from the immune system (Yip, 2003). This type of reaction is commonly caused by proteins that are found in foods such as peanuts, watermelons, bananas, avocados, potatoes, tomatoes and also some seafood (Yip, 2003). Other causes of type I reactions are insect bites, penicillin, and other types of medications (Yip, 2003).

Type I reactions nearly always occur within minutes of being exposed to the allergen (Yip, 2003). Symptom can vary greatly. The mild type symptoms are reactions like urticaria (a rash), hay fever and allergic conjunctivitis (Yip, 2003). More severe reactions are asthma and in rare cases anaphylactic shock that can result in death (Yip, 2003).

Prevalence of Allergy

The exact prevalence of latex allergy in the population is not known. However it can be estimated to be less than 1-2% in the general population (Taylor & Erkek, 2004). Anyone who is routinely exposed to natural rubber latex is at risk of developing an allergy, although the risk of sensitization generally decreases with age (Reider et al, 2002).

Interestingly children who suffer from spina-bifida or meningomyelocele have an unusually high prevalence of latex allergy; it ranges from 20% up to 65% (Taylor & Erkek, 2004). It is believed that this is because these patients suffer a higher prevalence because they have repeated mucosal exposure to the latex from multiple surgical, therapeutic and diagnostic procedures (Taylor & Erkek, 2004). Anaphylaxis is 500 times more likely to occur in these patients (Taylor & Erkek, 2004).

Latex allergy is traditionally an occupational hazard and it most commonly occurs in health-related professions (Taylor & Erkek, 2004). Health care workers have a reported prevalence of latex allergy of 6 to 17% (Toraason et al, 2000). It is believed that

when health care workers are exposed to latex proteins, either by wearing latex gloves or inhaling glove powder, repeatedly they develop sensitivity to the natural rubber latex (Toraason et al, 2000). Occupations that have the highest risks include physicians, dentists, operating room personnel, dental assistants, laboratory personnel, hospital house keeping personnel and paramedics (Taylor & Erkek, 2004). Workers who also have reported significant rates of sensitivity and do not work in the health care industry include house cleaners, rubber band manufacturers, surgical and latex glove manufacturers and also latex doll manufacturers (Taylor & Erkek, 2004).

Another common trend in the prevalence of latex allergy is that of those who experience it, around half suffer from pre existing hand eczema (Taylor & Erkek, 2004). Some glove wearing natural rubber latex allergic patients may have only persistent hand eczema as a symptom, and this may be the initial sign that the patient has become allergic to latex (Taylor & Erkek, 2004)

It is also common for those who suffer from latex allergies to also have food allergies to particular fruits and those with food allergies to develop latex allergies (Toraason et al, 2000). This is known as a cross-reaction (Toraason et al, 2000). A cross-reaction occurs when an individual becomes sensitized by exposure to proteins from one source and then the individual will have a reaction later when exposed to another source (Yip, 2003). Some fruits that commonly produce this cross-reaction are bananas, avocados, chestnuts, kiwis, potatoes and tomatoes (Toraason et al, 2000). These reactions produce localized itching in patients with also a small prevalence of anaphylactic shock (Toraason et al, 2000).

Methods of Diagnosis

There are various pathological methods for testing sensitivity to latex allergy. The most popular tests are radioallergosorbent tests (RAST), enzyme linked immunosorbent assays (ELISA) and western blots (Toraason et al, 2000). These tests test for the latex protein specific IgE antibodies and can successfully identify about 75% of all patients with IgE sensitivity (Toraason et al, 2000). Serology should be the initial test for sensitivity as it is much safer than the skin prick test that is described below.

The skin prick test requires qualified specialists to be familiar with the correct technique and also an accurate ability to be able to interpret results accurately (Toraason et al, 2000). The results of the SPT depend greatly on the quality of latex extract used and a variety of concentrated latex extracts should be used (Taylor & Erkek, 2004). SPT has advantages over other serological tests because it is more sensitive when used correctly, cheaper and can be easier to perform (Taylor & Erkek, 2004). These tests should be used in conjunction with a medical history questionnaire, which should initially qualify the patient for further testing (Taylor & Erkek, 2004).

Allergy Effects

Latex allergy in occupationally sensitized health care providers is an important cause of occupational impairment and disability (Taylor & Erkek, 2004). A majority of workers who experience symptoms choose to continue to work and remain symptomatic (Taylor & Erkek, 2004). These people may report continuous work related symptoms that can increase in severity over time (Taylor & Erkek, 2004). This can lead to an eventual loss of time from work, and in some severe cases the worker may quit working to change jobs or retire prematurely (Taylor & Erkek, 2004).

Cost incurred can vary greatly. Some incurred by the employer range from the purchasing of powder free or latex free gloves, substitution of hospital equipment containing latex to the installation of air filtration systems and laminar flow changing stations (Taylor & Erkek, 2004). Costs incurred by the worker can include but are not limited to job relocation, job change, retraining and re-education (Taylor & Erkek, 2004). If latex allergy results in occupational disability then other expenses to be incurred are medical and legal costs including rehabilitation and workers compensation expenses (Taylor & Erkek, 2004).

Treatment of Latex Allergy

At present there is no known cure or treatment for latex allergy. The best method to relieve symptoms is to avoid all natural rubber latex products. This method is also useful in prevention of latex allergy. By simply substituting products such as latex gloves with substitutes made from vinyl or other synthetic materials reactions to latex can be minimized (Yip, 2003). The main problem with this is that latex gloves are a superior product because they provide reliable barrier protection, they are tactile and they can be produced at a very reasonable cost (Yip, 2003).

Latex Alternatives

The main type of gloves that have been manufactured to replace latex gloves are the nitrile gloves (Sawyer & Bennett, 2005). These gloves offer comparable barrier protection against chemical and biological agents and are more puncture resistant (Sawyer & Bennett, 2005). Tests carried out by Sawyer and Bennett demonstrated that manual dexterity is not compromised by using nitrile gloves, although the results showed that latex gloves performed marginally better than the nitrile gloves, but not significantly enough for dexterity to be compromised or for there to be an increased risk of sharps injuries (Sawyer & Bennett, 2005). When testing fine dexterity it was found that nitrile gloves provided 8.6% less fine finger dexterity when compared with latex (Sawyer & Bennett, 2005). This means that only small finger movements were impeded by nitrile gloves (Sawyer & Bennett, 2005). Some of the key features of increased fine finger dexterity, which is also exhibited by latex gloves, include better elasticity and also a less smooth, nearly tacky surface (Sawyer & Bennett, 2005).

Their study also showed that latex gloves are preferred for use in the health care industry, but this may be attributed to the fact that nitrile gloves and other latex alternatives are still a fairly new edition to most health care settings (Bousquet et al, 2006). An interesting point to note was that in the Sawyer & Bennett study, participants who had short fingers reported that they felt they had reduced dexterity with nitrile gloves (Sawyer & Bennett, 2005). This could represent the fact that nitrile gloves have less elasticity in them when compared with latex gloves (Sawyer & Bennett, 2005).

In a study of employees working in independent hospitals where there was a change of gloves from high protein, high powder to low powder or powder free natural rubber latex gloves that are low in protein and allergens, what resulted was a dramatic decrease in the incidence of latex allergy (Yip, 2003). The use of these gloves allowed latex sensitive workers to work with workers wearing normal gloves. Other results to emerge from this study were that a majority of allergic individuals showed a drop in their latex specific IgE antibodies; two workers were able to return to work. A saving of

$200,000 was reported by one hospital because the number of allergy cases was reduced and allergic individuals could continue working. This demonstrates that simply switching gloves may present a solution to alleviating occupational latex allergy in the work place (Yip, 2003).

Management of Latex Allergy

With proper management, latex allergy can be controlled and prevented from causing health problems n the future. The first step in managing latex allergy is to identify what type of immunological reaction is taking place. Patients should then be assessed to see how severe the reaction is to determine if the patient is high risk of low risk. If the patient is determined to be a high risk patient then next step is to educate the patient on latex avoidance and the use of alternative non-latex products in the work and home environment (Muller, 2003). It must be noted though that it may be unrealistic to expect someone to avoid latex altogether because latex is such a widely used product (Muller, 2003).

Some patients receive pharmaceutical relief for symptoms suffered. Typically people with latex allergy are treated with corticosteroids and anti-histamines in order to control nasal, eye, skin and respiratory problems. For severe patients who are at risk of anaphylaxis they may carry an injectable form of epinephrine or adrenalin and should wear a medical alert bracelet to inform emergency medical teams of their condition. Also prior to surgical or dental procedures a patient can be treated with prophylactic medication to minimize the occurrence of a reaction to latex (Muller, 2003).

When at work, employees should be encouraged to wash their hands after use of any sort of gloves, latex or not for reasons other than latex allergy. But this procedure is also helpful in managing the condition. For workers who have irritant contact dermatitis the use of a topical barrier cream or cotton glove liners can prevent direct contact of latex with the skin. Also the use of a non-petroleum based moisturizing cream or lotion to the hand before and after glove use helps to prevent particles from entering the skin (Muller, 2003).

Conclusion

Latex allergy has been a growing concern for many health care workers for sometime. Not until recently were relevant and useful studies being carried out to identify the prevalence of latex allergy and the high cost of latex allergy to the community. It wasn't until these factors were identified that the loss incurred by latex allergy was understood and the rate at which the prevalence was increasing was recognized. Since this has happened some measures of control have been recommended and implemented. The effectiveness of the hazard control measures (such as substitution of latex with another product) has been good in some instances but in other cases data is still being collected to evaluate the effectiveness of the hazard control measures used. What is clear is that even though the diagnostic tools available are quite good, there is still room for improvement, especially with the skin prick test.

Latex allergy can be effectively managed in the work place and at home with some simple and inexpensive changes, such as providing latex free and powder free gloves as an alternative. As research continues awareness will build further and the incidence of latex allergy and loss caused by it will continue to decline.

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