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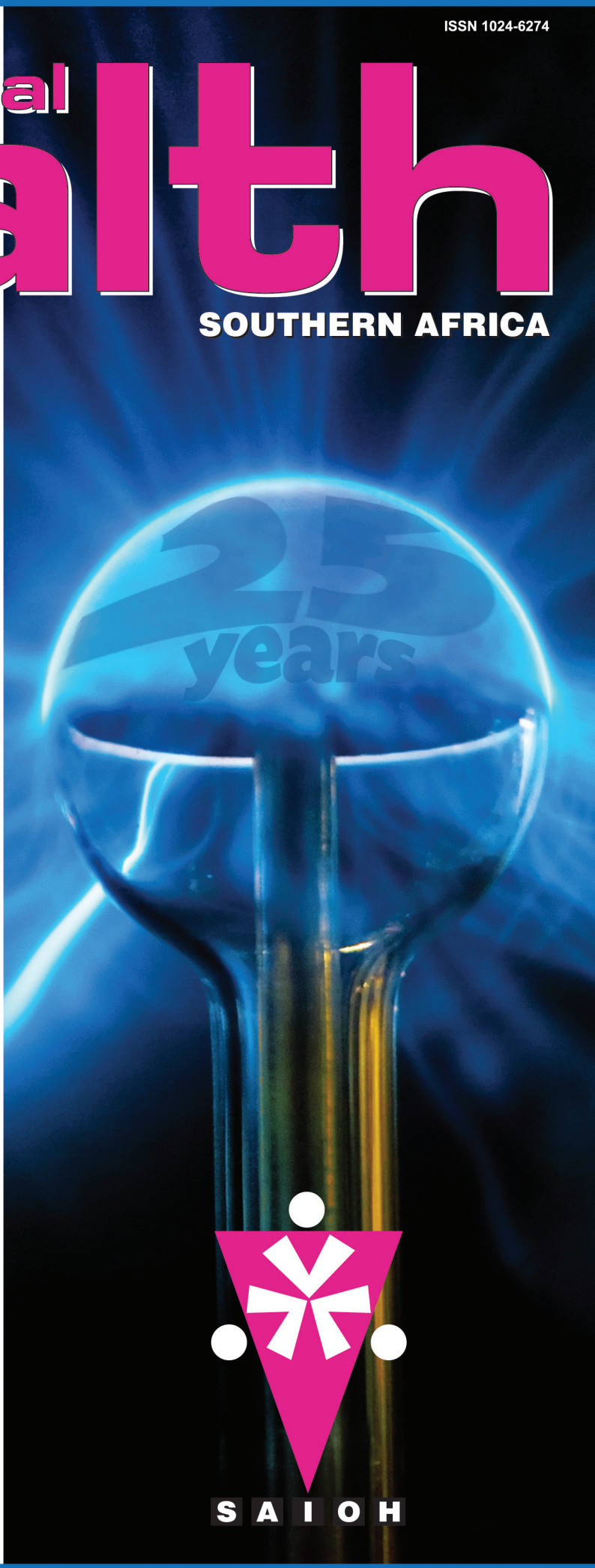
SAIOH – 25-year history

Radiation: Friend and foe

Occupational heat exposure



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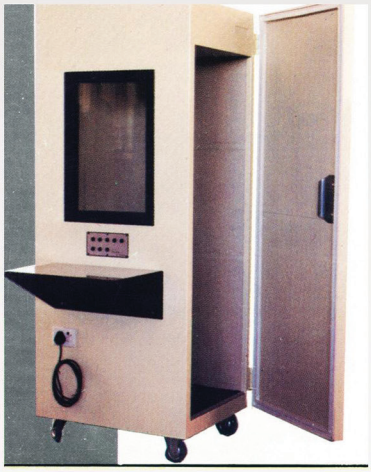

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Regulars

Congratulations!

The Presidents of the MMOA (DB De Villiers), SASOHN (Sonja Kruger) and SASOM (Daan Kocks) congratulate the SAIOH President and members on the 25th anniversary of their profession's organisation in South Africa.

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This journal is on the list of Approved South African Journals, and authors qualify for a subsidy for their affiliated tertiary institutions.

Guest editor's column...

Sibongiseni Myeni,
Guest Editor

Occupational hygiene in southern Africa has come of age! In 'The 21 Irrefutable Laws of Leadership', John Maxwell states that a leader's lasting value is measured by succession. It is clear to me that the occupational hygiene profession in southern Africa would not be celebrating 25 years of existence if we did not have leaders who believed in the law of legacy. As we celebrate our past achievements we look back and realize that the development, growth and strength of occupational hygiene in southern Africa would not have been sustainable without the support from highly committed and dedicated occupational health colleagues like occupational health doctors, occupational health nurses, as well as occupational safety practitioners to mention a few. The great appreciation of SAIOH goes to individual societies that continue to politically and academically advance the agenda of occupational health in southern Africa: SASOM, MMOA, SASOHN, IOSM, MVSSA and SAPEMA as well as other societies, we salute you all.

In his article on the history of occupational hygiene in southern Africa, the immediate Past President of the Southern African Institute for Occupational Hygiene (SAIOH), Deon Jansen van Vuuren gives us a clear perspective of the rich history of occupational hygiene as a profession in southern Africa. It is quite enriching to understand where the profession comes from and the dedication and commitment of individuals that went into it.

Talk about ionizing radiation and you initiate an ongoing debate about the good and bad of it. You raise emotions about the possibility of cancer and you instantly initiate a vibrant debate on how important ionizing radiation is in technological advancement and development. This topic becomes even more important in medical settings where X-rays are utilized as diagnostic tools with the aim of saving lives through early detection of medical conditions. In his article, Don Emby urges medical professionals to exercise caution and always be alert regarding the use of ionizing radiation. He warns of the potential of ionizing radiation to cause cancer. Furthermore, he discusses the consequences of inappropriate use of radiation as well as the new developments in the field of radiology. This is an important aspect for occupational hygiene professionals, which should not be overlooked, especially when it comes to risk identification, assessments and recommendations on risk management.

One of the most important occupational hygiene physical stressors in many work environments is heat. In this issue, Darren Joubert and Graham Bates present some recent developments in the area of occupational heat stress, heat illness and the human physiological response. They take us through physiological responses to heat exposure, such as sweat rates, electrolyte loss and the effects of dehydration. In the second part, they discuss the measurement of heat stress and describe a new heat stress index that has been developed in Australia.

In his letter to the Editor, Leslie London highlights the importance of fluorescent tracers as a tool for research, exposure control and training. He emphasises that here we have methods that have considerable potential to contribute to the control of pesticides hazards in agriculture in developing countries, like South Africa in particular and Africa as a whole. As occupational hygiene professionals may well be aware, this is of significant importance when it comes to occupational hygiene practice.

As we enter into the next 25 years of occupational hygiene practice in southern Africa, the profession is faced with new challenges that need new approaches. Despite our past and current good contribution to the wellbeing of employees, we need to ask ourselves some hard questions which may give us some painful answers. We need to have the discipline to confront the brutal facts about our current reality concerning our contribution towards occupational health programmes as well as a healthy workforce and society. To what extent do we add value to business? To what extent do we influence occupational health/hygiene legislation? To what extent do we influence occupational hygiene / health policies at our work environments? John Maxwell says that the true measure of leadership is influence – nothing more, nothing less. What is the measure of our occupational hygiene leadership as professionals? To what extent do we contribute to prevention of illness by offering sound occupational hygiene recommendations? How and to what extent do we follow up on the recommendations that we offer? In his book, 'Good To Great', Jim Collins says good is the enemy of great. We can no longer settle for a good in the field of occupational hygiene. This calls for occupational hygiene professionals to continuously develop their skills and keep current with trends in the field. If we understand that today matters and that yesterday ended last night, we cannot stand still and forever celebrate our past achievements at the expense of continuous growth.

Occupational hygiene professionals are increasingly expected and required to play prominent and meaningful roles in project design studies and project risk management. Occupational hygiene professionals are expected and required to anticipate occupational health issues before the handover and commissioning of projects. This will go a long way insofar as business cost saving is concerned. It is easy and cheaper to handle and deal with occupational hygiene hazards at the design stage of a project than after commissioning. After all, the aim of occupational hygiene is control of employee exposure to health hazards. This is where occupational hygiene will add value to businesses and employee wellness. As occupational hygiene is not just about identifying problems but also providing solutions, the interface between occupational hygiene professionals and engineering professionals cannot be overemphasised.

I wish SAIOH many more successful years of occupational hygiene service and may the co-operation amongst OH & S societies continue.

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From the Editor...

Linda Grainger, Editor

I have three pieces of news to report to you, our readers.

Firstly, I am pleased to inform you that the occupational exposure control limit for silica in Table 1 of the Hazardous Chemical Substances Regulations has been reduced from 0,4 mg/m^3 to 0,1 mg/m^3 (Gazette No. 31172, No. R. 683, 27 June 2008). From 1 January 2009, all industries involving silica exposure must indicate the number of samples taken and analysed, the composition of dust, the concentration of the constituents and what steps they are taking to comply with the new OEL. Given the prevalence of silicosis and that the avoidance of silica inhalation is the only effective prevention measure this is a most welcome development.

Secondly, Danie Ungerer has asked us to notify SASOM members that in addition to posting their CEU questionnaires in the usual manner, they can now also forward them electronically to the SASOM office.

Lastly, one of our regular advertisers – Adri Stockton of On-Site Occupational Health X-rays, has won the Small Business Category (2008-2009) of Woman of the Year, awarded by the SA Council for Business Women. Congratulations Adri!

Linda Grainger

Upcoming events

INTERNATIONAL CONFERENCES

Date	Place	Topic	More information
18–21 March 2009	Spier Estate, Cape Town	The 8th Global Meeting of WHO Collaborating Centres in Occupational Health	No details available.
22–27 March 2009	Cape Town	ICOH2009 Occupational Health: A Basic Right at Work, An Asset to Society	Website: www.icoh2009.co.za Jenny Acutt' Tel.: 086 111 4417
2–6 August 2009	Venice, Italy	19th Intl. Symposium on Shiftwork and Working Time	http://www.shiftwork2009.it
26–29 August 2009	Helsinki, Finland	4th International Conference on Nanotechnology – Occupational and Environmental Health	http://www.tsr.fi

LOCAL CONFERENCES

Date	Topic	Region	Target	Cost	ContactName
5–7 Nov 2008	The Reasonably Practicable Approach to OH. SASOHN Annual Conference	Sibaya Hotel and Conference Centre, Durban	OH nursing practitioners	R1750 (Conference only)	Linda Stokes SASOHN National office Tel: +27 (0)11 892 3174 E-mail: sasohnoffice@mweb.co.za Daily from 08h00–14h00 www.sasohn.org.za
21 Nov 2008	Occupational Medicine Diamonds – a clinical programme	Bains Game Lodge, Bloemfontein	OH practitioners	SASOM/SASOHN members R1000.00 includes Celebratory Dinner. Bus available from Gauteng to Conference.	Jenny Acutt Tel: 086 111 4417 Fax: +27 (0)11 5075085 E-mail:sasomdm@iafrica.com

2008 SAIOH COUNCIL AND CERTIFICATION BOARD MEETING AND EXAMINATION DATES

7 November	07h00	Council/Written Exams

HEALTH AWARENESS DAYS, WEEKS AND MONTHS

NOVEMBER

Red Ribbon Month
Quality Month
Sun Smart Awareness Month – CANSA

Day	Topic
5	National Children's Day
3–7	SADC Malaria Week
14	SADC Malaria Day
14	World Diabetes Day
25	International Day for the Elimination of Violence Against Women
25/11 – 10/12	16 Days of Activism on No Violence Against Women

Letter to the Editor...

Use of fluorescent tracers for dermal exposure sampling in agriculture

Dear Editor

The review by du Plessis and colleagues on dermal exposure sampling methods[1] is a very valuable summary for occupational hygiene assessments. However, the review may have missed an opportunity to promote the use of fluorescent tracers in agricultural settings not only as a low-cost, rather than high-cost method, but also as a tool for worker training. Published research from Nicaragua[2,3] has demonstrated the feasibility of adapting the original methods developed by Fenske and colleagues[4,5] (cited in the review) for field use in a resource limited setting. Rather than constructing a controlled laboratory site for measuring the fluorescent tracer, Aragon and colleagues devised portable field cabinets to screen out light so that the fluorescence following field application can be measured in the field setting to generate both qualitative and semi-quantitative estimates of exposure. These methods are not resource intensive and can be used in field settings to derive robust estimates of exposure for research or exposure control purposes. Further, the video material was found to be useful to educate farmers as to the presence of skin contamination and about the hazards of poor hygiene in pesticide application, offering very powerful visual evidence to promote behaviour change.

The Work and Health in Southern Africa (WAHSA) Action on Pesticides project has focused on this technology as an important opportunity for promoting health and safety in relation to pesticides in the region.[6] In October 2006, WAHSA ran a training workshop at the ANCAP-SETAC Conference on Pesticide Use in Developing Countries on the use of fluorescent tracer methods for estimating pesticide exposure in agriculture[7] and in the next period will be supporting various projects making use of this methodology in the region. As a tool for research, exposure control and training, readers should be made aware that fluorescent tracer methods have considerable potential to contribute to the control of hazards from pesticides in agriculture in developing countries.

Leslie London

Occupational and Environmental Health Research Unit, School of Public Health and Family Medicine, University of Cape Town

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SA Institute for Occupational Hygiene

OHASA + IOHSA = SAIOH: 1983 – 2008 = 25 YEARS

I think the heading says it all. "We", SAIOH, are 25 years old this year. As is common in old age, we have not only forgotten details, but also our record keeping has been somewhat erratic… read: "no records found". This account of the history of SAIOH is mainly based on what I could salvage in the archives at Ray's Kaya.

OHASA or the Occupational Hygiene Association of South Africa was founded on 28 March 1983, whilst IOHSA or the Institute of Occupational Hygienists of Southern Africa was officially launched on 19 February 1993.

Dr David Stanton aptly put it in an editorial of the African Newsletter on OH&S: "After some years of often heated discussion, amalgamation of OHASA and IOHSA was finally completed when first a joint OHASA (incorporating IOHSA) Council was formed on 6 October 1999. Then the Southern African Institute for Occupational Hygiene (SAIOH) with an independent Certification Board (SAIOH – CB) was finally formed in 2000. The exact date when the new-look SAIOH was "launched" was 4 March 2000.

This reminded me of the seven years of good luck, followed by seven years of bad luck of Joseph in Biblical times. In 1983 OHASA was officially launched, then after seven years the talks/meetings/workshops began in 1990 to set up an independent, professional body for occupational hygiene, finally leading to the official launch of IOHSA in 1993. Then after some rough years and not only "often heated discussion" (Dr D. Stanton) but often 'over-heated' discussion (believe me – I was there) did SAIOH become the one and only occupational hygiene institute in Southern Africa in 2000.

EVENT/DATES	COMMENTS (REASONS, NEWS, ETC.)
Commission of Inquiry on Occupational Health in SA (Judge Erasmus). 1974 – report published in 1976.	Widely known as the Erasmus Report. It stated that: • the situation with regard to industrial hygiene is acute; and • the training of industrial hygienists has been seriously neglected.
Formation of the Occupational Hygiene Association of South Africa (OHASA). 28 March 1983 (official launch).	After the Erasmus Report, several discussions and meetings followed with the aim of forming an occupational hygiene society. This led to the establishment of OHASA in 1983, to create awareness and enhance occupational hygiene as a discipline. I believe the final chapter took place in the Eskom Megawatt Park Club with about 15 persons present, including Messrs. Willem Barwise, Dr John Johnston, Piet Marais, Alex Holmes (official launch) and Frikkie Sauer, etc. Willem Barwise was the first President of OHASA and Dr Johan Schoeman was elected as the first Secretary.
Formation of the Institute of Occupational Hygienists of Southern Africa (IOHSA) 19 February 1993 (official launch).	After several informal/impromptu discussions and a request from the Department of Labour (then the Department of Manpower) a meeting was organised to discuss the possibility of establishing an organisation for the occupational hygiene professional. Mr Roelie Cronje and Ms Susan Burke initiated the process and the meeting took place at Witwatersrand Technikon on 5 October 1990. Mr Johan Schoeman (now Dr J Schoeman) chaired the meeting with Ms Susan Burke (later Mrs S. Cronje) recording the minutes. The prime objective was to: determine the need for an organisation to promote and protect the professional status of occupational hygienists. A sub-committee was formed to: • investigate and define what an occupational hygienist is; • define the responsibilities of OHASA and the to be formed new organisation; • aim for the establishment and maintenance of international recognition; • register occupational hygienists according to set criteria; and • ensure a good working relationship between the above-mentioned new organisation and OHASA. Approximately 14 persons were present including Messrs. Richard Truter, Rob Ferrie, Roelie Cronje, Piet Marais, E. Ellis, Edgar Waller, S.N. Middel, Dr Johan Schoeman, Hein Hughes-Treherne, Sandy Nicoll, Willem Lombaard, Deon J. van Vuuren, Dr John Johnston and Ms Susan Burke. Some interesting times followed until in February 1992, when nominations for the transitional Committee of IOHSA were called for. The council thus consisted of elected representatives from the following sectors (elected and co-opted persons in brackets): • Education (Dr Johan Schoeman, Pierre Wepener and Leon Harmse); • Practicing Consultants (H. Gaze, Julie Brailsford, Piet Marais, Roelie Cronje and Willem Lombaard); • General Industry (S.N Middel, Jo-Anne Bradley, Dave McDowell, Rob Ferrie); • Trade Unions (Jace Naidoo); • Mining Industry (Sandy Nicoll, Dr Johan Kielblock); • Government Agencies (Dr R. Kok, Deon Joubert – Manpower and J.M.O. van Sittert, Trevor Muntingh – GME); • Local Government (Richard Truter); and • other members (Faizel Salie, H. Gordham). This transitional committee worked tirelessly for several years, establishing an Examination Committee, professional categories, evaluation standards, a constitution, etc. On 10 February 1993 the first IOHSA council meeting was held with the following people in attendance:

EVENT/DATES	COMMENTS (REASONS, NEWS, ETC.)
	President, Richard Truter, Vice President: S.N Middel and Hon. Secretary and Treasurer: Dr Retief Kok. Other Council members were Dr Johan Kielblock, Dave McDowell, Dr Johan Schoeman, Sandy Nicoll, Jace Naidoo and Deon Joubert. IOHSA was then officially launched during an inaugural dinner at Eskom Megawatt Park Club, on 19 February 1993.
Interim years OHASA 1983 – 2000	Some high points and low points: • The first OHASA Presidents (in no specific order, and I know I have not "captured" all) were: Willem Barwise (1st), Dr Harold Schröder (2nd), Alex Holmes, Dr Phil Piek, Niek Genis, Piet Marais, Hein Hughes – Treherne, Roelie Cronje, Jo-Anne Bradley, Willem Lombaard, Dr David Stanton and Johan Jacobs. • The Secretaries for most of these years were Deon J. van Vuuren and Cathy van der Fyver with OHASA going slightly more "professional" in 1993 by appointing Brenda Webster as its part-time/paid Secretary. • Several national conferences were held, usually with the social events ensuring their success. The majority took place in Gauteng, at the Indaba Hotel, CSIR Conference Centre, Eskom Training College, etc., but we also had several in KZN (Karridene Hotel, Elangeni Hotel, Itala Game Reserve), in the Eastern Cape (PE Technikon) and the Western Cape (Cape Technikon). We even had our own Conference logo once: an elephant called Ockie OHliphant. The very first conference was held at Technikon Witwatersrand (towards the end of 1983 if not mistaken), organised by Johan Schoeman. • The following international conferences were held: Joint International Conference: Health and Safety in Welding and Related Processes, 23, 24 March 1993; Occupational Hygiene towards 2000 on the 25th March 1993; IOHA 6th International Scientific Conference 19–23 September 2005, the first meeting of which was held on the 12 September 2002 at the Chamber of Mines. • OHASA had its own tie and an Occupational Hygiene Handbook at one stage and Ergosaf had to buy the ties and Wits Technikon the Afrikaans version of the handbook to save OHASA from bankruptcy. Deon used to hand the ties out at the conferences and dinners "ala" Bunny Matthysen of NOSA's style. • As usual politicking played a large role from 1994 – 1998, at a time when there was a perception that more occupational hygienists belonged to OHASA than to IOHSA. But thankfully this changed, leading to the amalgamation of OHASA and IOHSA in 1999, initially referred to as OHASA (incorporating IOHSA).
Interim years IOHSA 1992 – 2000	Some of the many highlights were: • Setting up the Examinations Board with Dr John Johnston, the first Chairman. This included the application procedures, the evaluation criteria and competency requirements, the written and oral examinations and the first Certification Examinations that were held in 1995. • Getting BIOH examiners out to SA to certify/test a core of IOHSA Examiners. • OHASA and IOHSA Council members sitting the exam for the BEBOH Certificate in Operational Competency in Occupational Health, courtesy of a World Health Organization grant. • Developing a Points Maintenance System in 1995, in line with the American Industrial Hygiene Association system (now referred to as CPD Points), where credits are earned for personal development in occupational hygiene as well as for involvement in IOHSA (now SAIOH) activities. • Growing the IOHSA membership from ±30 in 1993, to ±160 in 1999. • Getting the Department of Labour to put out new guidelines on its Approved Inspection Authority (AIA) requirements, i.e. where an AIA must be managed by an IOHSA certified occupational hygienist and where all operational staff members in an AIA are required to be certified by IOHSA in their respective work categories (1997). Later the Department of Minerals & Energy also included IOHSA certification in their requirements. • A challenging obstacle for OHASA was to promote the discipline through education, given the dearth of literature, specifically occupational hygiene textbooks. English textbooks were unaffordable for most students and there were no Afrikaans texts. The publication of an Afrikaans textbook was prioritised. Although three editors were appointed, two eventually produced it: Harold Schröder and Johan Schoeman. Following negotiations with numerous publishers, OHASA was informed, in a letter dated 9th April 1992, of the good news that Juta & Company Limited was prepared to take the challenge. On the 15th May 1992 the publishers were informed by the President, Willem Lombaard, that Johan Schoeman was to act on OHASA's behalf. In 1989 the book "Inleiding tot Beroepshigiëne" saw the light, at an initial price of R159,00. Subsequent to the publishing of the Afrikaans textbook it was translated into English. The value of the book was evident from the positive book reviews and radio interviews conducted with Harold Schröder and Johan Schoeman. These included Die Burger, Safety Management, Cape Times Jobfinder, Chamber Digest, Human Resource Management and the AIHA Journal. • The growth of the financial position of the Institute indicated by the 1993 bank statement showing a balance of R3667, a 1999 bank statement showing a balance of R45 365 and the budget for 2008 making provision for an income of R289 430 in addition to a similar amount in a fixed deposit. • Presidents of IOHSA (again not all, and not in specific date sequence): Richard Truter (1st) S.N. Middel (2nd), Rob Ferrie, Dr Johan Schoeman, Dr John Johnston, Jace Naidoo, etc. • The development of the IOHSA Guidelines (with permission of the HSE, UK): Occupational Health Risk Assessment (October 1997) and the Employers Guide to Monitoring strategies for HCS in workplaces (1998). • Certification examinations were held regularly, first at NIOH (then the NCOH) in Braamfontein and with Ray Strydom (Ray of Safety) taking over the secretarial duties from Brenor (wef. 1/4/1998), at the BIFSA offices in Midrand. • Following a presentation made by Dr John Johnston and Dr Johan Schoeman in Geneva, Switzerland. IOHSA was granted membership of IOHA in Stockholm in 1996.
Final chapter in the amalgamation of OHASA and IOHSA to form the Southern African Institute for Occupational Hygiene (SAIOH). 4 March 2000	• After several difficult and mostly non-progressive meetings, starting as far back as 1994, the OHASA and IOHSA Councils at long last took a much debated amalgamation issue seriously and started joint OHASA/IOHSA meetings early in 1998. At one such meeting, now called the OHASA (Incorporating IOHSA) council meeting held on 6 October 1998 at the NCOH, it was decided to set the date of amalgamation as 6 October 1998. Both institutions would remain intact until their AGMs in 1999. Both Presidents: Johan Jacobs (OHASA) and Jace Naidoo (IOHSA) made a joint statement thereon, on 12 October 1998. • A strategic/objectives setting workshop was held in Bryanston on 4 March 2000. The Southern African Institute for Occupational Hygiene (SAIOH) was now officially launched, with a new name, new logo, new council members, etc.

EVENT/DATES	COMMENTS (REASONS, NEWS, ETC.)
	• Dr David Stanton (President), Piet Marais, Rob Ferrie, Coen Buddingh, Dr John Johnston, Hennie van der Westhuizen, Schu Schutte and Deon J.van Vuuren were the first Council members. Rob Ferrie was elected as the chairman of the newly formed SAIOH Certification Board).
SAIOH up to the present time 2000–2008	• With the formation of SAIOH, a long cherished objective could now be reached: that of creating an awareness of SAIOH as a professional Institute and enhancing occupational hygiene as a discipline. • In 2002 SAIOH was successful in its bid to host IOHA's 6th International Scientific Conference and in 2005 SAIOH and the Mine Ventilation Society jointly organised IOHA 2005 at Pilanesberg Game Reserve. This was an enormous success mainly through the efforts of David Stanton, who did most of the organising and management of the conference. The conference was attended by some 350 delegates, mostly international. • At the conference, the SAIOH Certification Board submitted its application for IOHA accreditation of its professional Certification scheme. It received the accreditation in 2006, and the official certificate from IOHA was presented by the President of IOHA, Rob Ferrie to the President of SAIOH, Deon J van Vuuren at the SAIOH 2006 Conference in Cape Town. This was a golden era for SAIOH as: • Rob Ferrie (who for several years had represented SAIOH on the IOHA Council and the IOHA National Accreditation Recognition Committee (NARC), was elected President of IOHA (2006 – 2008); • Deon Jansen van Vuuren was nominated to represent SAIOH on the NAR Committee of IOHA; • the SAIOH-CB Professional Certification scheme receive recognition by IOHA; and • a hugely successful National Conference was held at the Cape University of Technology (Pentech Campus) in Bellville, Western Cape. • In 2007 SAIOH joined forces with the Institute of Safety Management, the SA Protective Equipment Marketing Association and the Safety First Association to organise a joint venture conference and exhibition – SAFECONEX Africa 2007. This was a significant success with some 160 delegates attending: a first time for occupational health and safety professional bodies presenting a National OH&S Conference of this magnitude. In June 2008 at the Indaba Hotel and Conference centre in Fourways, SAFECONEX Africa 2008 was again extremely successful with more than 250 delegates attending. • Professional registration and certification is also growing in leaps and bounds: every three months, an average of 50 candidates sit the examinations in the various exam centres in Cape Town, Durban, Port Elizabeth and Gauteng. Currently SAIOH has 463 members, and the 449 who are professionally registered consist of the following categories: • 135 Occupational Hygienists; • 84 Occ Hyg Technologists; and • 230 Occ Hyg Assistants. • Financially SAIOH is doing exceptionally well. At the end of June 2008 it had a very healthy bank balance, including a substantial amount in a 32-day investment plan. This means that we can seriously start growing our profession, by improving the industry and the public awareness and looking after our professional members … these being the main challenges for the foreseeable future. • SAIOH has an active Transformation Policy. • Some marketing aids are being developed, i.e. a digital presentation on SAIOH as well as a PowerPoint presentation. • The SAIOH Ethics Committee is set up and has already dealt with three cases. • The CPD system works well. • In August 2007 the "new look" Council took office, with Sibongiseni Myeni (the SAIOH President), Melinda Venter (Vice President), Phanuel Tau (SAIOH CB Chairman), and Ray Strydom (our Administrative Manager) as the main players. • The publishing of an Occupational Hygiene Journal, despite numerous attempts, never materialised. Occupational Hygiene was always part of another journal, such as the "National Safety" journal published by the Safety First Association and "Safety Management" published by NOSA. Newsletters were also attempted on numerous occasions and eventually Hennie van der Westhuizen published the first newsletter in February 1997. Unfortunately it died a sudden death. Finally, in 1994, SAIOH joined forces with the SA Society of Occupational Medicine (SASOM) and the SA Society of Occupational Health Nursing Practitioners (SASOHN) in publishing the "Occupational Health SA" journal, which has continued to be successful until the present day. • Although valiant attempts were made to introduce a mentorship project (and Rob Ferrie even announced the advent of a formal Mentorship project on 7 March 1996) it, as with some of its overseas counterparts, never materialised. This in spite of the fact that IOHSA has identified the development of such a programme as a priority. However, informal mentorship activities are very common.

In its 25th year, SAIOH and its members may well pause and ask Quo Vadis? It is not just a matter of "Quo Vadis?" any more … it is only: "the sky is the limit!"
All SAIOH members are invited to join in a celebratory dinner to mark this 25th anniversary. It will be held at the Indaba Hotel on the 11th March 2009 (the evening before SAFECONEX Africa 2009).

Written by Deon Jansen van Vuuren, assisted by Johan Schoeman.

Radiation: Friend and foe

Abstract

Exposure to ionizing radiation is a known risk factor for cancer. Prevention of complacency with regard to the hazards of ionizing radiation depends on maintaining a high level of awareness of radiation in the environment. A particularly important subject for medical and occupational health practitioners is the use of ionizing radiation for medical diagnostic imaging and chest X-ray screening. Natural radiation in the environment also remains a hazard under certain circumstances.

This four-part paper aims to raise awareness of the dangers of ionizing radiation by focusing on recent technological developments which have resulted in an increase in the dose of radiation used in medical imaging. At the same time technological developments which can reduce the radiation dose in chest X-ray screening are outlined. Finally, attention is drawn to two further arenas where naturally occurring radiation in the environment may play an aetiological role in the changing pattern of cancer incidence in modern society.

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Introduction

Ionizing radiation has invaluable applications in medical diagnosis and occupational health (OH) screening and surveillance programmes. The potentially damaging interaction of ionizing radiation with biological systems, including human tissues is a painless process. Therefore, severe and even lethal damage can occur before any physical awareness of the injury becomes apparent. Because of the occult nature of the injury the danger is often underestimated.

This article aims to raise awareness of the hazards of ionizing radiation from medical diagnostic radiation associated with computed tomography (CT) scanning; to inform those involved in chest X-ray screening programmes of the advantages of new digital X-ray technology; and to draw attention to two potential arenas where there is an occult potential for radioactive isotopes normally found in the environment, to play a role in the causation of cancer.

Part 1: Radiation dose from CT scanning: A widely unrecognized potential radiation hazard

Ionizing radiation, particularly related to medical diagnostic imaging, has come under renewed scrutiny. In 2005, the National Toxicology Program of the National Institutes of Health in the US categorized ionizing radiation as a known human carcinogen.[1] In the same year, the National Academy of Sciences in the US released the Biological Effects of Ionizing Radiation (BEIR VII) report. It concluded that an X-ray exposure of 10 miliSieverts (mSv) is associated with a risk for the subsequent development of cancer of 1 per 1000 patients.[2] Although criticized for possibly being over cautious in its risk estimation, it is notable that on average a chest or abdominal CT scan delivers an exposure of approximately 10 mSv[3] (equivalent to approximately 200 chest X-rays).

In the light of these reports, it is timeous that the issue of radiation should be revisited by the medical profession.

The early part of the 21st century has seen dramatic improvements in the technology of CT scanners. Single slice scanners have given way to multi slice scanners, which have enabled finer cuts and faster scan times. (With the old scanners, the finer the cuts, the slower the scan time and the greater the breath-hold limitations.) Dual channel scanners were rapidly superseded by 16-channel scanners, followed by 64-channel scanners and then 128-channel scanners. Now 256-channel 'super-scanners' are in the pipeline. With the latest machines, a last 'Holy Grail' of radiology, namely the ability to image the coronary arteries without the need for invasive arterial catheterization is within our grasp. However, this progress comes at a price – the risk of increased radiation exposure to individual patients and the population in general that could result from the relatively high exposure per examination, particularly where increased utilization occurs.

In the US there has been an explosive increase in the use of CT scanning as multi-channel CT scanners have become more widely available. This is on the back of an already steep upward trend in the use of X-ray imaging. It is estimated that the number of CT examinations increased more than twenty-fold, from 3 million in 1981 to 63 million in 2005.[4]

Along with the increased utilization of CT scanning, has come substantial benefits related to our new-found ability to non-invasively examine the internal organs. These include earlier and more accurate diagnosis, more targeted interventions and shorter hospital stay.[3] There is no doubt that the benefits of appropriately used CT scanning far outweigh any possible risk from the radiation.

Concerns however, arise in two areas:

1. the potential for unnecessary exposure to radiation from the indiscriminate use of CT scanning; and
2. exposure of children and young adults (especially young females) to ionizing radiation.

In South Africa there has been a conservative approach to the use of high-tech imaging, so that unnecessary use of CT scanning appears to be uncommon. Whereas, in the US, the approach appears to have been less circumspect and excessive use of CT scans by medical practitioners, driven by the desire for fast answers, and the fear of malpractice lawsuits, is not uncommon.

Richard Semelka, Professor and Vice Chairman, Department of Radiology, University of North Carolina at Chapel Hill, articulates a worrying US trend:

"Diagnostic imaging has become the modern physical exam. In the near future, virtually every individual suspected of having disease will undergo a cross-sectional imaging study. Unfortunately, it may be difficult to bring about a decrease in the number of excessive medical imaging studies [now being] ordered. With imaging studies having become the modern physical examination and the fact that we live in a highly litigious society, clinicians feel that they cannot afford to miss anything, no matter how unlikely".[3,5]

It is essential that we heed the current lessons from North America to ensure that we are not lured down this same road of excessive use of examinations involving ionizing radiation. Appropriate use of expensive technology such as CT scanning is also a vital element in containing medical costs.

Regarding children it is important to note their increased sensitivity to radiation as compared to adults. Their risk of induction of cancer by ionizing radiation has been estimated at 1 in 550 [6] – almost double the adult risk. Other authors have estimated that children may be up to ten times more sensitive to the effects of ionizing radiation compared with adults.[7]

A criticism of a conservative approach in the use of ionizing radiation, is that we are all daily exposed to background radiation and have evolved cellular mechanisms capable of repairing damage caused by ionizing radiation. The counter argument is: "Sola dosis facit venenum – it is only the dose which makes the poison." The average individual dose received from background radiation is approximately 3.6 mSv – delivered over the period of a year.[8] A CT scan of the abdomen and pelvis delivers 10 mSv, approximately 3 times this dose, in a few minutes. This is not what our repair mechanisms have evolved to cope with. An analogy might be the cellular mechanisms evolved to metabolize alcohol. A 750 ml bottle of brandy drunk over a period of a few minutes is likely to have a fatal outcome. The same volume of brandy, if taken over a year, equates to marginally more than 2 ml per day; an amount unlikely to impose a challenge to the cellular metabolic systems.

Many of the early pioneers of the science of radiation and radiology were exposed to high doses of radiation and succumbed to its carcinogenic effects. In addition, from the 1930s into the early 1960s, ionizing radiation was used to treat many benign conditions. These included sacro-ileitis, and post partum mastitis.[9] Numerous children received X-ray screening and radiation treatment for "enlargement" of the thymus gland and many have subsequently died from radiation-induced malignancy. These treatments were terminated when the association with the subsequent development of cancer became clear.

Further evidence for harm from injudicious medical use of ionizing radiation has come from the large radiation doses given by bi-weekly fluoroscopic (non image intensified) screenings to determine whether an iatrogenic pneumothorax, performed for the treatment of tuberculosis, was still present. Fifteen-plus years later, the incidence of breast cancer on the side subjected to fluoroscopy was doubled.[10]

Unfortunately we have short memories. To paraphrase George Santayana[11]: "Those who do not learn from the mistakes of history are destined to repeat them." Samuel Taylor Coleridge put this more philosophically[11]: "If men could learn from history, what lessons it might teach us! But passion and party blind our eyes and the light which experience gives is a lantern at the stern, which shines only on the waves behind us!"

The National Academy of Sciences highlighted the risk of inducing cancer from the use of ionizing radiation in their BEIR VII report,[2] based on information gleaned from many sources, including studies of the atomic bomb survivors from Hiroshima and Nagasaki and on a linear, no threshold model. It would be irresponsible for the medical community to ignore the findings that are contained in a report by one of the world's leading scientific authorities.

Part 2: New technology means reduced radiation risk from chest X-ray screening

Despite the increasing concern regarding the potential danger of ionizing radiation to the individual and the general

"The potentially damaging interaction of ionizing radiation is ... painless ..."

population from high-dose imaging procedures such as CT scanning, the news on the mass chest X-ray screening front is good. Direct digital radiography, now being widely introduced to replace mass miniature radiography for tuberculosis screening, brings the advantage of a significantly decreased radiation dose; which can be up to four times lower than mass miniature radiography. It is estimated that the risk of cancer induction from a direct digital chest X-ray, with a radiation dose of 0.02 mSV,[12] is of the order of 1 in a million.[13]

When using ionizing radiation, knowledge of the wide range of radiation dosage that accompanies different types of X-ray examination is essential. Within the practice of OH, the introduction of direct digital radiography as a replacement for mass miniature radiography for chest X-ray screening represents a major step forward in reducing the potential radiation exposure to the workforce; and therefore to the population in general.

Part 3: Naturally occurring radioactive radon gas can potentially become a hazard in homes

From the point of view of potential radiation danger to the general population, a further area that warrants scrutiny is the (generally low level) prevalence of radioactive isotopes in our environment.

By far the largest source of naturally occurring radio-isotopes is radon gas and its decay products, generally known as 'radon daughters' (or 'radon progeny'). A US source estimates that on average, six atoms of radon emerge from every square inch of soil every second.[14] These are rapidly dispersed into the atmosphere and do not constitute a hazard under normal circumstances. This natural emission of radon gas accounts for approximately 55% of natural background radiation.[15] Radon emissions are higher where there are outcrops of granite rock. It also accumulates by diffusion in closed spaces such as basements or mines, resulting in high levels of radiation. A well-known granite formation, which has been associated with this problem, is the Reading Prong, which extends through a wide band of Pennsylvania and New Jersey State.[16] Increased radon levels in homes are not confined to the Reading Prong and have been detected throughout the US. Nearly 1 out of every 15 homes in the US is estimated to have elevated radon levels.[17]

An increased incidence of lung cancer in uranium miners heavily exposed to radon gas, has been documented.[15,18] It has been estimated that in the US between 15 000 and 22 000 of the 125 000 annual deaths from lung cancer may be attributable to radon exposure.[16]

Accumulation of radon gas, giving rise to high radiation levels within homes (and mines), does not appear to be a problem in South Africa; but this is a subject that may not have received sufficient investigation as yet. Further research in this area would be worthwhile to make sure that we are not failing to detect homes with abnormal levels of radiation due to radon gas accumulation.

Part 4: Normally ingested environmental radio-isotopes – a possible factor in colon cancer

Every food has some small amount of radioactivity in it. The common radionuclides in food are potassium 40 (^{40}K), radium 226 (^{226}Ra) and uranium 238 (^{238}U) and the associated radon progeny. When radon gas migrates through the atmosphere, small amounts of the solid radon progeny are deposited on the soil and water below, entering the food chain and hence the bodies of birds, animals, fish and insects. Drinking water contains up to 0.17 picoCuries (pCi) per liter of radium 226. Red meat contains 0.5 pCi/kilogram (kg) of radium 226 and 3000 pCi/kg of potassium 40.[8] The

radium 226 and potassium 40 content (in pCi/kg) in some plant derived foods are as follows[8]:

• banana	1	3520;
• brazil nuts	1000–7000	5600;
• carrot	0.6–2	3400;
• lima bean raw	2-5	4640;
• white potatoes	1–2.5	3400.

An increased risk of colon cancer is associated with a low fibre diet, which in turn is associated with a slow colonic transit time. Increasing fibre in the diet provides a bulkier colonic content and, therefore, a faster transit time. This could be a factor in preventing colon cancer by speeding the transit and elimination of ingested radioactive materials.

Although the levels of ingested radiation are very low, the potential cancer-inducing quality of the radiation is very high. Radon and its short-lived progeny decay with the emission of alpha and beta particles. Alpha particles have limited ability to penetrate matter but cause approximately twenty times more cellular damage than X-rays. (In the calculation of the radiation dose equivalent, the quality factor [Q] for alpha particles is 20, versus a quality factor of 1 for X- and gamma rays.[19])

The effects of inhaled radon daughters and their potential role in the causation of bronchogenic carcinoma have been studied. Being basically solid materials (radioactive isotopes of polonium, lead and bismuth), they can stick to the mucosal lining of the bronchi, from where they release their alpha particles. Despite their poor penetrating power, the alpha particles penetrate the mucosal cells because they are emitted on the mucosal surface. Because alpha particles release all their energy into a single cell, causing approximately twenty times the damage of X-rays, they are regarded as being up to 100 times more likely to cause cancer than other types of radiation.[14]

What applies with regard to the bronchial mucosa, would also apply with regard to the colonic mucosa. Once again, this would be further supported by a slow transit time where most ingested radiation would be delivered to the area of colonic mucosa with the longest contact with the colonic content; namely the sigmoid and rectum. These regions also happen to be the commonest sites for colonic cancer.[20]

Perhaps the best-known association between exposure to a radioactive isotope and the subsequent development of cancer is the association between exposure to radioactive iodine and thyroid cancer. In the wake of the Chernobil nuclear reactor disaster in 1986, which was accompanied by a large emission of short-lived radioactive isotopes of iodine into the atmosphere, the incidence of thyroid cancer in the exposed populations in Russia, Ukraine and Belarus has increased 12- to 34-fold; particularly amongst those exposed as children.[21]

Exposure to external radiation has been shown to be associated with an increased risk of leukemia and solid cancers. [2,22,23] In lung and thyroid cancer, a causal relationship with both external radiation such as X- and gamma rays; and internal radiation (in the form of inhaled and ingested radioisotopes) has been established. A hypothesis that radiation from the environment, in the form of radioactive isotopes ingested in our diet and retained within the colonic content, may be a factor in the causation of cancer of the colon can, therefore, also be considered.

Conclusion and recommendations

It is important for the medical profession to maintain ongoing vigilance with regard to ionizing radiation because of its potential for causing cancer. Four issues of current particular importance to medical and OH practitioners have been identified.

If used inappropriately the radiation dose from medical diagnostic radiation, particularly CT scans, carries a potential danger of causing cancer in the individual and of increasing the incidence of cancer in the general population. New developments in the fields of digital X-ray imaging can result in a significant decrease in the dose of ionizing radiation involved in chest X-ray screening. The new digital chest X-ray systems deliver a significantly lower radiation dose than standard analog systems or mass miniature systems. Digital radiography is now the preferred method of screening and should be adopted as the new industry standard.

Radioactive radon gas in the environment can accumulate undetected in homes, where it may present a hazard to the occupants. Naturally-occurring isotopes in the environment might play a role in the causation of colon cancer. These last two issues require further research in order to establish the significance of their risk in South Africa.

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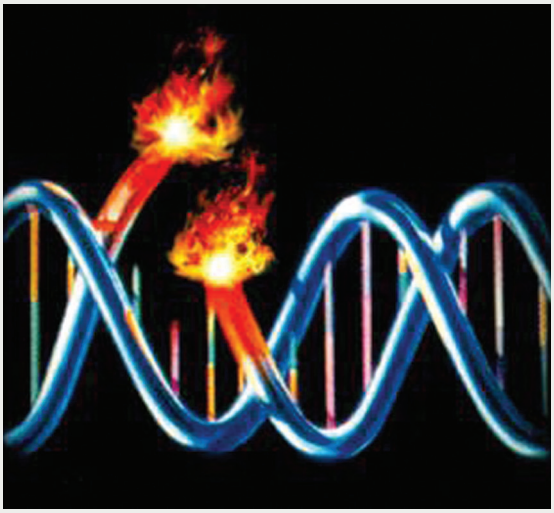
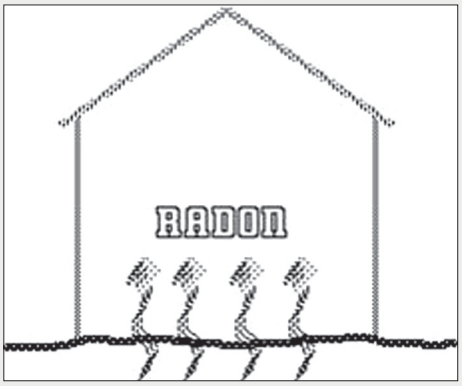
"Ionizing radiation, particularly as it relates to medical diagnostic imaging, has come under renewed scrutiny."



The DNA picture collection part 1: dark background. http://members.lycos.nl/TheDNApage/dnapixdb.html



Radiation in your own home? The radon problem[14]

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The critical evaluation of medical literature on diagnostic tests

Part 3

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The series on evaluating literature on diagnostic tests continues with this third part. The use of likelihood ratios completes the discussion on the evaluation of the accuracy of the diagnostic test. The next section considers how the test results could help us in caring for our patients.

3.2. WHAT ARE THE RESULTS OF THE STUDY? CONTINUED

H. Likelihood ratios (LR)[1,2]*:*

The use of decision limits has certain disadvantages:

- It converts numeric test results into a 'positive' or 'negative' therefore throwing away information regarding the degree of deviation of a test above or below the cutoff point.
- Decision limits do not individualize.

A likelihood ratio on the other hand is a direct determination of predictive values of observed test values.

The LR can be calculated from the sensitivity and specificity of a test.

Likelihood ratio of a positive test: $LR_{(pos)}$ = Sensitivity/(1-Specificity)

Likelihood ratio of a negative test: $LR_{(neg)}$ = (1-Sensitivity)/Specificity

Likelihood ratios can be used with a nomogram; the post-test probability of a patient having a disease or disorder is derived by joining the pre-test probability and the likelihood ratio. The pre-test probability might simply be the prevalence of a disease or disorder.

Advantages of using likelihood ratios[3]

- LRs are comprehensible and easier to handle than sensitivity and specificity.
- LRs can be used sequentially, so that the post-test probability from one diagnostic test becomes the pre-test probability for the next.
- LRs combine clinical judgment with laboratory science.
- LRs can be calculated at different levels of test results.
- LRs demonstrate unequivocally the almost impossibly high standards needed for screening tests, but suggest ways in which screening could be made more effective.
- LRs highlight the way in which a clinical audit can be used to generate local data relevant for local use.

Each calculation involves answering two questions:

i. How likely is it to get a given test result among people with the target disorder?

ii. How likely is it to get the same test result among people without the target disorder?

Example: Results are taken from the PIOPED Study,[4] in which ventilation-perfusion scan results (the diagnostic test being evaluated) were compared to the results of pulmonary angiograms (used as the gold standard for diagnosis of pulmonary embolism). (See Table 6.)

- LR=1 means that the post-test probability is exactly the same as the pretest probability i.e. the probability is unchanged.
- LR>1 increases the probability that the target disorder is present, and the higher the LR, the greater the increase in probability.
- LR<1 decreases the probability of the target disorder, and the smaller the LR, the greater the decrease in probability.
- LR>10 or LR<0.1 generate large and often conclusive changes from pretest to posttest probability.

To use the concepts of sensitivity and specificity, test results have to be divided into normal and abnormal, in other words a 2x2 table has to be created (see Table 7).

Likelihood ratio for positive test results = (TP/TP+FN)/(FP/FP+TN)

Likelihood ratio for negative test results = (FN/FN+TP)/(TN/TN+FP)

Using the previous set of data, depending on what we call normal and abnormal, we can transform this table into 3 such 2x2 tables (see Tables 8 to 10).

Sensitivity = TP/TP+FN = 102/102+149 = 41%

Specificity = TN/TN+FP = 616/616+14 = 98%

Likelihood ratio for a positive test result (high probability scan) = 18.3

Likelihood ratio for a negative test result (other results) = ratio of FN/total to TN/total = ratio of 149/251 to 616/630 = ratio of 0.59 to 0.98 = 0.61

Sensitivity = 98%

Specificity = 20%

Likelihood ratio for positive test results = 1.23

Likelihood ratio for negative test results = 0.1

Table 6. Comparison of ventilation-perfusion scan results with pulmonary angiography results[1,4]

	Pulmonary angiogram (Gold standard)				
V/Q scan results	Pulmonary embolus present		Pulmonary embolus absent		
	No.	Proportion	No.	Proportion	Likelihood ratio
High probability	102	102/251 = 0.406	14	14/630 = 0.022	0.406/0.022 = 18.3
Intermediate probability	105	105/251 = 0.418	217	217/630 = 0.344	0.418/0.344 = 1.2
Low probability	39	39/251 = 0.155	273	273/630 = 0.433	0.155/0.433 = 0.36
Normal/near normal	5	5/251 = 0.020	126	126/630 = 0.200	0.020/0.200 = 0.10
Total	251		630		

The use of different thresholds would result in:

- Increased sensitivity.
- Decreased specificity.
- Loss of diagnostic information associated with the high-probability scan result.

Sensitivity = 82%
Specificity = 63%
Likelihood ratio for positive test results = 2.25
Likelihood ratio for negative test results = 0.28

Jaeschke et al.[1] recommend the LR approach because it is simpler and more efficient than other measures.

3.3. Will the results help us in caring for our patients?

A. *Will the reproducibility of the test result and its interpretation be satisfactory in my setting?*[1]

Poor reproducibility can be the result of problems with the test itself, or usually results whenever a test requires interpretation. Ideally, an article about a diagnostic test will tell readers how reproducible the test results can be expected to be. This is of special importance when expertise is required in performing or interpreting the test.

B. *Are the results applicable to our patient population?*[1]

The question here is whether the test will have the same accuracy among our patients as was reported in the article. Test properties may change with a different mix of disease severity or a different distribution of competing conditions.

When patients with the target disorder all have severe disease, LRs will move away from a value of 1 (sensitivity increases).

If patients are all mildly affected, LRs move toward a value of 1 (sensitivity decreases).

If patients without the target disorder have competing conditions that mimic the test results seen in patients with the target disorder, the LRs will again move closer to 1 and the test appear less useful.

In a different clinical setting in which fewer of the non-diseased have these competing conditions, the LRs will move away from 1 and the test will appear more useful.

The phenomenon of differing test properties in different subpopulations has been most strikingly demonstrated for exercise electrocardiography in the diagnosis of coronary artery disease.[5]

If you practice in a setting similar to that of the investigation and your patient meets all the inclusion criteria of the study, and does not violate any of the exclusion criteria, you can be confident that the results are applicable. If not, judgment is required. You should ask whether there are compelling reasons why the results should not be applied in your patient setting, either because the severity of disease in your patients, or the mix of competing conditions, is so different that generalization is unwarranted. The issue of generalization can usually be resolved if you can find an overview that pools the results of a number of studies.

Conclusion

The value of likelihood ratios has been highlighted. The consideration of the implications of the test results for caring for our patients has been raised and will be concluded in the next issue.

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Table 7. 2x2 table showing discrimination of accuracy between two tests[1]

	Reference Standard	
Test result	Disease present	Disease absent
Disease present	True positive (TP)	False positive (FP)
Disease absent	False negative (FN)	True negative (TN)

Table 8. Only high-probability scans are abnormal (disease present)[1]

	Pulmonary angiogram (Gold standard)	
Scan category (test result)	Pulmonary embolus present	Pulmonary embolus absent
High probability (disease present)	102 (TP)	14 (FP)
Other (disease absent)	149 (FN)	616 (TN)
Total	251	630

Table 9. Different thresholds for normal versus abnormal[1]

	Pulmonary angiogram (Gold standard)	
Scan category (test result)	Pulmonary embolus present	Pulmonary embolus absent
High, intermediate and low probability (disease present)	246 (TP)	504 (FP)
Near normal/normal (disease absent)	5 (FN)	126 (TN)
Total	251	630

Table 10. Setting the cut-point in the middle: high and intermediate probability scans are abnormal (disease present); low and near normal/normal probability scans are normal (disease absent)

	Pulmonary angiogram (Gold standard)	
Scan category (test result)	Pulmonary embolus present	Pulmonary embolus absent
High and intermediate probability (disease present)	207 (TP)	231 (FP)
Low and near normal/normal (disease absent)	44 (FN)	399 (TN)
Total	251	630

Occupational heat exposure

Part 1: The physiological consequences of heat exposure in the occupational environment

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Abstract

Heat in the occupational environment is a common hazard and with increased industrialisation, deeper mines and imminent climate change due to global warming is sure to become a larger occupational health and safety risk in the future. This paper, the first in a series of two papers on heat exposure presents some recent developments in the area of occupational heat stress and heat illness and the human physiological response to heat such as, sweat rates, electrolyte loss and the effects of dehydration.

Introduction

In any work environment where industrial processes create heat the risk of heat-related illness with increased environmental heat loads on workers is increased, especially in deep underground mines or where naturally occurring ambient climatic conditions are prone to extreme heat episodes and high humidity levels. In these environments workers have to maintain normal body temperatures (within 1 or 2°C) in order to work without developing heat illnesses for shifts of up to 12 h. The purpose of this paper is to present some recent developments in the current knowledge of occupational heat stress and heat illness and the human physiological response to heat. References from recent peer reviewed research sources have been used to support the presentation and discussion of heat stress research that would be of practical use to OHS practitioners.

Thermoregulation and the heat balance equation

Body core temperature is the result of the balance between those processes that create body heat and those that dissipate heat. The formula below has been shown to approximate how the body's thermoregulatory system works:

$$S = M + R + Cd + Cv - E$$

S = stored heat
M = metabolic heat production
R = amount heat gained or lost by radiation
Cd = conductive heat lost or gained
Cv = convective heat lost or gained
E = evaporative heat loss

From this formula[1] it is evident that heat balance in the body depends upon the amount of heat produced by muscle activity and metabolism and the amount of heat that is gained or lost either by the effect of the environment and evaporation of perspiration. Dripping sweat that does not evaporate does not significantly contribute to heat loss. Air movement and velocity aid the cooling of the body and

are thus important parameters for control of heat build-up in the body and effective cooling.

Risk factors for heat illness can be classed into two categories: heat stress is the environmental parameters that impose a heat load on the human body and heat strain is the response of the body to the heat load derived from the environment.[1] Personal factors are classified as those factors which can impact on the ability to maintain thermal stability and influence strain outcomes. These are the individual factors of a worker such as, age, fitness levels, body composition, degree of acclimatisation, health status, fluid consumption, alcohol and caffeine consumption, which can affect hydration status, and the use of some medications.

Physiological response to heat stress

When a worker is exposed to high levels of heat and humidity the body reacts by increasing the heart rate, stroke volume and therefore cardiac output.[2] However, a significant amount of this blood flow will be diverted to the peripheral circulation to dissipate heat to the surrounding environment. The circulating blood diverted to the periphery reduces the amount of oxygenated blood going to the metabolically active muscles thus decreasing the work capacity of the worker. Internal heat in the peripheral circulation is lost to the environment by way of active sweating in an attempt to maintain thermal homeostasis, which leads to progressive water and electrolyte loss over time.[3]

Acclimatisation

Acclimatisation is the process where the body adapts to or becomes accustomed to increased heat exposure. It depends upon the activity level of the person in the heat as well as the duration of heat exposure. Generally 14 days is adequate to provide a significant level of acclimatisation but within 4–5 days the acclimatisation process has been initiated and progressed to a reasonable level. Some benefits of acclimatisation include:

• reduction in sodium loss in sweat by up to 50%[4];

"Dripping sweat that does not evaporate does not signifiantly contribute to heat loss."

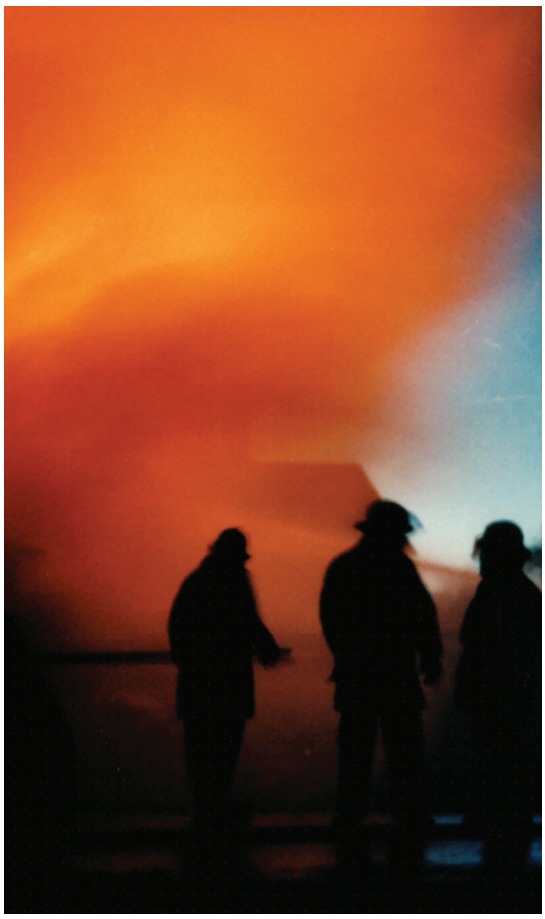
• a quicker initiation of sweating on exposure to heat[5];
• increased sweat rate[6] and more efficient body cooling;
• reduction in lactate accumulation in blood and muscles[7];
• reduction in heart rate and stroke volume[6,7];
• decreased skin and core (rectal) temperatures[6,8]; and
• hypertrophy of sweat glands (increase in size).[9]

Types of heat illness

When the environmental and metabolic heat loads exceed the ability of the body to dissipate the heat, various types of heat illness may develop with varying degrees of severity.

Prickly heat is a term used to describe skin inflammation, especially following profuse sweating. The sweat gland ducts become blocked and the sweat is forced out across the wall of the sweat duct into the subcutaneous tissue resulting in a red rash with small thin walled blisters containing a clear fluid (sweat) which can lead to infection. Thermoregulation is compromised in this state, and removal from the hot environment and good hygiene is often sufficient to eliminate or prevent the condition.[7]

Heat cramps are painful uncontrolled muscle contractions usually occurring in the gastrocnemius (calf muscle) or the biceps femoris (in the thigh area) and associated with working in the heat.[10] Exercise induced cramps may occur in susceptible individuals. Donoghue et al.[10] found that heat cramps are associated with dehydration in underground miners (though not hyponatraemia), and when observing football players prone to cramping, other authors indicate that sweat sodium losses and fluid deficits are more often found in players experiencing cramping.[11] These observations support a conclusion that fluid/electrolyte loss/imbalance is involved. Anecdotal evidence strongly suggests that optimal hydration levels significantly reduce the prevalence of muscle cramps.



Heat exhaustion is the inability of the blood circulation to meet metabolic and thermoregulatory demands. Generally speaking, persons who are unacclimatised, unfit, obese or dehydrated are more prone to this condition. Weakness, inability to continue working, frontal headache, anorexia, nausea, dizziness, and in some cases fainting are the usual symptoms. Often fluid intake and rest in a cool place will be sufficient to revive the individual, or intravenous infusion of fluid (normal saline/glucose) may be needed.[10]

Heat stroke is a life-threatening condition where the body's cooling ability fails and the temperature increases to dangerous levels. The development of this condition is a possibility in persons who are highly motivated to complete physical tasks or for those in paced labour in the heat, or highly competitive sports-persons. The mortality rate is approximately 80%, as the body attains a temperature that causes tissue damage and the brain, liver and kidneys are the principal organs affected. Heart rate and core temperature elevation, and the cessation of sweating are the usual physiological signals. Clinically heat stroke can be distinguished from heat exhaustion by unconsciousness often preceded by confusion or convulsions.[10]

The development of heat illness is related to increased environmental heat loads. However, other emerging issues in the modern workplace and personal factors also may affect thermal regulation which are becoming more prominent including: 1. increased levels of fatigue (with increasing workloads and stress levels as shift work and fly-in fly-out schedules become more common); and 2. increasing obesity levels through decreasing levels of recreational physical activity. At present over half the Australian and South African populations are considered to be overweight or obese.[12,13] These factors will start to play a larger role in the development of heat illnesses and in the future will certainly increase the risks in workers.

Biochemistry of heat illness

Heat illness has many specific physiological effects that manifest themselves in various ways and are often related to the reduction in body fluids due to continual sweating. When blood samples of workers suffering from heat illness are taken, there is an increase in red and white blood cell and platelet concentrations due to lower plasma volumes associated with dehydration. Fluid

"Generally 14 days is adequate to provide a significant level of acclimatisation ..."

volume depletion initiates sodium retention in the kidneys[10] and sweat glands. Sweat is hypotonic to plasma. Therefore, prolonged sweating concentrates the blood and water is lost out of proportion to sodium, which the body attempts to conserve, this being a vital electrolyte in many biochemical and physiological functions. Fluid and sodium loss result in hypovolemia, which reduces the body's ability to dissipate heat which causes an increase in temperature.

Hypohydration and dehydration

Prolonged sweating will lead eventually to hypohydration or the more serious condition of dehydration, which is the excessive loss of body water. Signs and symptoms of dehydration include increasing thirst, dry mouth, weakness or light-headedness (worse on standing), and a darkening of the urine or decrease in urination. Severe dehydration can lead to changes in the body's biochemistry, kidney failure, and may become life-threatening.[10]

A worker exercising in heat can sweat in excess of 1.5 L/hr[14] and over a 12 hour shift may lose over 10 L of fluid. Studies have shown a fluid deficit of up to 3.5 L[2] after a work shift. Both cognitive[15] and physical function have been shown to diminish with hypohydration and dehydration[6,16,17] and this in turn can influence productivity, work output[18] and safety at work.

Electrolyte loss

Substantial loss of sodium (Na^+) via sweat can lead to body electrolyte reduction and disturbance, which in turn can impair muscle and neural functioning.[19] An unacclimatised person may secrete sweat with a Na^+ concentration of 64 mmol/L (CI 95%; 36-54) or 1.5 g/L[20] or higher and can lose large amounts of Na^+ if sweating profusely for a prolonged period, such as occurs in shift work conditions. An acclimatised person on the other hand may secrete sweat with a Na^+ concentration of 45 mmol/L (CI 95%; 55-72) or 1 g/L,[20] which is 50% less

than an unacclimatised person. The 24-hour adequate intake (AI) level of Na^+ for a normal young adult in the US is set at 1.5 g (65 mmol),[21] in Australia at 490–920 mg (20–40 mmol)[22] and South Africa at <2 g (87 mmol).[23] These values are for individuals not exposed to high temperatures and who lose large volumes of sweat and sodium.

Fluid and electrolyte replacement

There is a maximum rate at which fluid can be absorbed into the body, approximately 1.5 L/hr limited by absorption rates and gastric emptying.[24] Drinks with high concentrations of carbohydrate (sugar) and electrolytes (salts) are absorbed relatively slowly, and are thought to impede fluid replenishment.[25] Normal sodium loss from day to day does not require additional electrolyte supplementation, as a normal diet provides enough replacement sodium chloride.[17] However, where sweat rates are high, and especially in unacclimatised individuals, the need to replace daily electrolyte loss at regular intervals is essential to avoid electrolyte disturbance and impaired performance.

Some commercially or self prepared drinks such as cordials have varying concentrations of glucose and sodium which is added to the drinks for the purpose of replacing sweat salt losses, and to maintain blood glucose levels (energy). Consequently, the consumption of these drinks, if consumed as a sole replacement beverage results in excess sodium and glucose intake when quantities of up to 8–10 L/day are required in extreme heat stress conditions, i.e. a 12 h shift underground. On the other hand, if high sweat losses are replaced with plain water, dilution of the plasma may occur and inadequate plasma sodium concentrations could result in hyponatraemia.[25]

A fluid replacement beverage must therefore promote water absorption at the maximum rate in order to counteract fluid loss associated with heavy sweating and it should be hypotonic (<300 milliosmolar), containing sodium (>12 mmol/L), potassium (~5 mmol/L) and glucose (>5 mmol/L). The correct ratios will promote maximal fluid uptake and absorption, replace electrolyte losses, and reduce fatigue by providing a ready source of energy for muscular work.[20]

Conclusion

Heat stress is an important occupational hazard in industry. Along with environmental monitoring and exposure control measures, the combination of adequate hydration, electrolyte replacement, acclimatisation and the promotion of healthy lifestyles through education are all vital components in enhancing the health of workers in heat.

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Occupational heat exposure

Part 2: The measurement of heat exposure (stress and strain) in the occupational environment

Abstract

This paper is the second in a series of two papers and presents some of the current knowledge and developments in the area of heat stress and measurement of heat exposure in the occupational environment. Its emphasis is on the most commonly used heat stress index in South Africa and recent development in Australia of a new heat stress index. In addition, some principal physiological measurements of heat strain are presented.

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Introduction

Over the years many attempts have been made to equate the level of heat stress with a measurable level of physiological heat strain (consequences) with over 90 different heat stress indices being developed up to the early 1980s.[1] This has led to some confusion as to what may be the best way to assess heat stress and strain and made collection, analysis and comparison of environmental and physiological heat stress data, difficult to interpret. A robust easy to use heat stress index that can be standardised across industries is thus vital in progressing research in this area, and should help ensure protection of workers' health by assessing all required environmental variables.

Heat stress indices can be classified as either empirical or analytical. An empirical index is based upon the assessment of two or more environmental heat parameters and the associated expected response in humans. An analytical index is based on the heat balance equation, clothing and physiological response of the body and either predicts thermal strain based on environmental conditions or monitors physiological indicators of heat strain.

Environmental parameters incorporated in many of the heat stress indices have included various combinations of ambient air temperature, relative humidity, evaporative cooling, radiant heat, conductive heat (from sources such as the rock face), and air movement (direction and velocity). Due to the many variables in calculations and different environmental parameters used, the different indices generally do not agree and have widely divergent results when compared in the same environment.[1,2]

This paper will present the most commonly used heat stress index, the Wet Bulb Globe Temperature index (WBGT) and then present a recently developed index from Australia the Thermal Work Limit (TWL) which is presently used in the mining industry. A short discussion will follow on some practical physiological measurements of heat strain and hydration levels that can be used in the field.

Wet Bulb Temperature index (WBGT)

The WBGT index is one of the most commonly used heat stress indices, and the standard in South Africa in industrial settings and is mentioned in Occupational Health and Safety legislation.[3] Interestingly, the use of the WBGT index is not mandatory in the mining environment where a mix of individual environmental parameters are used in the proposed occupational hygiene regulations of >25°C wet bulb and/or >32°C dry bulb and/or >32°C mean radiant temperature.[4] The index was developed in the 1950s for the protection of military personnel, and it combines the dry bulb, wet bulb and globe temperatures into a single figure based upon the formula:

Indoor WBGT = 0.7 NWB + 0.3 GT and the modification for Outdoor WBGT (with solar load) represented as Outdoor WBGT = 0.7 NWB + 0.2 GT + 0.1 DB.

Where:
NWB = Naturally ventilated wet bulb temperature
GT = Globe temperature inside a "Vernon (6″ black) Globe"
DB = Dry bulb temperature (air temperature)

Screening criteria for heat stress exposure and recommended work-rest regimes have been developed[5] and set by the American Conference of Governmental Industrial Hygienists (ACGIH)[6] for varying WBGT indices where work demands at different metabolic rates are considered against varying WBGT indices and acclimatisation levels

and the recommended work-rest cycle is then given. The objective of the work-rest regimen is to maintain a balance between work rate (metabolic heat production) and rest rate in accordance with the environmental thermal conditions so as to ensure the core temperature of a worker does not exceed 38°C[6] (see Table 1).

Values are given as WBGT °C.

Some of the shortcomings of this method are the observer variability that can be introduced in estimation of the workload into categories set by the ACGIH of light, moderate, heavy or very heavy. If varying work loads and rest periods in different environments are taken during the work shifts then an estimated hourly time-weighted average (TWA) calculation must be used. The screening criteria also apply to the normal five-day work week and eight-hour day with conventional breaks, so if extended shifts are undertaken the criteria require recalculation. In situations where the workload is very heavy with unfit workers the ACGIH recommend detailed analysis and or physiological monitoring as an added measure. Other shortcomings that have been highlighted by various authors are the over-emphasis of the DB reading in the WBGT calculation towards the top end of the scale, an insensitivity to the cooling effects of air movement above 1.5 m/s [7,8] and high levels of humidity.[9]

Thermal Work Limit (TWL)

A more recent development in Australia of the TWL index has seen its introduction into a variety of industries with an associated reduction in heat illness.[10,11]

The TWL is defined as the maximum sustainable metabolic rate that euhydrated (adequately hydrated), clothed, acclimatised individuals can maintain in a specific thermal environment, whilst maintaining a safe deep body core temperature (<38.2°C) and sweat rate (<1.2 kg/hr).[8] The index is designed specifically for self-paced workers defined as those who can and do regulate their own workload and are not subject to excessive peer, managerial pressure or financial incentives. The index has the advantage that it does not rely on subjective estimation of work rates[8] but does still rely on measurement of specific environmental parameters.

The TWL uses five environmental parameters (dry bulb, wet bulb and globe temperatures, wind speed and atmospheric pressure) and accommodates for clothing factors and acclimatisation status to arrive at a prediction of a safe maximum work rate for the environmental conditions, clothing worn and acclimatisation status of the worker. Information on how the TWL is derived and a simple free software package (Excel format)[12] is available online which can be used to calculate TWL, sweat rates and various other parameters by inserting specific measurement results.

The basic purpose of the TWL index is to calculate the maximum metabolic rate, in W/m^2 of body surface, that can be continually expended in a particular thermal environment within safe physiological limits[8] i.e. the thermal work limit. The higher the number the higher the sustainable work rate in terms of thermal stress (see Table 2).

At high values of TWL the thermal conditions impose no limits on work. See Table 3.

The TWL also has application to engineering sciences, as it allows productivity decrement due to heat (seen as a reduced sustainable metabolic rate) to be linked to cost-benefit calculations of heat control strategies such as improved local ventilation or refrigeration. This is particularly useful when we consider that 11.4% of the total working cost of an underground goldmine can be attributed to electricity consumption[13] and that in 1999 the mining industry consumed 18.4% of the electricity sold in South Africa.[13]

Because the TWL is measured in W/m^2, it can easily be compared to Watts of refrigeration. The impact of localized cooling using various types of refrigeration can therefore be measured directly.[8] For example, consider a mine being ventilated with 10 m^3/s supplied air at 30°C WB, 40°C DB, 40°C Globe, 100 kPa barometric pressure, and a wind speed of 0.2 m/s. The initial TWL is 110 W/m^2 (which are

Table 1. Screening criteria for TLV and action limit for heat stress exposure[6]

	Acclimatised				Unacclimatised			
Workload demands	**Light**	**Moderate**	**Heavy**	**Very heavy**	**Light**	**Moderate**	**Heavy**	**Very heavy**
Continuous work	**29.5**	**27.5**	**26**		**27.5**	**25**	**22.5**	
75% Work / 25% Rest	30.5	28.5	27.5		29	26.5	24.5	
50% Work / 50% Rest	**31.5**	**29.5**	**28.5**	**27.5**	**30**	**28**	**26.5**	**25**
25% Work / 75% Rest	32.5	31	30	29.5	31	29	28	26.5

Values are given as WBGT °C.

Table 2. Some typical metabolic energy production values associated with various mining activities for a South African miner of average size[1]

Task	Energy production W/m² (surface area = 1.8 m²)
Winch operation	66
Sweeping	120
Drilling	178
Loading and pushing ore cars	237
Shovelling rock	260

Table 3. Recommended guidelines for TWL values and control action that should be implemented

Risk	TWL (W/m²)	Action
Low	**>220**	**Unrestricted work**
Medium	141–220	Acclimitisation Zone - Acclimatised workers allowed to work but not alone.
High	**116–140**	**Buffer Zone** **- Unacclimatised workers must not work at all.** **- No lone or isolated workers.** **- Air flow must be increased to greater than 0.5 m/s.** **- Rectify ventilation if out of service.** **- Redeploy persons wherever practical.** **- Workers to be tested for hydration, withdraw if dehydrated.** **- Work should only continue with authorisation.** **- Dehydration test to be conducted at end of shift.**
Critical	**<115**	**Withdrawal Zone** **- Persons must not work in this environment unless in emergency conditions or to rectify environmental conditions.** **- Permit to work in heat to be completed and authorised by manager.** **- Dehydration test to be conducted at end of shift.**

- Note: Work can still be undertaken when the TWL is less than 115 W/m² however a formal permitting system with management approval should be required.
- See Brake and Bates[8] for additional information on requirements and application of the TWL index.

withdrawal conditions for self paced work, refer to Table 3). If local refrigeration of 100 kW(R) (kilowatts of refrigeration effect) is installed it can be calculated using standard psychometric equations that temperatures in the workplace will drop to 28°C WB and 31.4°C DB, which results in an increase in TWL to 158 W/m². The capital and operating costs of this engineering intervention (refrigeration) can be directly evaluated against the cost benefit of improved productivity. Using the above example, the TWL could have been increased to the same 158 W/m² by increasing the wind speed over the skin from 0.2 to 0.7 m/s without any addition of refrigeration, a much cheaper option by installation of a local spot cooling fan or venturi air mover. This as Brake and Bates[8] indicate is not to say that increasing the wind speed over the skin is able to increase the TWL in all situations; typically, increasing the wind speed beyond 4 m/s provides little further benefit to cooling. The above example shows how the TWL index has the potential to assess different heat control strategies against cost-benefit implications and can also be extended out to include the heat load implications in various clothing ensembles and personal protective equipment use in regards to thermal insulation and vapour permeability[8] and body cooling and heating.

PHYSIOLOGICAL MEASUREMENT OF HEAT STRAIN

The measurement of heat strain can also be used to measure the severity of an environment on an individual. The main parameters used for evaluating heat strain are body core temperature, heart rate, sweat loss and urine specific gravity (USG) for hydration status. Generally, all of these parameters can be evaluated under laboratory conditions, but extension to field measurements makes this far more

Table 4. An example of Specific Gravity Hydration Level guide

Urine SG level	Risk rating	Hydration rating	Action required
1.000 – 1.021	Low	Adequate hydration	No action.
1.022 – 1.026	Moderate	Hypohydrated	Drink 1 L of water.
1.027 – 1.029	High	Dehydrated	Drink at least 1.5 L of water.
>1.030	Critical	Clinically dehydrated	Unacceptable risk, stop work and drink water until properly hydrated (may take several hours).

difficult and sometimes impossible due to the practical constraints of fieldwork. One particular parameter – USG – lends itself to field assessment of individual hydration status and is presented below.

Urine specific gravity for hydration status

Sweat loss and fluid intake have a direct influence on hydration status and USG readings can be used as an indication of the hydration status of a person. A urine refractometer is used, a simple instrument that measures the concentration of particles in a solution (grams/ml) by its ability to refract light passing through a small specimen of urine. Urine is a good marker of hydration, when it is of high osmolarity (resulting in dark colour) it indicates hypohydration (lowered hydration levels) and the conservation of body fluids by the body.[14] These readings are non-invasive, easy and quick to conduct. Urine specific gravity could be used as an educational tool for workers as to the required fluid intake before and after heat exposure[15] (see Table 4). In some mines in Australia, it is used to assess hydration of miners before a shift as a proactive precautionary measure to avoid increased risk of heat related illness due to inadequate hydration at the start of the shift. Alternatively, colour photographs of urine samples of different specific gravities could be a more practical and simpler on-site educational tool and a reminder to workers to drink adequate fluids (see Figure 1).

Conclusion

Many attempts over the years have been made to assess heat stress in the environment using a variety of different environmental and personal parameters and indices derived from these. To date, no single index has managed to incorporate all heat stress parameters into an easily applied and calculated index. The WBGT heat stress index is used in South Africa yet it too has limitations. The recent development of the TWL index which has been based upon many of the other indices and prior research offers a simple to use index. Thermal work limit considers all of the required environmental parameters as well as workload, clothing, acclimatisation status and metabolic heat production to derive a single figure output which is easy to interpret. This indicates the limit of heating and cooling that is sustainable and will avoid heat related disorders. The importance of fluid and electrolyte replacement and physiological monitoring of this cannot be over-emphasised as an additional personal monitoring measure and should go hand in hand with environmental thermal control efforts and worker education.

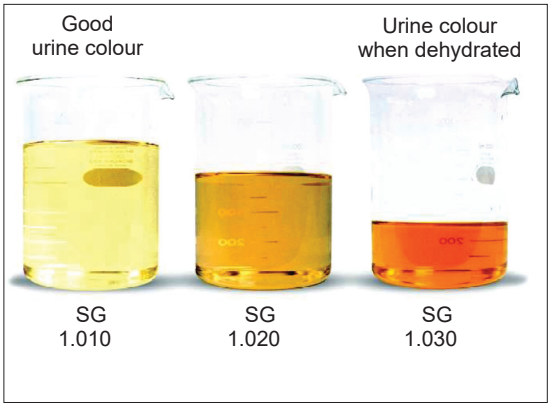

Figure 1. An example of a colour photo indication of urine samples of different specific gravities which relate to hydration status and the requirement for further hydration

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Feedback from the 36th Medichem Congress, Amsterdam 2008

The 36th Annual Medichem Congress 2008 was held in Amsterdam during September. For South African delegates it was a memorable occasion as it was exactly ten years ago that we hosted the Medichem Congress in South Africa.
This year also celebrates the 60th anniversary of SASOM and with the ICOH 2009 conference in Cape Town a lot of networking opportunities were available.

Exciting news for South Africa from the outgoing board member Dr Andre Kotze is that the nomination of Dr A Combrinck, a SASOM Executive Committee Member, as Medichem Board Member was accepted and he attended his first Board Meeting.

Dr WM Coombs (Chairman SASOM Biological Monitoring Committee and Medichem member), Dr A Combrinck (new Medichem Board Member for South Africa)

Medichem Congress, September 2008

Programme

Day 1, September 10 2008

Title	Presenter
Registration of participants and welcome of guests.	
Welcome	Peter Boogaard, Chairman Organising Committee.
Introduction	Peter Elverding, former CEO DSM, The Life Sciences and Materials Company, The Netherlands
Nanotechnology and nanoscience: bridge between chemistry, physics and biology	Prof. Paul Borm, Professor of Toxicology, Univ. Düsseldorf, member Dutch Health Council
Medical Surveillance of Workers Exposed to Nanomaterials	Prof. Michael Kosnett, Assoc. Clinical Prof., Div. of Clinical Pharmacology & Toxicology, University of Colorado Health Sciences Center
Break & Poster session	
Biomonecs: application and availability to the market	Dr Paul Scheepers, Assoc. Prof. in Risk Assessment and Molecular Epidemiology, Univ. of Nijmegen, NL
Title	**Presenter**
Applied genomics and bioinformatics for the identification of mechanisms of toxicity	Timothy W. Gant, Medical Research Council Toxicology Unit, University of Leicester, UK
ECETOC Framework for the integration of human and animal data in chemical risk assessment	Kim Z. Travis, Human Safety, Syngenta, UK
A weight of evidence approach to causal inference	Dr Gerard Swaen, Epidemiologist, Dow Chemicals Benelux, member Dutch Health Council
Discussion	
Lunch & Poster session	
Demographic change – an issue for statutory accident insurance?	Thomas Köhler, BG Chemie, Preventive Medicine, Heidelberg, Germany
Strategies for sustainability at Navistar	Dr W.B. Bunn and Dr T.W. Hesterberg, Navistar, Warrenville, USA
The meaning of Early Health Effect markers, e.g. Evidence based, NO-meas., oxidative stress, homocysteine	Ir. Dick Brüggemann, Director Doctor Stein Laboratories, NL
Short break	
Evaluation of Lesions Caused by Hydrofluoric Acid (HF) on Human Skin ex vivo and Decontamination with Tap Water, Calcium Gluconate, and Hexafluorine®	Dr Alan H. Hall, president & chief medical toxicologist Department of Preventive Medicine and Biometrics, University of Colorado Health Sciences Center, Denver, CO, USA

Title	Presenter
Mortality in the German porcelain industry 1985-2005, first results of an epidemiological cohort study.	Dr Thomas Birk, Environ GmbH, Essen, Germany
Advances in Decontamination of Chemical Skin/Eye Injuries: Diphoterine® and Hexafluorine®	Alan H. Hall, M.D. and Norbert F. Shrage, M.D.
General assembly	
Social program on board of Partyship 'Kapitein Kok'	Transportation from the partyship 'Kapitein Kok' to Central Station and Dam Square will be arranged.
Start with wrap-up of day 1	Chris Money
Planning for the future: exposure registries for engineered nanomaterial employees	Dr Diane J. Mundt, Environ International, Amhurst, USA
Nanotechnology – opportunities and risks from the statutory accident insurance` point of view	Dr Maren Beth-Hübner, BG Chemie, Preventive Medicine, Heidelberg, Germany
Practical aspects of Nanotechnology: Good Practices	Dr Ir. Remco Houba, industrial Hygienist, Expertise Center for Chemical Risk Management
Break & Poster session	
Exposure Routes; Workplace Assessment	Willy Asnong, Corporate Industrial Hygienist, Solvay NV/SA, Brussels, Belgium
Genotoxic Risk in Formaldehyde Exposure: Biological monitoring for carcinogenic substances using the Micronuclei Assay	Prof. Susana Viegas, Dept. Technological Sciences and Laboratories & Community Intervention, Lisbon, Portugal
Biomonitoring as pragmatic tool for Risk Assessment under Reach	Dr Peter J. Boogaard, Senior Toxicologist, Shell Health, Shell Int. B.V.,The Hague, NL
Genetic factors in cancer risk from exposure to occupational agents	Prof. Lode Godderis, Department of Occupational, Environmental en Insurance medicine, Cath. Univ. Leuven, Belgium
Lunch & Poster session	
Title	**Presenter**
Chemical, medical surveillance and biological monitoring in South Africa	Dr Murray Coombs, Regional Health Director IMEA, Dow Chemical and South Africa Society Occupational Medicine BM Chair, South Africa
From standards to standardization in a global organization	Dr Robin Donnelly, Vice President, Shell Health, Shell International B.V., The Hague, NL
Break & Poster session	
"Helping unravel the muddled mind." (Practical guide for aiding dyslexic and dyspraxic clients).	Dr Alan Bray, South West Independent Medical Services Ltd, Exeter, UK
Sustainability: shaping our business	Dr André Veneman, Director Sustainability, AkzoNobel, Amsterdam, NL
Closure	Dr Peter J. Boogaard, Senior Toxicologist, Shell Health, Shell Int. B.V., The Hague, NL
Drinks	Meet & Greet

Dr Coombs presented the annual update of the Ampath Biological Monitoring database results. He discussed the five year biological monitoring trends indicating that chemical exposure in South Africa remains a major occupational health concern. He presented case studies on manganese, benzene, coal tar pitch volatiles and arsenic.

Further information:

Medichem Congress: www.medichem.org

ICOH 2009 Conference: www.icoh2009.co.za

Ampath database results: Volker Schillack: schillackv@ampath.co.za

Biological Monitoring presentation: Dr WM Coombs: mcoombs@iafrica.com

SAIOH AGM, 25 June 2008:
Indaba Hotel, Fourways

President's Report, abridged

Colleagues, distinguished guests, ladies and gentlemen, we are gathered here today in this very important year of our 25th anniversary. It is historical that the Occupational Hygiene (Occ. Hyg.) profession in South Africa is now 25 years old.

Over the past years the profession of Occ. Hyg. has gone from strength to strength, which would not have been possible without the calibre of our leaders. They had a vision at the time when the profession did not have a legal muscle in South Africa, and campaigned tirelessly for the cause of good Occ. Hyg. in our workplaces. This has raised the status of the Occ. Hyg. profession in South Africa and created awareness in other African countries. Today we have international recognition of our very own organization, the Southern African Institute for Occupational Hygiene. To all our previous leaders at various levels, I salute you!

Today the Occ. Hyg. profession is not just recognized for its contribution to ensuring that workplaces work towards the ideal of being healthy and safe, it plays a major role in job creation and in the economy of our country.

I can say that we are well on our way towards moving from good to great. We need to continue to strengthen our organization. This can only happen by maximum participation of our members in all our programmes, especially at branch level.

Branches

The four branches, KwaZulu-Natal, Central, Mpumalanga and CapWest, are all fully functional. They are a platform where young professionals interact with seasoned professionals towards a common goal of improving the way we conduct our business and learn from one another.

A branch in the Northern Cape is being formed and will be inaugurated in July of this year. This is another milestone in the history of our organization. Interest exists in forming branches in other southern African countries e.g. Namibia.

Membership

A growing number of individuals are showing interest in our profession and most companies now recruit Occ. Hyg. professionals with valid SAIOH certificates. This is indicated by our membership growth: 31 new members in 2007 and 33 in the first five months of 2008. We have 230 Occ. Hyg. Assistants, 84 Occ. Hyg. Technologists, and 135 Occ. Hygienists. Sadly, 39 members failed to pay their renewal fees for 2007 and 2008 and stand to lose their membership and professional registration: 26 are Assistants.

Liaison and cooperation

We continue to foster relations with other stakeholders. Together with Safety First, IoSM, SAPEMA and the MVSSA, we seek better ways of doing this business of occupational health and safety.

Unfortunately, we have not been able to maintain our good relations with the authorities. Our intended regular meetings with the Department of Labour have not materialized but we will continue with these initiatives as they are important for making our workplaces healthy and safe through good Occ. Hyg. methods. We shall also continue to seek ways of working with the Department of Minerals and Energy, the Department of Health, the Approved Inspection Authorities and other stakeholders.

We have played a pivotal role as part of the *Occupational Health Southern Africa* journal. I encourage our members to provide ideas for the President's page and to contribute articles to the journal as this is a way of sharing what you as professionals do in the field.

The National Council

The National Council (NC) met three times during the year 2007/2008. Drawing on previous experience, it has been instrumental in the organization of SAFECONEX 2008. SAIOH, through the NC, with Safety First, IoSM and SAPEMA decided that this event should be held on an annual basis. These organizations have formed a national lead body in occupational health and safety, called NOSHBO. The NC supported this initiative to ensure cooperation and synergy of their efforts to achieve safe and healthy workplaces.

The *Handbook on Mine Occupational Hygiene Measurements* was published in 2008. Through the efforts of people like Dr David Stanton, Dr Johan Schoeman and many others, SAIOH played an active role in the realization of this dream.

We now face the challenge of archiving the SAIOH records and making them available for our 25th anniversary celebration of the Occ. Hyg. profession in South Africa. We call upon anyone that can contribute in whatever way to remind us of where we come from, to come forward and make records available.

The NC decided to renew the recognition of professionals who have excelled in different areas of their profession, to increase awareness and make our professionals take more pride in their careers. More information will soon be announced.

The NC has realized a need to review and amend our constitution where necessary, so that it remains relevant and up to date. It can only be changed by the members. You will be kept informed about the implementation of this decision.

Transformation

Transformation, as initiated by our Immediate Past President, remains one of our key areas in growing and developing our organization. The NC finalized key activities under the Transformation Document that was finalized in 2007. We believe that there is nothing that is as constant as change.

The Certification Board

The Certfication Board meets four times per year in its role as watchdog of the professional registration objectives of SAIOH.

2008 has seen an explosion in the number of persons applying for this: in 2007 an average of 15 candidates sat for the first four written exams held. During November 2007 as well as January and April 2008 the average has been 45 candidates per session.

A new trend is that final-year students at tertiary educational institutions are now required to write the Assistant exam and our thanks go to Mr Leon Harmse (TUT), Dr Nico Claassen (UP), Dr Johan Schoeman and Dr Fritz Eloff (NWU) for spearheading this initiative. A total of some 60 students have participated in 2007 and 2008.

SAIOH Priorities for 2008/2009

- Enhance, strengthen and support branches.
- Enhance and implement transformation.
- Renew and enhance liaison and joint forums.
- Marketing and promotion.
- Enhance communication.

Conclusion and discussion

We have many achievements behind us. The aim is to ensure that we continue to build from these achievements as we move forward and face the many challenges ahead. We need to ensure that we move from 'good' to 'great'.

As mentioned by some great author, "today matters, yesterday ended last night".

For us to continue developing and growing we need to plan today.

I thank you.

Sibongiseni Myeni, President – SAIOH
Cell: 082 335 5491,
E-mail: info@seninhle.co.za

Motivation letter to the Director: Health Promotions Unit

Early this year, the MMOA sent the following letter to the Director: Health Promotions Unit, Department of Health and copied to the Honourable Minister of Health and Director-General Health. To date, no response has been received.

Motivation for inclusion of smoking cessation programmes in TB/HIV five-year strategic plans

While we as the Mine Medical Officers' Association (MMOA) applaud the development of the TB and HIV five-year strategic plans for South Africa, it is with regret that we note that neither plan includes smoking cessation as an integral component. The MHSC/MMOA recognizes that tobacco smoking has a negative impact on workers' health particularly in silica dust settings and has mandated further research and implementation of workplace smoking programmes. However, workers belong to communities and, as such, deserve continuity of care once they leave the employment environment. Hence inclusion of smoking cessation initiatives in the National Strategy is warranted.

Smoking prevalence in the country is estimated at 22% and while there is progressive legislation that has contributed to a decrease in the prevalence over the years, tobacco control remains an important public health priority particularly within HIV and TB programmes. Groenewald et al. recently published in the SAMJ that tobacco smoking has been ranked third (after unsafe sex/sexually transmitted diseases and hypertension), in terms of cause of mortality out of seventeen risk factors evaluated in South Africa.

Tobacco smoking has definite associations with both HIV and TB being a strong risk factor for the latter in particular.

Tobacco smoking and TB

There is overwhelming evidence in support of links between tobacco smoking and TB. More than half a century ago, Doll and Hill illustrated that smoking increases the:

incidence of TB infection

progression of TB infection, and

death rates from TB

In summary, there are links between tobacco smoking and many aspects of TB (International Union Against TB and Lung Disease fact sheet), namely:

TB infection

TB disease

TB treatment delay

Slower smear conversion

Drug resistance to Isoniazid (INH)

Retreatment of TB

Death during or after TB treatment

TB mortality rates

In 1992 in South Africa, Hnizdo illustrated that there is a strong link between tobacco smoking and TB disease severity and also a strong dose-response relationship between tobacco use and TB. In 2004 Sitas et al. estimated that 20% of TB deaths in SA are due to smoking and this implies that one in every five deaths from TB can be prevented if the patients were not smokers.

Tobacco smoking and HIV/AIDS

Recent evidence suggests that 70% to 80% of HIV infected patients smoke. In 2007 a meta-analysis found that smokers were more likely to become HIV positive, than non-smokers. It is well accepted that there are increased health risks associated with people who smoke tobacco and have HIV infection as listed below.

Increased risk of HIV-associated pulmonary infections particularly tuberculosis, *Pneumocystis Carinii* and community-acquired pneumonia

Increased risk of accelerated form of lung damage consistent with an emphysema-like process

Increased risk of HIV-associated oropharyngeal lesions such as hairy leukoplakia and candida

Higher incidence of AIDS-defining and non-AIDS-defining malignancies

As an established risk factor for atherosclerosis, it has been associated with coronary events in patients receiving protease inhibitor therapy

Even smokers on Highly Active Anti-Retroviral Treatment (HAART), have more inter-current, non-AIDS defining illnesses than non-smokers. Furthermore dyslipidaemia, as an important side effect of the protease inhibitors used in HAART, predisposes these patients to the development of cardiovascular diseases. The challenge is for all HIV programmes to amend their ABC strategy to ABCD (D = Don't smoke) so including tobacco control as recommended by the National Council Against Smoking.

A recent study by Neil Martinson at Wits found that:

Smoking is associated with TB in HIV-infected adults

Prevalence and incidence of TB are increased in women who smoke with a strong dose-response relationship

After adjusting for HAART therapy, INH preventive treatment and CD4 count, current smokers were at 37% greater risk of incident TB than never smokers.

It follows that tobacco smoking interventions, being important public health measures, may also contribute to the effectiveness of both HIV/AIDS and TB control programmes and should be included as a recommendation in the National Strategic Plans.

Dr Vanessa Govender, Executive Committee Member of the MMOA at the time of writing the letter, currently Vice-President

Western Cape Kaleidoscope 29 August 2008

The Kaleidoscope is an event that SASOHN Western Cape has presented for a number of years. The workshop has always been a huge success as our SASOHN President, Sonja Kruger, stated in her opening speech when she said "I always get something to take back". The Mount Nelson Hotel, Cape Town's most famous hotel with majestic views of Table Mountain was the chosen venue this year. True to form everything was well organised but not the weather, which was a typical wet Cape Town.

What was lost in the weather was gained in the academic programme. A quick shuffle due to the late arrival of a speaker saw Dr Ina Rothman as the opening speaker. What a way to start as Ina is a dynamic and vibrant presenter who had the entire audience eating out of her "Bulls-supporter" hand. She left no doubt in our minds that assessment of an employee's psychological fitness to work is both necessary and can be more easily implemented through the use of the correct assessment tool.

Karen Michell, SASOHN Educational Representative explained the proposed new scope of practice and the draft nursing charter. She highlighted how easy it is to move out of our scope of practice in our eagerness to fulfil all our clients' needs. She presented food for thought through case studies and reminded the audience to think of the issues and to strive to avoid the landmines that can cause problems when rendering care to our clients in the workplace.

Heidi Rowley, from Reach for a Dream, shared her experience of working with children with terminal illnesses who have a wish that they would like to have fulfilled. Her talk brought home the realities of life and the need to be appreciative of what we have, most especially our health. The powerful video that was shown brought a few tears as we saw how grateful recipients from Reach for a Dream are.

After tea we were reminded of the latest CPR guidelines by Michelle Kings. CPR methodology is updated on a regular basis, which makes it necessary for professional staff to remain abreast of these changes. In an emergency situation, CPR does save lives as long as the people rendering

Display by Edumed of a variety of gloves used in the healthcare setting

the treatment know what they are doing. One never knows when one will be called to apply CPR and the message is "do not get caught not knowing what to do".

Lilian Masebenza discussed gender discrimination and the challenges women of today still face. Michael Baigraim gave a very interesting talk on the rights and responsibilities of the OHNP in a disciplinary process. A clear distinction was made between what constitutes a disciplinary process and what is a labour relations issue. Each delegate was given a booklet on labour relations for easy reference. Finally, Dr Wikus van Niekerk gave a talk on vibration, which ended an intellectual but fun filled day.

Nine exhibitors spoilt the delegates with displays of new technology, sample goodies, lucky draws and interesting exhibitions. I would like to thank our sponsors for their continued support in making the Western Cape Kaleidoscope such a success, and a special word of thanks to Pathcare for sponsoring the invitations, files and certificates. See you all again in Cape Town in March 2009 for the SCOHN SASOHN pre-conference workshop.

Theresa Bosman
Chairperson Western Cape

SASOM's Diamond Year continues

2008 will be remembered as the busiest year in SASOM's 60 years of existence.

ICOH2009

Many SASOM members – and others – are working long hours on the scientific and social programmes and the website administration of the International Congress on Occupational Health (ICOH2009) in Cape Town from 22–27 March 2009. It appears that thirty-seven SASOM members have submitted abstracts to ICOH2009, seven have registered as members of the International Commission on Occupational Health (bringing South Africa's total to around 67) and many more have motivated to company managers for sponsorship and permission to attend the Congress.

SASOM wishes to thank everyone who is giving so liberally of their time and energy to ensure a successful ICOH2009.

Membership

2008 has also been a year with the highest percentage of our membership in good standing. We wish to thank all our members for their loyalty. Twenty-seven new members have subscribed to SASOM this year and many students studying for the Diploma in Occupational Health have called the National Office for information and guidelines.

Conferences and Annual General Meeting

The Annual SASOM Congress was brought forward to April to enable the SASOM and ICOH staff to cope with the ever increasing number of delegate and exhibitor registrations and electronic and telephonic enquiries from all corners of the globe.

A one-day Conference has been arranged to coincide with the SASOM AGM and Annual Dinner at Bains Game Lodge in Bloemfontein on 21 November 2008. Two presentations were added to the programme published in the previous issue of the journal. Dr Charles Roos will present aspects of Nuclear Medicine and Dr Johan Grobbelaar aspects of Hearing Conservation. SASOM has applied for ten Continuing Education Units for the programme.

The SASOM Annual General Meeting will follow the Conference at 16:30 and the Annual Dinner, with some surprises, at 18:30 for 19:00.

2009

We believe that 2009 will be our greatest year to date with a new occupational health service accreditation system, a new set of SASOM guidelines and of course ICOH2009 in March. The benefits of attending this Congress will reflect in all spheres of occupational health, not only in our country but throughout the world. It changes mindsets, builds confidence and gives new direction to many of the attending delegates.

Continuing Educational Units

Dr Danie Ungerer wishes to inform SASOM members that in addition to posting their CEU questionnaires in the usual manner, they can now also forward them electronically to the SASOM office.

Ms Ulundi Behrtel from the SA Medical Association will present a paper on Continuing Educational Units at the SASOM Conference on 21 November 2008.

Contact Jenny Acutt in the SASOM National Office on 086 1114 417 or +27 (0)12 803 7418 or e-mail: sasomdm@iafrica.com for more information.

National Air Pollution Assessment Services c.c

Reg No. 1988/14144/23
VAT No. 4300120211

National Air Pollution Assessment Services c.c. (NAPAS c.c.), was established in 1988 and has been providing its clients with professional occupational hygiene monitoring services throughout South Africa.

NAPAS c.c. is one of the first Approved Inspection Authorities (A.I.A. Certificate No: CI 014 OH) that was registered with the Department of Labour, to provide occupational hygiene monitoring services (physical and chemical stress factors, including lead, asbestos and ventilation systems).

Its team of consultants has experience in the mining and industrial sectors consisting of ventilation, occupational hygiene and environmental monitoring fields, ensuring that its clients' requirements are identified and met with turnkey solutions.

Apart from its Ventilation, Occupational Hygiene and Environmental Divisions, NAPAS c.c. also has an Instrumentation Division that markets, services, repairs and calibrates all occupational hygiene monitoring equipment for its clients.

NAPAS c.c. represents Cirrus Research plc, an international leader in noise monitoring equipment, based in the United Kingdom as its sole distributor for the southern African region. The Cirrus Research plc product range includes sound level meters, frequency analysers, environmental and airport noise monitoring stations, acoustic calibrators and the world's first compact doseBadge® Personal Noise Dosimeter.

The doseBadge® Personal Noise Dosimeter is a unique solution to the problems associated with the measuring of personal noise exposures. The doseBadge® itself is small and weighs only 51 grams; it is constructed out of a rugged and durable metal case, has no controls, cables or screens which means that this eliminates the risk of the wearer tampering with the device to alter their personal noise exposure as associated with other similar instruments. Report compilation is done with the dBLink 3 Software, allowing users to compile detailed reports.

The CR:110AIS doseBadge® Personal Noise Dosimeter is the first fully certified Compact Personal Noise Dosimeter in the world and has set the standard for others to follow with International Intrinsic Safe Certification that conforms to the EU ATEX Directive, the EEx, as well as SABS approval for use in South Africa under IA No: MS/05-370X. Under these certifications the CR:110AIS doseBadge is the first certified Explosion Protected (Ex ia I/IIC T4) Compact Noise Dosimeter and is suitable for use in hazardous locations zones 0, 1, 2 in surface operations as well as in underground mines (including coal).

The Cirrus 110AIS

Also available is the CR:262+ Class 2 Data Logging Sound Level Meter. It is simple and easy to use and carries IEC 61672-1 and SANS 61672-1 Class 2 Certification. The CR:262+ measures and Log $L_{Aeq,t}$ and Peak dB (C) as required by the MHSC Milestones and PC Software is included.

For the ultimate in noise monitoring efficiency, the company offers a Safety Officer's Noise Measurement Kit that consists of a Cirrus Sound Level Meter of your choice and doseBadges contained in a compact case.

Its local Cirrus Research plc Accredited Service and Calibration Centre will ensure that your noise monitoring equipment is serviced, repaired and calibrated to international standards while eliminating high shipping costs and turnaround times.

NAPAS c.c. has assisted numerous clients (mining and industrial) through monitoring personal exposures of employees to recommend control measures that will establish a healthy and safe working environment.

NAPAS c.c. is involved with and has successfully implemented and managed complete ventilation systems for both small and large mining corporations throughout southern Africa.

National Air Pollution Assessment Services c.c. is dedicated to providing outstanding service in all of its related fields and has been involved in the mining and industrial sectors for the past 20 years. NAPAS c.c. looks forward to being of assistance to you no matter how big or small, ensuring that its clients' requirements are professionally met.

These services and instrumentation are available exclusively from NAPAS c.c. For more information or a demonstration, please feel free to contact Riaan Oberholzer on +27 (0)11 674 2080/71, e-mail: info@napas.co.za or visit its website at www.napas.co.za

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