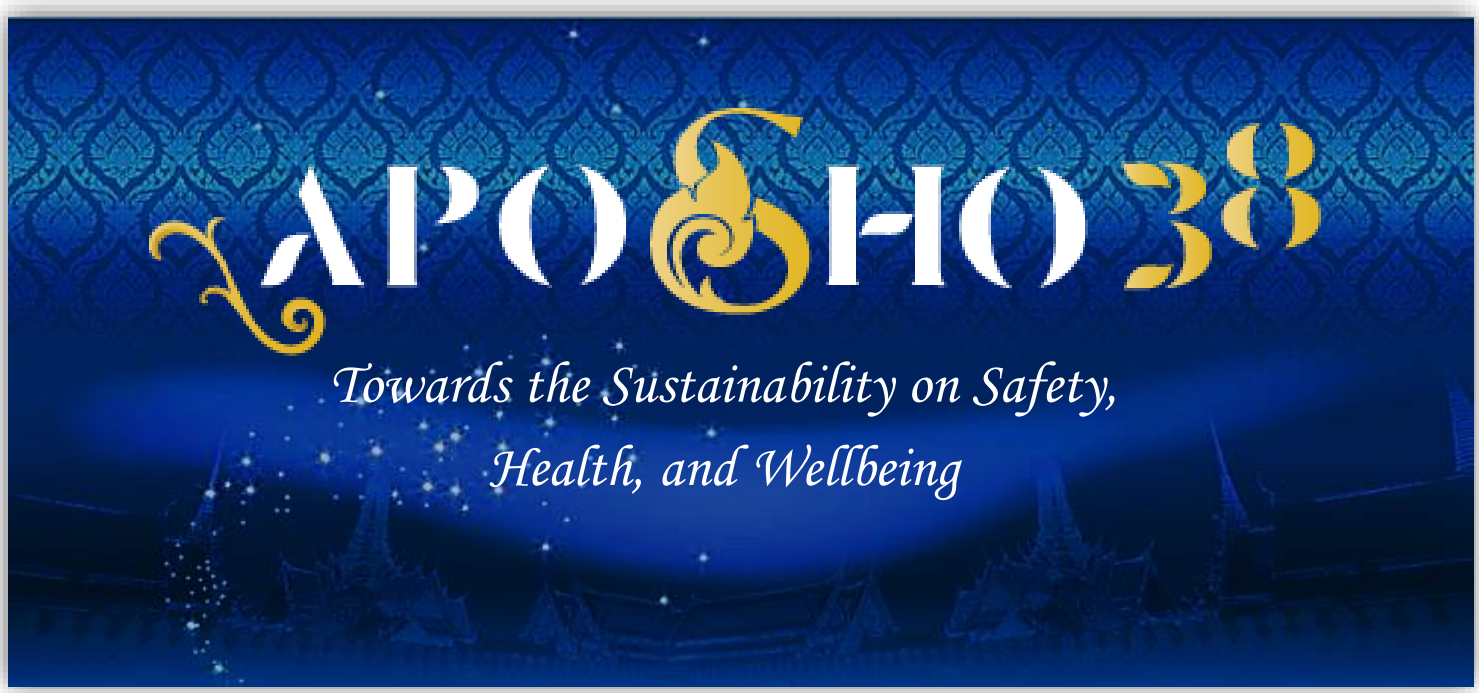

The 38th APOSHO Conference

Asia Pacific Occupational Safety & Health Organization

Abstract Book

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Reducing Physical and Mental Health of Internet Users: An Intervention of OHS Education among Adolescent in Makassar.

Yahya Thamrin
Masyitha Muis
Lalu Muhammad Saleh
Awaluddin
Tasrifin Tahara
Lin Karmila Yusri
Ismaniza Ismail

Background:

Our previous research found that gender, school status, parents' education level and occupation, internet usage activity and intensity are factors influencing physical and mental of adolescent internet users. The study found that the variable of internet usage intensity has the greatest influence on adolescent mental health while the excessive use of internet brought negative impacts to physical and mental health among adolescent. This research aims to explore intervention model and to identify the effectiveness of the strategy to decrease the problems.

Methods:

A mixed methods design was used to answer the research objectives. Qualitative research was conducted using focus group discussion (FGD) to explore parents, teacher and students' perspectives regarding the problems and alternative intervention to reduce the negative impacts of the internet addiction. Four groups were interviewed that consisted of two groups of parents together with teacher and two groups of students from two different schools. Furthermore, quantitative research was applied using experimental study one group pre-test and post-test design to address the effectiveness of intervention.

Results:

Some parents and teachers maintained their kids face difficulties in terms of academic achievements. Games, videos, social medias, pornography are the main threats. Students acknowledged experiencing physical and mental problems and asked for OHS education how to use internet safely and healthy.

OHS education modules had been developed and face to face training had been done among 30 students to measure the effectiveness. This study found that there was a difference that statistically significant (Z-*value* 0.000) before and after training regarding students' knowledge and confidence how to use internet safely and healthy.

Conclusion:

OHS education and training materials is needed to be developed and implemented in order to reduce the negative effects of excessive use of internet among adolescent.

OSH Support for Small and Medium-Sized Enterprises through Innovative Solutions – Hong Kong Experience.

Bonnie YAU
Alice LAM

Small and Medium-Sized Enterprises (SMEs) are the backbone of Hong Kong, accounting for over 98% of local enterprises. However, SMEs often lack resources and occupational safety and health (OSH) knowledge. To address this, the Occupational Safety and Health Council (OSHC) has been subsidizing SMEs through ongoing sponsorship schemes to help them acquire appropriate safety training and equipment. Under these schemes, SMEs only need to pay a small fraction of the personal protective equipment (PPE) costs to get what they need. This not only provides financial aid, but also promotes innovative solutions for accident prevention and assists SMEs in enhancing their safety performance. The introduction of new equipment into the market also helps bring down costs.

To ensure adequate and timely OSH support, OSHC proactively identifies SMEs' needs through stakeholder meetings, reviews of latest industrial accidents, and monitoring industry trends. For example, with the rise of electric vehicles (EVs), OSHC has introduced a long-term sponsorship scheme for the vehicle maintenance industry, subsidizing SMEs to purchase PPE such as "Lockout Tagout" kits, insulated mats, and gloves. OSHC also provides safety training courses and promotional materials to address the new OSH challenges posed by EV maintenance.

Another example is the introduction of a custom-made, user-friendly, and safety-certified telescopic scaffold tower to improve work-above-ground safety for various industries. The platform height of the Teletower can be adjustable within just a few minutes to four different levels from 1 to 1.75 meters, accommodating the above ground works for diverse work scenarios. Eligible SMEs can purchase the Teletower at an affordable cost and receive free training to ensure competency in using it. By adopting a holistic approach of providing subsidies, innovative solutions, and free training, OSHC remains vigilant and versatile in supporting SMEs' safe work practices, playing a crucial role in promoting OSH in Hong Kong.

APOSHO-003

Multi-party collaboration for a People-entered Prevention Culture achieving Quantum Leap in Safety, Health and Wellbeing Performance for the Construction Industry.

Bonnie YAU
Winson YEUNG

Construction industry is facing ageing workforce and high-risk working environment. Enhancing safety performance and promoting workers' health and well-being have become pivotal concerns. To meet the challenges, collaboration is the key. OSHC lines up project clients, contractors and labour unions to run initiatives such as Independent Safety Audit Schemes (ISAS), Surprise Safety Inspection Programmes (SSIP), Safety Culture Programmes, Training and Heart-Caring Programmes to reinforce a zero vision and people-centred prevention culture in the industry.

Employers and employees hold direct responsibility for OSH. Yet, OSHC believes clients could play a pivotal role in improving OSH performance and well-being of workers. OSHC collaborates with project clients, such as Housing Authority (HA, biggest housing developer in HK) and Housing Society to apply holistic approach to enhance vision zero culture at construction sites.

OSHC developed and manages ISAS and SSIP for project clients. The two combined could effectively assess contractors' safety plans and their implementation periodically. This, accompanied by clients' measures, such as pay-for-safety scheme, motivates contractors to continuously make safety improvement. Clients' encouragement to implement Safety Climate Survey and Work Safety Behaviour Programmes at sites put further impetus to improving site safety culture. Clients' support for running Heart-Caring Programme through on-site health checks, online weight-losing course and mindfulness training enables early screening of health risks, early prevention and early management of cardiovascular diseases and related work stresses.

In the past 15 years, HA has achieved ~69% decrease in accident rates, while experiencing 9.6% enhancement in SCI. Accident rates were also persistently less than 35% of industry average. Heart-caring programme is relatively new. Some 350 contractors joined, >2100 workers completed on-site health checks. 85% were classified as "at-risk", 65% of them joined weight-losing course, and 94% agreed their health awareness increased, with ~50% had BMI/ BP improved.

The Use and achievement of Korean Safety Ladder (K-Ladder) for the Prevention of Accident for Portable Ladder Workers

Donglee Yang of Korea Occupational and Safety and Health Agency

Background:

Development of Safety Ladder for the Prevention of Portable Ladder Workers Accidents.

Methods:

In-depth analysis of the cause of accidents, investigation of usage conditions, analysis of safety ladder product groups at home and abroad, and gathering opinions on safety ladder development from stakeholders.

Results:

The achievement of Korean safety ladder (K-Ladder) to prevent accidents for portable ladder workers

Conclusion:

Portable ladders are widely used in homes and industrial sites as a substitute for a work platform when working in a high place, as well as a pathway to go up and down to a place where work is performed. However, due to the structural instability of ladders and users' negligence in safety measures, 176 accident deaths and 19,900 accident injuries occurred at industrial sites in Korea over the past five years, and related measures are urgently needed. In particular, in Korea's Occupational Safety and Health Act (Article 24 of the Industrial Safety and Health Standards Rule), ladders are defined only as pathway and their use as work platform is restricted.

However, based on the 'Portable ladder safety work guidelines' of the Ministry of Employment and Labor enforces in 2019, it is allowed to be used as a work platform only in some works. In most industrial sites, it is often not used according to the prescribed regulations, and the erroneous perception that a portable ladder can be used as a substitute for a work platform has become a common practice, and related accidents continue to occur despite the strengthened use regulation measures.

In order to prevent such portable ladder worker accidents, it is important to prepare an improvement plan so that the current laws and regulations can operate in the industrial field and induce the correct use of workers, but preparing effective preventive measures that go beyond regulatory compliance It has a positive function that can increase acceptance and maximize the effect of reducing industrial accidents. In other words, it seems that the effect of preventing accidents appears temporarily by implementing strengthened regulations and mobilizing administrative power for users to comply, but accidents are likely to last for a long time, and in order to eliminate the risk factors of these high-risk ladder work, rather than regulatory measures, the development of new safety technologies specialized in preventing accidents on ladders can be effective. Therefore, in this presentation, we will show the achievement of using a safety ladders (K-Ladder) that can replace existing ladders and securing safety for portable ladder work.

Navigating societal challenges: sociological perspectives on mandatory insurance infrastructure for occupational diseases and injuries in Kazakhstan.

Akira Ogami
Hajime Ando
Ryutaro Matsugaki

Background:

Understanding the complexities of mandatory insurance infrastructure for occupational diseases and injuries in Kazakhstan requires a sociological lens. This study aims to explore the societal challenges inherent in this infrastructure, examining its implementation, effectiveness, and societal impact. Objectives include analyzing the societal dynamics shaping insurance schemes, identifying barriers to access, and proposing strategies for enhancement.

Methods:

Employing a mixed-methods approach, this research conducts qualitative interviews, focus groups, and quantitative surveys with diverse stakeholders. Qualitative data is analyzed thematically, while quantitative data undergoes statistical analysis to uncover trends and correlations.

Results:

Initial findings reveal intricate societal factors influencing insurance infrastructure. Sociocultural norms, economic variables, bureaucratic inefficiencies, and power dynamics significantly affect access and utilization. Despite efforts, disparities persist, particularly among vulnerable groups such as informal workers.

Conclusion:

This study underscores the interplay between societal structures and insurance institutions in Kazakhstan. Addressing sociocultural, economic, and institutional barriers is crucial for developing inclusive strategies. By fostering social justice and equitable access to healthcare, policymakers can strengthen the insurance infrastructure and promote societal well-being.

High-risk Workplace Prediction Models

Suhyeon Lee
Changhun Lee
Kwangil Baek
Yongjin Kim
Taewon Kim
Hyuncheol Yoo

Background:

To reduce occupational accidents, diseases and fatalities, KOSHA (Korea Occupational Safety and Health Agency) has selected workplaces with high-risk for inspection and monitoring. However, priorities for targeting inspection workplaces are different depending on knowledge, work experiences and amounts of datasets available. Therefore, KOSHA has designed scientific prevention methods to offer occupational safety and health service by making its models called 'High-risk Workplace Prediction Models' based on OSH (Occupational Safety and Health) Big data and AI.

Methods:

Models are divided by industries – manufacturing, construction and service – and developed considering types of industries' characteristics. Datasets consist of approximately 41 to 45 types, which are prior agency's inspections reports, hazard prevention plans. As data preprocessing, necessary features are selected by blending data, creating derived variables. After feature transformations, high-risk workplaces with a high probability of occupational accidents are predicted using the XGBoost algorithm. In addition, AutoEncoder and SHAP (Shapley Additive exPlanations) are used to increase interpretability.

Results:

In 2023, F1 Score are calculated as 0.73(manufacturing), 0.72(construction) and 0.67(service). Workplaces for manufacturing with high-risk are expected as 12.6% of the total and they are likely to have more 9.2 to 11 times occupational injuries, fatalities and labor losses than non-high-risk ones, which represents effectiveness of model prediction. Moreover, model stability for manufacturing was tested and verified so that it has been used for selection workplaces for inspection and monitoring.

Conclusion:

As Ministry of employment and labor and KOSHA has started monitoring and on-site inspections with high-risk workplace prediction models, it is expected that small businesses, lack of occupational preventions, will be provided on-site supports and improve self-safety management/awareness. In addition, KOSHA plans to gather more relevant datasets and expand scope of industries in models for full coverage in workplaces.

Revolutionizing Workplace Safety: The Power of Digital Integrated Risk Management.

JC Sekar

Background:

In today's rapidly evolving work environments, the digitalization of Occupational Safety and Health (OSH) activities is essential. However, many organizations focus merely on converting analog processes to digital formats, missing the opportunity to harness the full potential of the data offered by digital technologies. The objective of this research is to emphasize the need for an integrated digital approach in risk assessment, transforming it from a mere compliance exercise into a vital tool for enhancing workplace safety. A robust risk assessment is central to any safety initiative, providing the foundation for identifying, evaluating, and mitigating workplace hazards.

Methods:

We have piloted the integration of digital technologies in the risk assessment process, demonstrating how an integrated risk management approach can be transformative. By leveraging digital tools, the risk assessment process becomes more robust, accurate, and actionable. Controls identified in the risk assessments drive other applications, such as risk communication through digital toolbox talks, streamlined asset maintenance, permit to work systems, and incident investigations using digital libraries. This interconnectedness is made possible by digital technologies, ensuring that safety measures are consistently applied and monitored across all operations.

Results:

The digital integrated risk management approach fosters the development of a comprehensive suite of OHS digital tools. These tools work synergistically, driving a continuous improvement loop that enhances safety outcomes and operational efficiency. Our experiences highlight that an integrated digital strategy in risk assessment is central to boosting other Occupational Health and Safety efforts. This approach not only ensures compliance but also promotes a proactive safety culture.

Conclusion:

Adopting an integrated digital strategy for risk assessment revolutionizes workplace safety, especially benefiting deskless workers by providing real-time safety insights and tools. This fosters a more competent and engaged workforce, empowering them with the resources to proactively manage risks. Such a strategy enables organizations of all sizes, particularly small enterprises, to elevate their safety standards and cultivate an environment of continuous improvement. By embracing this approach, companies can transform their safety culture, ensuring a safer, more efficient, and resilient workplace for all.

BTEX Exposure Risk Assessment on Truck Drivers at Hazardous Area Classification of Fuel Tank Storages.

Thawatchai Dacherngkhao
Sunisa Chaiklieng

Fuel was vaporized and emitted into the ambient air as hazardous chemicals included benzene, toluene, ethylbenzene, xylene (BTEX) which cause health effects to the fuel related workers at gasoline stations. Especially benzene, which is a human carcinogen and one hazardous chemical causing the fires risk.

This study aimed to study BTEX exposure and risk assessment in hazardous zones classification at fuel storage tank while fuel loading. Data was collected at 13 stations from 13 fuel truck drivers by the questionnaires, measurements of BTEX concentrations with NIOSH-1501, and BTEX exposure risk estimation following the U.S. EPA-IRIS method as the hazard index (HI). The hazardous zones (HZ) classification was divided by air pollution model. There was estimated matrix multipliers as reversed VOCs to BTEX exposure with HI and fire possibility (flammability limit level; %LEL-UFL). Total VOCs concentration and fire possibility were measured by flammable gas detector. These findings revealed that average (min-max) concentrations were 23(0.3-682.1) ppb for benzene, and 70(3.2-1,490.0) ppb for toluene, which benzene exposure were exceeded the NIOSH standard (≥100 ppb of benzene).

The health risk assessment of truck drivers as summary was indicated that five gasoline stations showed unacceptable risk (HI≥1) with the average HQ found at five stations of benzene and one station of xylene exposure. Hazardous zone was classified according to the hazardous exposure index (HzI) indicated zone I (HZ-I) and zone II (HZ-II), HZ-I was 3 meters radius and HZ-II was 3.1-5 meters radius around the fuel tanks of trucks with one station for HzI≥1 in 3 meters radius around on the average (maximum) of 0.29 (1.23) of HzI and one station for 0.5-1 of HzI at 5 meters of that average (maximum) of 0.09 (0.50) of HzI. There were no ranges of flammability limit (less than 1.3 of %LEL-UFL) at 2 meters around the tanks.

In conclusion, the safe zoning at gasoline stations for fuel truck drivers is more than 5 meters radius (safety factor=0.50; 50% of maximum HI) while fuel loading at fuel stations which should be communicated to the gasoline customers and workers for safety awareness and prevention of VOCs exposure.

APOSHO-009

Innovative Safety: Building a Safety Culture with Social Media

David Lim

According to Forbes magazine, in 2023, an estimated 4.9 billion people used social media worldwide. A single person has access to six to seven different platforms every month. In 2024, 65.5% of people access the internet using a mobile device. Literally anyone has access to social media regardless of age, race or gender. Social media is used to connect people and share ideas. It is also used widely on a corporate or organizational level, mostly for marketing purposes or to communicate with clients. However, it can also serve as a very powerful tool to enhance workplace safety and implement safety culture.

The usage of different concepts of contents and various social media platforms has made communication more effective and efficient with our members, but also with members of the public, employees, and safety professionals. Our organization currently uses five different social media platforms. Through case studies, I will explain how we interact with people on the internet.

Images like illustrations and cartoons can convey the meaning or essence more effectively than a verbal description. Social media is an effective tool to spread information, improve safety measures, and promote better practices. It serves as an effective tool in delivering procedures or information. A tap of a finger can send crucial safety information instantly. However, the world of social media changes day by day, making adaptation inevitable. In recent years, visual content like YouTube short-form content is more preferred by the audience.

The presentation will focus on how social media is being adopted in our organization, and how to adapt to the evolution of social media.

Customizing Safety: A Blueprint for Establishing Research Centre for Design for Safety.

Vincent HO
Nicole YIU

Establishing the Research Centre for Design for Safety (RCDfS) in Hong Kong is a model for creating dedicated research and innovation hubs focused on enhancing safety in the construction industry. This paper outlines the general steps and strategies employed in setting up the RCDfS, offering a replicable framework for other countries aiming to foster a safety culture through similar initiatives.

The process began with a comprehensive needs assessment to identify critical safety challenges within the local construction industry. The centre was established through collaboration with relevant research institutions, governmental organisations, and industry stakeholders in occupational safety and health. Key steps included securing funding, forming an interdisciplinary team, and establishing partnerships with local industry advisors. Initial activities focused on raising awareness through events such as safety competitions, workshops, and webinars. These activities were designed to engage the local industry and expand the centre's influence. Continuous engagement with researchers and industry professionals facilitated the analysis of local safety issues and the development of tailored solutions. The framework emphasised university-industry-research collaboration to ensure the practical application of research findings.

The successful establishment of the RCDfS has led to significant advancements in safety practices within the construction sector. The centre's activities have fostered innovation, improved safety awareness, and facilitated the adoption of proactive safety measures. By maintaining close collaboration with industry advisors and stakeholders, the RCDfS has ensured that its research and initiatives are practical and impactful, leading to a measurable reduction in workplace accidents

The experience of establishing the RCDfS in Hong Kong provides valuable insights and a practical framework for other countries aiming to enhance construction safety. Key success factors include a strong foundational knowledge base, interdisciplinary collaboration, continuous industry engagement, and a proactive approach to safety education and innovation. By adopting similar strategies, other regions can effectively address their unique safety challenges and foster a safety culture within their construction industries.

AI-Enhanced Rapid Audiogram Interpretation in Occupational Health: Integration of a Fine-tuned LLM within the OSH-Hazcare App

Muhammad Zafri bin Zainuddin
Mohd Zuhairi bin Zainuddin

Background:

Timely and accurate interpretation of audiograms is crucial for effective hearing conservation in occupational health. Traditional methods can be time-consuming, potentially delaying interventions. This study explores the integration of a fine-tuned Large Language Model (LLM) for rapid audiogram interpretation within OSH-Hazcare, our medical surveillance app for workers. We focus on the LLM's potential to distinguish between sensorineural and conductive hearing loss patterns in the app's audiometry module.

Methods:

We fine-tuned the Gemini Flash 1.5 LLM on a diverse annotated audiogram dataset from noise- exposed workers across various industries. The model was then integrated into the audiometry portion of the OSH-Hazcare app. Within this context, we applied the LLM to interpret a set of audiograms along with accompanying demographic and occupational data. The LLM was prompted to identify patterns indicative of sensorineural or conductive hearing loss and provide concise interpretations, leveraging the app's existing data structure.

Results:

The OSH-Hazcare-integrated LLM demonstrated:

1. Seamless integration: Rapid audiogram interpretations within the app's workflow.
2. Specialized pattern recognition: Identification of occupation-specific audiometric patterns enhances the app’s capabilities.
3. Contextual reporting: Generated descriptions considering occupational factors and potential implications of noise exposure, complementing the app's medical surveillance features

Conclusion:

This study showcases the potential of integrating a fine-tuned LLM into OSH-Hazcare to accelerate preliminary audiogram interpretation in occupational health settings. The model's ability to provide prompt, specialized analyses within the app could enable quicker case triaging and more timely interventions. Future work will focus on expanding the LLM's capabilities within OSH-Hazcare and validating its performance against expert interpretations.

The effective utilization of Self-Diagnosis Check List for Assessment of Worker's Accumulated Fatigue

Itsuki MIZUI

Background:

Developing brain and heart disease due to overworking is a serious problem for workers, their families and companies. Furthermore, *"KAROSHI"*, or death from overworking, is a serious problem in Japan. For prevention of these health hazards due to overworking, we created *"Self-Diagnosis Check List for Assessment of Workers' Accumulated Fatigue"*, hereinafter called *"SCWAF"* and *"Check List for Assessment of Workers' Accumulated Fatigue by families"*, hereinafter called *"SCWAFF"*. We will introduce the contents and the effective use of *"SCWAF"*.

Methods:

Firstly, workers will answer 14 questions of subjective symptoms for the past month. The questions include work time interval, the time of rest from closing time until the start of the next working day, appetite for food and sleeping time. Secondly, workers will answer 13 questions about their work situation for the past month. Thirdly, these answers are scored. For example, "hardly ever" is 0, "sometimes" is 1, "often" is 3 and rated on a scale of 1 to 4. Finally, these scales are scored 1 to 7. The higher the score is, the higher the possibility of accumulated fatigue is by more than 2 up to a maximum of 7points. If workers get a high score, they need to change their work conditions and see an occupational physician.

Results:

The SCWAF is able to measure the workers' accumulated fatigue easily and workers can realize and change their own condition. Therefore, the checklist can be a useful tool for the prevention of the health hazard due to overworking.

Conclusion:

The SCWAF facilitates workers' self-recognition and can be used as a medical pre-questionnaire for consultation by occupational physician because workers can check their accumulated fatigue level easily. Also, workers' family members can be recognized and advise based on the worker's appearance from the family's point of view by using the SCWAFF. It also can be beneficial when their families discuss their work situation and rest for improvement.

Seat Suspension Design for Reduction of Whole-Body Vibration of Forklift Drivers in Warehouse.

Anuwat Kongjareon
Vichai Pruktharathikul
Sunisa Chaiklieng

Background:

Whole-body vibration transmitted through the seat during forklift operation significantly contributes to musculoskeletal disorders among forklift operators. The study aims to design vibration absorbing materials for forklift driver seats and to compare whole-body vibration levels before and after implementing the new design

Methods:

The research employs a quasi-experimental study approach conducted in real workplace settings, measuring whole-body vibration levels of forklift drivers using a human vibration instrument under normal working conditions.

Results:

The result of combination of butyl rubber sheets that were 25 x 25 x 1.5 cm in width, length and thickness, as well as layer 1 and layer 2 foam sponges that were 53 x 42 x 5 cm in size, improved the materials inside the seat. The measurement of the whole-body vibration exposure compared to the average period of 8 hours A (8) before and after the design of the vibration absorbing material inside the forklift seat showed significant differences in all three cases. While comparing the measurement group's vibration values to the ISO 2631-1, 1997 standard over an 8-hour period (A8), it was discovered that the vibration value exceeded the standard by 97.06% of 100% prior to design, and that the vibration exceeding the standard decreased to 50.00 percent of all measurements following design..

Conclusion:

This study concludes that incorporating butyl rubber and foam sponge into forklift driver seats effectively reduces whole-body vibration transmitted through the seat during forklift operation.

Ergonomics risk on musculoskeletal disorders among cultivated agriculturists in upper northeastern, Thailand.

Worawan Poochada
Sunisa Chaiklieng

Background:

The agricultural activities accounted for the majority of informal employment in Thailand. There is the high prevalence of musculoskeletal disorders (MSDs) among agriculturists and the previous study show that the type of farming was related to part of body pains. This study aims to investigate the ergonomics risk among cultivating agriculturists.

Methods:

This cross-sectional descriptive study was to assess the ergonomics risk from agricultural activities among cultivating agriculturist who were 18 years and older, and located in upper northeastern, Thailand; Khon Kaen province, Udon Thani province, and Nong Bua Lamphu province. Observational technique of ergonomics risk assessment (Rapid Entire Body Assessment; REBA) was used. Grand score of REBA were classified into 5 risk levels: negligible risk level, low risk level, moderate risk level, high risk level, and very high-risk level.

Results:

Among 636 agriculturists, 67.61% were female, average age at 55.57 (±10.38) years old. The three popular plants in studied area were rice, sugarcane, and cassava, respectively. Most cultivators had high ergonomics risk (34.75%), followed by moderate risk (31.92%) and acceptable risk (15.88%), respectively. If classified by type of cultivation, it was found that farmers growing sugarcane (48.75%), corn (37.50%), rice (30.89%), and vegetables (44.44%) were mainly ergonomic risks at high levels. For cultivating cassava (48.39%), rubber (41.86%) and fruit (40.00%), the ergonomic risks are mostly moderate level. Awkward posture for cultivated agriculturist were squatting or kneeling, and trunk blending.

Conclusion:

Most of cultivators had high risk level of ergonomics for working posture. Therefore, awareness on safe working posture in their activities should be promoted and the MSDs surveillance should be created, including designing additional equipment for work to be convenient and suitable for future cultivation.

Health Risk Assessment of Formaldehyde Exposure Among Hospital Staff in Histopathology Tissue Preservation.

Fera Shima

Background:

Formaldehyde, a known human carcinogen, poses significant health risks to hospital staff, particularly in histopathology where it is extensively used for preserving tissue samples. This study aims to evaluate the extent of formaldehyde exposure during tissue grossing procedures and to identify effective control measures. The objective is to enhance workplace safety by mitigating the associated health hazards and exposures.

Methods:

The research method involved a case report of a Chemical Health Risk Assessment (CHRA) and a chemical exposure monitoring program conducted during formaldehyde-exposed tissue grossing at pathology laboratories of two hospitals in Malaysia (2020 and 2022). Based on the results, the adequacy of current control measures is evaluated to ensure they effectively mitigate formaldehyde exposure risks for hospital staff.

Results:

Formaldehyde exposure monitoring revealed personal exposures of eight-hour full-period and short-term samples to be below the detection limit value. These results compare favorably with OSHA's Permissible Exposure Limits (PEL-TWA and PEL-STEL) while utilizing control measures like grossing stations with local exhaust ventilation (LEV), surgical masks, safety glasses, and nitrile rubber gloves, along with safe work procedures.

Conclusion:

This case study successfully evaluated formaldehyde exposure during tissue grossing at two Malaysian hospitals. The study confirms that a combination of control measures, including local exhaust ventilation (LEV) systems, personal protective equipment (PPE), and safe work practices, effectively minimized exposure levels below OSHA's permissible limits (PEL). These findings demonstrate the effectiveness of this control strategy and its potential for broader application in pathology laboratories of other hospitals to mitigate formaldehyde exposure risks and enhance worker safety.

The study of sensitivity, specificity and accuracy of the developed risk matrix compare with the serum cholinesterase test.

Chuthamas Chagkornburee
Sunisa Chaiklieng
Pornnapa Suggaravetsiri

Background:

Exposure of pesticide on human health is an important issue due to the agricultural sector in global. The problem is a possible cause of acute and chronic effects. Thus, cholinesterase reactive paper was widely used in Thailand to be screening for pesticides exposure and risk. However, rarely study determines developed risk matrix for occupational exposure to pesticides. This study aimed to study sensitivity, specificity and accuracy for the risk analysis from risk matrix development compared with the serum cholinesterase test kit.

Methods:

The data were collected in this study both of questionnaire and serum cholinesterase test. Participants were volunteer agricultural workers (pesticide exposure) including use and unuse of pesticides in the total of 206 agricultural workers from 6 provinces in the northeast of Thailand. The risk matrix development was calculated by work-related pesticide use level and prevention (5 likelihood levels) multiplied by adverse symptoms level (4 severity levels). The results were risk score 1-20, these were classified to be 2 risk levels (scores ≤5 = low risk; >5 = high). In addition, finger blood examination met the criteria conditions as follows, temperature 25 degrees Celsius, the researcher test by 1 drop of serum without red blood cell into cholinesterase reactive paper, afterward at 7 minutes, the researcher compared results of color changing with standard guideline, these were classified by 2 groups (normal to safe low risk; and risk to unsafe level).

Results:

Of 206 volunteer participants had both risk assessment matrix and cholinesterase reactive paper results. Most of them were 107 female (51.94%), 99 male (48.06%). Age ranged 19-76 years old (mean= 53.47; SD=10.35). From the test of cholinesterase, the prevalence of the pesticides exposure was 83.98% (95%CI: 78.97-88.99). Sensitivity was 30.64% (95%CI: 24.34-36.93). Specificity was 81.82% (95%CI: 76.55-87.09). Positive predictive value (PPV) was 89.83% (95%CI: 85.7-93.96).

Conclusion:

Active case finding is a good guidance to perform the surveillance program. Therefore, next study should be improving develop tools for self-assessment among pesticide applicators.

Innovations and Impact of the Research Centre for Design for Safety in Hong Kong.

Vincent HO
Nicole YIU

The Hong Kong Polytechnic University (PolyU) has established the Research Centre for Design for Safety (RCDfS) to address the urgent need for enhanced safety in the construction industry in Hong Kong. Building on a strong foundation in safety-related research and education, particularly within the Department of Civil and Environmental Engineering (CEE), the RCDfS leverages the interdisciplinary strengths of CEE, the Department of Building and Real Estate (BRE), and the Industrial Centre (IC). The centre aims to develop a research capability to embed safety into every aspect of construction design and practice, transforming the construction industry's approach to safety from reactive compliance to proactive prevention.

RCDfS employs a multifaceted approach to achieve its objectives. RCDfS includes an open-access, web-based knowledge centre as a depository of literature, regulations, codes of practices, guidelines, project reports, and case studies related to DfS around the world. RCDfS organises PolyU CEE Asia-Pacific Design for Safety Award Competitions to encourage innovative safety solutions in construction design. We also organise regular workshops and webinars to provide the industry with continuous education and resources on DfS principles. These activities aim to foster collaboration among students, faculty, and industry professionals, promoting the widespread adoption of safety-centred design practices.

The implementation of these activities has yielded significant positive outcomes. The annual competitions stimulated creativity and practical safety solutions, leading to several innovative products and design/build projects adopted by the industry. Workshops and webinars enhanced safety awareness and provided practical insights into risk assessment, hazard identification, and best practices. The Centre also aims to improve workers' well-being by fostering a proactive safety culture and providing continuous education and resources. RCDfS makes substantial contributions to safer construction practices locally and internationally, demonstrating the importance of interdisciplinary collaboration in achieving higher safety standards.

Workplace Health Risk Assessment in a Geothermal Drilling Industry – PHILIPPINES.

Dr. Rogelio V Dazo, JR

Background:

Under Republic Act 11058, the State affirms labor as a primary social and economic force, and that a safe and healthy workforce is an integral aspect of nation building. Specifically, the State shall ensure a safe and a healthful workplace for all working people by affording them full protection against all hazards (safety or health) in their work environment. Therefore, with this RA 11058, a safe and healthy workplace for its workers should be the goal of every industry.

Methods:

This paper describes the processes conducted in dealing with health hazards and their risks in the workplace. The workplace described here is ThermaPrime Drilling Corp. which is a drilling company serving the geothermal energy industry. After identification of the hazards and their risks, these are evaluated against existing standards to determine their potential to cause harm upon exposure. Control measures are then determined and established to reduce the level of exposure to "as low as reasonably practicable" (ALARP). For the methodology, the entire ThermaPrime drilling operations and support services were broken down into assessment units. Assessment teams were formed composed of Occupational Safety and Health personnel and subject matter experts working in and familiar with the business processes and activities. Job types were identified for each assessment unit and classified according to similarity in exposure profiles. Harmful effects (Acute or Chronic) of each hazard (Physical, Chemical, Biological, and Ergonomics) were established and a Health Hazard inventory was developed. These hazards were evaluated per task, job type, and work area basis using the Task Appraisal Form. Thence, control measures, where existent, were evaluated as to effectiveness in addressing the exposure to the risk, as well as recommendations on how to improve on these measures. A list of either remedial action plans or measures to address the identified risks, as well as their prioritization, are included in this paper. These control measures were prioritized to assist management which measure to undertake first, identify the person responsible to address the gap, and the completion target date of the measure and correspondingly documented.

Results:

ThermaPrime develop Health Hazard Register of all identified physical, biological, chemical, ergonomic and psychological stress that workers maybe expose to and may have an adverse effect to their health. Existing control measures were identified and evaluated if these are sufficient, if not, then additional control measures were added as long as it is ALARP. This also determines the level of risk of the health hazard as to low, medium or high to help management prioritize controlling these hazards.

Conclusion:

Controlling health hazard is very important in any type of industry, it is vital to identify these hazards to tailor fit all actions to be done in order to control these hazards and prevent or minimized the effect to health of those who will be exposed. These activities and their results are subjected to regular reviews, updates, and improvements; document updates are made as necessary; and with multiple active participants contributing to the process. This process makes the document a 'live' document.

Leveraging digitalization for Enhanced Fitness-to-Work Assessments in Occupational Health.

Dr. Shawaludin Husin

Background:

Ensuring that employees are fit to work is a critical aspect of occupational health, particularly for roles with significant physical and mental demands. Traditional methods of fitness-to-work assessments can be cumbersome and inefficient, leading to potential risks for both employees and employers. Digitalization provides a comprehensive, web-based solution designed to streamline these assessments, ensuring compliance with regulations and enhancing overall workplace safety. To evaluate the effectiveness of digitalization in automating and enhancing fitness-to-work assessments, thereby improving occupational health management.

Methods:

A comprehensive review of digitalization functionalities was conducted, focusing on its web-based and mobile capabilities, automated processes, regulatory alignment, record-keeping, and analytical features. Data was collected from various organizations using digitalization to assess its impact on fitness-to-work assessments and overall occupational health management.

Results:

Organizations using digitalization reported significant improvements in the efficiency and accuracy of fitness-to-work assessments. The automated processes reduced the administrative burden, while the analytical features enabled better tracking and comparison of health data. Employers benefited from enhanced compliance with regulatory standards, and employees experienced improved accessibility to health assessments.

Conclusion:

Digitalization represents a significant advancement in the field of occupational health management. By automating and streamlining fitness-to-work assessments, it provides substantial benefits to employers, employees, and occupational health doctors. The system not only ensures regulatory compliance but also enhances workplace safety and health outcomes. Future research should focus on long-term impacts and potential enhancements to the system's capabilities.

Promoting Occupational Safety and Health through Development of a Mobile Application in Hong Kong, China

Mr. Li Wai-Kei

Background:

One of the major missions of the Labour Department is to ensure that risks to people's safety and health at work are properly managed by inspection and enforcement, publicity and promotion, as well as education and training.

To achieve this mission, a mobile application has been developed in order to enhance our publicity work to promote occupational safety and health (OSH) in Hong Kong, China. This initiative targets key stakeholders, including management, employees, safety officers, and industry partners, aiming to enhance safety practices and awareness across the board.

Methods:

A mobile application has been developed to provide user-friendly interface and attractive graphics. The key features of the mobile application are listed as below:

- "Work Safety Alert" in text and animation is to alert employers, contractors and employees to the occurrences of serious or fatal work injuries and remind them of the relevant safety and health measures needed to be taken to prevent recurrence of the tragedy.
- "Online OSH Complaint Form" enables employees and members of public to lodge complaints against OSH malpractices more expeditiously and conveniently.
- "Online OSH Training Course Enrolment" facilitates employers or employees easy signing up free-of-charge OSH training courses organised by the Labour Department.

Results:

- The mobile application "OSH 2.0" was launched in March 2024.
- Positive feedback and interest were received from workers and stakeholder.
- Increased awareness and understanding of the OSH through the mobile application.

Conclusion:

This presentation aims to demonstrate how our mobile application can provide the latest OSH information to assist different industry sectors to improve OSH performance, leading to a safer and more efficient workplace. By embracing this innovative tool, we would like to reduce risks, ensure compliance, and foster a culture of safety.

Lead Poisoning Management in Seven Lead Factories in Samut Prakan Province: A Five Years Retrospective Cohort Study.

Kate Chaivatcharaporn

Background:

Medical surveillance data of lead workers in seven lead factories in Samut Prakan province shown different prevalence of lead poisoning. This study aimed to study the prevalence and lead poisoning management in each factory.

Methods:

A retrospective cohort study was done. Seven lead factories in Samut Prakan province were included. Secondary data recorded of occupational medicine documents in Samut Prakan hospital in the year 2018 and 2022 were collected and analyzed using descriptive statistics. Factory profile, workplace monitoring data, medical surveillance data and walkthrough survey data were included.

Results:

Lead poisoning prevalence varied from zero to 14.3% in six factories in 2018 and zero to 6.5 % in seven factories in 2022. Most factories used to send their workers for chelation therapy which temporary lowered blood lead level.

Most factories shown good correlation between health surveillance data and workplace monitoring data. Two factories shown conflict data, there are lead poisoning cases presented in normal concentration of lead in workplace atmosphere. When repeating air sampling performed by governmental industrial hygiene unit, workplace lead air concentration significantly rose above limit. Engineering control along with appropriate PPEs and workers' hygiene improvement had been conducted in some factories. Furthermore, Samut Prakan hospital provided an industry-specific group occupational health system for all lead factories in Samut Prakan since 2017 and conducted "LEAD Health Group" where safety officers shared and learned techniques to reduce blood lead levels for their workers. These measures help all lead factories to prevent occupational lead poisoning sustainably.

Conclusion:

In conclusion, lead poisoning cases decreased constantly. Lead factories should focus on accurate workplace lead monitoring in order to make effectively lead exposure control in workplace.

APOSHO-022

Factors associated with menopausal disorders in working women in Japan.

Miho Lida, Sei Harada, Naoko Miyagawa, Atsuko Miyake, Minako Matsumoto, Shun Edagawa, Ryota Toki, Aya Hirata, Toru Takebayashi

Background:

Menopausal symptoms in working women can affect society through reduced work productivity and unemployment. However, few evidence exists on ways to maintain their health from an occupational health perspective. This study aimed to examine the association of menopausal disorders with various factors among working women in Japan.

Methods:

A longitudinal study was conducted among working women who participated in a community cohort study. Baseline surveys were conducted in 2012-2014, and follow-up surveys in 2018-2020. Women aged 40-60 years with irregular menstrual cycles or within 5 years of menopause at follow-up were selected. Through questionnaires at follow-up, women were asked if they had ever experienced menopausal disorders (menopausal symptoms that interfered with daily life). Degrees of symptoms were evaluated by Simplified Menopausal Index (SMI). Women who indicated that menopausal disorders existed at baseline were excluded. Those who developed menopausal disorders and those who didn't were compared on a broad range of factors obtained at baseline.

Results:

Of the 460 women analyzed (age 45.6 ± 4.8 years at baseline), 71 (15.4%) developed menopausal disorders. Of those, 42.2% reported an SMI score > 50 indicating medical consultation was recommended, but 66.2% didn't visit a medical institution. There were no differences in age, BMI, menopausal status, education, or family structure, but the proportion of women who drank regularly and reported insomnia at baseline were higher, and physical activity level was lower in the onset group. Factors such as social isolation indicated poorer psychological status in the onset group. No differences were observed in employment status or total hours worked in a week. However, women who developed menopausal disorders had a higher percentage of effort-reward imbalance and less work control.

Conclusion:

This study indicated that multifaceted support, including lifestyle, psychosocial health, and workplace support, may be key to preventing menopausal disorders in working women.

Prevalence of hepatobiliary diseases and pesticide exposure among agricultural workers in the northeastern region of Thailand.

Kulthida Y. Kopolrat
Sunisa Chaiklieng
Paiboon Sithithaworn
Pornnapa Suggaravetsiri
Kannika Trinnawoottipong

Background:

Occupational exposure to pesticides has been identified in the development of hepatobiliary diseases, especially liver cancer or cholangiocarcinoma (CCA). Pesticides play a major role in Thai agriculture by protecting crops and boosting yields. Therefore, this study aimed to determine the prevalence of associated hepatobiliary diseases and pesticides exposure via serum cholinesterase levels determination among agricultural workers in Northeastern Thailand.

Methods:

Data of biological monitoring via serum cholinesterase test on pesticides exposure was collected from the subdistrict health-promoting hospital in Khon Kaen, Roi Et, Udon Thani, Nong Bua Lamphu, Kalasin, Buriram, Nakhon Phanom, and Sakon Nakhon provinces and the abdominal ultrasonographic findings of the CCA risk population from the Isan cohort during 2016-2024. Data was analysed using descriptive and inferential statistics with the STATA version 11.0 program.

Results:

Among 917 agriculturists, most of them were female (60.20%), the average age was 54.88 years (SD = 8.53). The results of this study showed that the highest prevalence of hepatobiliary disease (46.03%), and periductal fibrosis (25.93%) and abnormal serum cholinesterase levels (89.42%), among agricultural workers was in Sakon Nakhon province. The prevalence of abnormal serum cholinesterase in males (84.11%) was higher than those in females (65.76%) ($P<0.001$). Serum cholinesterase levels and the severity of hepatobiliary diseases had a significantly positive linear correlation, although this correlation was probably low.

Conclusion:

The study highlights a link between pesticides exposure and hepatobiliary diseases. This information is helpful for further area-based studies on the association between pesticide exposure and long-term effects of liver cancer or cholangiocarcinoma, as well as the identification of risk factors for preventing pesticide exposure and reducing the risk of hepatobiliary disease or liver cancer.

SDS Implementation and Intelligent Disaster Prevention Applications

Chi-Min Shu
Gan-Syue Guo

Background:

With the swift evolution of industrial civilization, countless businesses in their pursuit of profits began to overlook intrinsic harm caused by the production process. Over time, this neglect undermined process safety management (PSM), obstructing chemical safety management's advancement. A lack of self-built safety data sheets (SDS) resulted in superficial chemical management, causing potential safety issues. Regarding SDS, there is often omitted parameters, hindering the establishment of fundamental safety information. This could impact process safety implementation. Moreover, inaccurate parameters produce incomplete understanding of chemical properties. There is room for enhancement in SDS depth, and slow data updates make SDS shareability difficult.

Methods:

This study implemented intelligent management by utilizing an information platform compliant with Industry 4.0 standards. It involved conducting actual tests and verifications of safety-related parameters, such as fire and explosions, in line with international standards, integrating process safety information (PSI), and creating an in-house SDS database.

Results:

Employing scientific and professional methods, we extensively and precisely identified the genuine hazardous aspects of chemicals. This facilitated the implementation of effective PSM and heightened hazard awareness among employees. As a result, we contributed to the enhancement of industrial safety standards across the board, ensuring stable and sustainable industrial production to safeguard human life. This root-cause resolution aligns with the concepts of environment, social, and governance (ESG) and addresses several dimensions of the sustainable development goals (SDG), encompassing the third, eighth, and twelfth goals of the SDG.

Conclusion:

Understanding the true hazards of chemicals in detail and integrating them into production processes is a unified effort aimed at human safety, thereby contributing to sustainable development on our planet.

Emerging Risk of Smartwatch usage at Plant Area and How to manage it.

Naziha Mohamed Nadzirin

Background:

Smartwatch is a popular gadget and being used widely. It offers various functionalities on top of timekeeping, ranging from fitness tracking and health monitoring to receiving/sending notifications/telephone calls, taking photos and productivity tools. Currently, most plants/process area allowed the usage of smartwatch. The newly released IEC TS 60079-48, a guide on the use of Portable or Personal Electronic Equipment as well as Energy Institute Research Reports highlighted that smartwatches could produce an ignition source due to device is powered by rechargeable lithium-ion cells. The objective is this paper to discuss how to manage smartwatch usage at hazardous area specifically in the plant or process area.

Methods:

Benchmarking current practices among energy producers, comparison of standards/guidelines, product specifications are referred, to come up with recommendation.

Results:

IEC TS 60079-48 is the latest guideline and provided the most detail technical requirements. Research reports by Energy Institute also found that smartwatch usage posed risk of fire at hazardous areas. Beside risk of fire, smartwatch also posed other hazards such as security (photo taking in the plant). In addition, the power capacity of smartwatches is getting bigger and bigger with more functionalities are being introduced. Following IEC TS 60079-48 guideline where smartwatch to be assessed and need to meet certain criteria such as sizes, battery capacity, type of material etc. to allow usage at hazardous area is recommended.

Conclusion:

There is a strong technical justification to control the usage of smartwatch in the plant. Following IEC TS 60079-48 guideline may be challenging and perhaps the most practical way is totally prohibiting the usage at plant(hazardous) area.

Challenges in Utilizing Unmanned Aerial Vehicles (UAV) for Chemical Emergency Response.

Punnapong Wisai
Eakkawit Phungtong
Mahunnop Phimkhet
Natthaphong Chaiyakham
Supachai Kaewpoung
Kiattisak Batsungnoen

Background:

This study introduces a novel real-time air quality monitoring system that installed with unmanned aerial vehicles (UAVs). The study aims to assess air quality in areas with significant health risks or difficult accessibility.

Methods:

The design and development utilized a low-cost sensor mounted on the DJI Mavic Air 2S drone, which facilitated the measurement of key parameters such as PM2.5, PM10, carbon dioxide, temperature, and humidity. The development involved four main components: 1) The air quality sensors were linked using the Modbus RTU RS-485 protocol; 2) Core data processing was handled by Node-RED; 3) A data logger system was implemented on a Raspberry Pi 4 with 8GB; and 4) A web application for real-time monitoring was created. The sensor's accuracy was verified using a standard air quality measurement device. The experiment measured simulated 2 pollutants from cigarettes smoke and diesel engine exhaust over a 3-minute collection period.

Results:

The results from both measurement types showed strong agreement with the concentrations of PM2.5, PM10, and carbon dioxide in the cigarette smoke environment, which peaked at 93.7 µg/m³, 124.9 µg/m³, and 3076.3 PPM, respectively. In contrast, the diesel engine exhaust exhibited maximum concentrations of 26.1 µg/m³ for PM2.5, 32.5 µg/m³ for PM10, and 2807.9 PPM for carbon dioxide. The sensor's high accuracy and excellent performance when equipped on UAVs demonstrate that our real-time air quality monitoring system, accessed through a web application, is a cost-effective and dependable solution for measuring air quality.

Conclusion:

This finding highlights the effectiveness of utilizing UAVs equipped with air quality sensors in polluted and high-risk environments, such as during fire incidents and chemical leaks. This technology not only protects the safety of emergency responders but also enables prompt alerts and evacuations in dangerous areas.

Safety Ownership – The missing component?

David Thomas

Background:

This paper, a thought leadership article, introduces new light in the debate around 'Safety 1 – Safety 2 approach paradigm'; developed to assist the Health and Safety Professional (HSP) in 'understanding' the impact of various parts of a 'system' on people's behaviour. These debates do not take account of the role, training and competence of the 'system owner'. From a UK paradigm, we have a term of 'duty holder', in effect the person ultimately responsible when things go wrong. The aim identifies and quantifies the antecedents for safety ownership (SO), the factor missing with approaches offered. The objectives are to define SO, establish whose job is it to understand the system, risks and mitigations including legislation; the role of line management and other professionals such as engineers; and how does this affect the role of and requirements from the HSP? Despite the number of job roles requiring a 'health and safety advisor' there's nothing in UK legislation requiring the employers to have access to advice, but a requirement for employers to obtain assistance from a variety of competent people to do the right thing. The paper considers the challenges of in house and 'outsourcing' and touches on influences of the 'leadership-followership' paradigm.

Methods:

The study uses a mixture of case studies from first person experience, publicly available recorded interviews and a semi systematic literature review to include regulatory guidance. It builds on experiences of being enforced in the UK mines and quarries sector as a duty holder, working in an H&S role in the UK's Local Authority (LA) Sector providing assistance to a number of LAs. The study compares these experiences over a 40-year period and challenges some of the basic understandings and validity of the 'Safety 1- Safety 2 paradigm'.

Results:

There is an impact on health and safety performance if there is a clearly defined duty holder who understands the organisational risks then they are in the best position to direct resources for their management and control as responsibility is personal.

Conclusion:

The study challenges the existing job title paradigm currently prevalent with its challenges around the direction of H&S and suggests that we focus on competent people rather than job titles.

Reducing Workplace Fatalities through the Internalization of Safety Awareness

Seungwon Seo

Background:

In late 2022, the South Korean government expressed its commitment to protecting workers from industrial accidents through the "Roadmap for Reducing Serious Accidents." Following this directive, the Korea Occupational Safety and Health Agency (KOSHA) has been actively working to prevent industrial accidents across various sectors.

Methods:

A notable initiative was the safety culture campaign in Gyeongsangnam-do, aimed at raising awareness about safe working practices among local residents. The campaign employed diverse strategies, including on-site campaigns at industrial complexes, where workers frequently gather, as well as in public spaces such as baseball stadiums, bank ATMs, parks, and residential areas. Additionally, the activation of safety and health education programs played a crucial role. These efforts targeted workers and the general public, emphasizing the importance of a safety-conscious mindset.

Results:

The safety culture campaign in Gyeongsangnam-do yielded significant results, with a 22.67% reduction in accident-related fatalities compared to the previous year. The number of fatalities in the region decreased from 81 in 2021 and 75 in 2022 to a record low of 58 in 2023.

Conclusion:

The safety culture campaign led by KOSHA effectively reduced the number of accident-related fatalities in Gyeongsangnam-do by fostering a safety-conscious mindset among workers and the general public. This case study underscores the importance of continuous safety education and proactive campaigns in achieving substantial improvements in workplace safety.

APOSHO-029

Investigating the Causal Relationship Between Low-Dose Environmental Cadmium Exposure and Bone Mineral Density in a Community-Based Cohort Study Using a Metabolomics Approach in Japan

Miho Lida, Sei Harada, Naoko Miyagawa, Takuma Shibuki, Atsuko Miyake, Minako Matsumoto, Shun Edagawa, Ryota Toki, Aya Hirata, Toru Takebayashi

Introduction:

The association between metal exposure and health outcomes has long been recognized, primarily within the domain of occupational health. Recent advancements in measurement technologies and public health approaches have shifted the focus towards the association between low-level environmental metal exposure throughout the life course and long-term health outcomes. In particular, cadmium has been established as a significant concern due to its links with various diseases such as diabetes, hypertension, and malignancies. This issue is especially critical in Japan and other Asian countries due to the strong correlation between cadmium exposure and common lifestyle habits including rice consumption. However, knowledge about the reality of low-dose cadmium exposure and its long-term health impacts remains insufficient. This study aims to elucidate the relationship between bone health and low-level cadmium exposure using an omics-based approach.

Methods:

We utilized data from the Tsuruoka Metabolomics Cohort Study (TMCS), a community-based cohort study in Japan initiated in 2012 and currently ongoing. We examined the relationship between urinary cadmium concentration, an indicator of chronic exposure, and subsequently measured bone mineral density (BMD). Additionally, we conducted comprehensive mediation analysis on 94 plasma metabolites, including polar metabolites measured by CE-MS, concurrent with the urinary cadmium measurements.

Results:

The study revealed a significant negative association between urinary cadmium concentration and subsequent BMD, suggesting that low-dose cadmium exposure may contribute to a decline in BMD over time. Furthermore, several metabolites, including amino acids, were identified as potential mediators in the relationship between urinary cadmium concentration and subsequent BMD.

Conclusion:

The findings suggest a possible causal relationship between low-dose cadmium exposure and subsequent bone health. These results, combined with ongoing research on the genetic background of cadmium exposure, may contribute to personalized preventive insights regarding low-level metal exposure in the environment.

POSTER PRESENTATIONS

APOSHO-Poster-001

Study on the Effectiveness of Personal Cooling Products" to help SMEs and workers better prevent heat stroke – Hong Kong Experience.

Bonnie YAU
Alice LAM

Climate change / Global warming results in hotter and longer summer. It is crucial for employers to get well prepared to mitigate risks of heat stroke at work. Proper risk assessments are necessary. Preventive measures include providing shade, ventilation, hydration, rest periods, reducing work intensity, and scheduling work during cooler times, etc. In addition to these, providing exposed employees with personal cooling products helps alleviate the problem. However, too many similar products make it difficult for employers to select effective products for heat stroke prevention.

In this study, the Occupational Safety and Health Council (OSHC) and the Hong Kong Polytechnic University investigated cooling effects of various personal cooling products. A climate chamber is set up to simulate a hot and humid environment and the research team assessed participants' physiological parameters and work efficiency while performing manual work wearing different cooling products inside the chamber.

Results revealed that cooling products, including cooling vest, PCM ice ring, neck cooler, and portable fan, effectively reduce physiological burdens (i.e. heart rates, respiratory rates, etc.), reduce work fatigue, and delay the onset of exhaustion in manual work to varied degrees. In other words, these cooling products are proven to be able to help relieve heat strain and enhance productivity in hot environments.

The study also provides evidence for enterprises to select effective personal cooling products and provide impetus for launching heat stroke prevention campaigns. Based on the findings, OSHC and the Labour Department jointly launched a promotional campaign, including a 'Cooling Products Sponsorship Scheme' for SMEs and trade unions from higher risk industries. By promoting the prevention concept and facilitating effective cooling solutions to industries, the campaign helps enterprises better meet the challenges of climate change.

APOSHO-Poster-002

Digitization and Technological Solutions to Improve Safety and Well-being in the Work Environment – Hong Kong's Experience.

Bonnie YAU
Winson YEUNG

To facilitate development of innovation applications and sharing for enhancing OSH, an Innovation and IT Committee was set up under OSHC in 2022. Players new to usual OSH arena, mostly from IT and Innovation sectors became OSH collaborators. An OSH Inno ExPo was held to facilitate exchange. An Inno OSH Award was launched to encourage inventions and technological applications.

To instill a new mind-set of Prevention Culture towards applying innovative technology and digitalization through encouraging innovations, applications and sharing across industries with a view to promote safety and well-being. Various technologies have been applied and the following are some examples.

1. In construction industry, AI facial recognition and IoT helps monitor high-risk operations. Robotics and exoskeletons avoid potential OSH hazards. Digital twins technology enhances risk mitigation, predictive maintenance, hazard identification and proactive measures. AI and IoT also enables early rescue.

2. For employees' health, biomarkers symptom AI monitoring enables identification of mental health problems, which helps devise treatment plans. A nutrition calculator APP employs AI to estimate calories of food and drinks based on photos to help maintain healthy diet. Smart Hospital initiative applies technology, e.g. automated robots avoid manual handling of heavy equipment. AI Retinal Image Analysis helps assess early risks of chronic diseases such as stroke, HBP.

3. For transport and logistics, Human Fatigue Monitoring System send early signal when driver is drowsy. Automated Parts Store using AI, IoT and robots, enhance spare parts retrieval and efficiency. Gantry Crane Remote Operations System facilitates automation of container handling operations.

4. Enhancing work efficiency, Excessive workload leads to health problems e.g. cardiovascular diseases and stress. Application of generative AI helps enhance work efficiency of OSH practitioners and general employees.

Facilitating applications and sharing is conducive to (i) reduce work accidents; (ii) cultivate a Culture of Prevention & (iii) increase productivity.

APOSHO-Poster-003

Development of an effective Balance Training Programme to Prevent Slip, Trip and Fall accidents at Workplace.

Bonnie YAU
Carol LO

Slip, trip, and fall at the same level (STF) have consistently been among the top workplace accidents all over the world. In Hong Kong, STF accounts for about 30% of occupational accidents. Manufacturing, retail, accommodation, catering, and construction are some of the higher risk industries. The trend of aging workforce would mean the problem will become more challenging. Traditionally, most fall prevention measures focus on the environment, work-related and/or management factors in workplaces.

The study tries to add one more focal point: the worker himself, with the aim of designing an exercise intervention programme for fall prevention, such that workers could (1) maintain balance, (2) be able to regain balance more readily and (3) prevent and minimize seriousness of injuries from fall.

Devise an exercise intervention programme based on literature review and relevant scientific theories. A 12-week Cluster-Randomized Controlled Trial was conducted. Experimental group followed a fall prevention exercise programme which includes progressive and diverse balance training, covering static and dynamic balance and resistance. Control group just did general stretching exercise. Participants were required to practice 10-15 minutes, five days a week, twice a day.

Results indicate significant improvements in the experimental group's static balance, dynamic balance, agility, leg strength, and explosive power, with no observable change for control group. Results also suggest that individuals with sedentary or less active lifestyles may experience even greater improvement. An ageing population would mean STF risks would be escalating in coming years. The intervention so designed has the potential to help change the trend, reducing workplace accidents and preserving the valuable workforce.

Health risk estimations on discomfort lighting condition of workers in universities, hospitals and industrial plants case study in Lao PDR.

Khamthavisouk Detchanthachack
Vichai Pruktharathikul
Sunisa Chaiklieng

Background:

According to government policy, the Lao People's Democratic Republic (PDR) promotes safety at work, including the prevention of risk factors for occupational disease. Various working conditions that affect the physical and mental health of workers such as environmental lighting can be monitoring what is dangerous to health. It requires measurement, analysis, and assessment of health risks together with the results which were compared to international standards as recommended by recognized organizations. This study's objective was to estimate the health risk of workers on light exposure in an employee's work area of universities, hospitals and industrial plants.

Methods:

This study is a cross-sectional descriptive analysis of 231 workers in the universities, hospitals, and industrial plants in Lao PDR by systematic sampling. The interview questionnaire of the comfort level of eyes classified into 2 levels of comfort and discomfort. The area measurement technique of lighting condition with a light meter (Digital Lux Meter model LX-71) with accuracy calibration and certification. Applied risk matrix for risk assessment was considered the likelihood of exposure in multiplying with the severity approach.

Results:

It was found that the prevalence of eye discomfort perception while exposure to lighting conditions was 74.90%. The lighting intensity was ranged between 43 to 221 lux. From the risk matrix, the estimation of exposure to unsuitable light condition for health risk was found at a high-risk level of 6.49% and a very high risk of 1.30%. The work area was utilization area in the production process showed that the most of exposure was at high risk (6.49%).

Conclusion:

The results of the study found eyes discomfort levels in areas where do not pass the standard, causing eye discomfort to workers, resulting in workers being at risk from exposure to discomfort lighting in the workplace. Therefore, there should be a safety management system for the employees to arrange management according to the nature of the workplace and to prevent the occurrence of visual disorders in the future that lead to occupational diseases.

APOSHO-Poster-005

Occupational Safety and Health (OSH) School-Based Gamification Intervention for Primary School Children.

Rama Krishna Supramanian
Lim Yin Cheng
Victor Hoe Chee Wai Abdullah
Nur Amani Natasha
Noor Hashimah Binti Hashim Lim

Background:

In Malaysia, the disclosure of occupational safety and health (OSH) aspects in school, especially among students is low. During the period from January 2016 to May 2017, a total of 54 accidents were reported in schools. The top 5 hazards identified were mercury spillage (15), accidents due to negligence (11), food poisoning (9), fire (7) and structural failure (3). The objective of this project is to design and implement a school-based gamification intervention to improve awareness regarding occupational safety and health (OSH) among primary school children.

Methods:

This project was divided into 2 phases, the first phase is design and development of a jigsaw puzzle with common hazards encountered by school children categorized into 3 groups mainly: school, commute to/from school and outdoor. Meanwhile, the second phase involved implementation and evaluation of the effectiveness of the intervention in improving awareness regarding OSH. The second phase uses a pre- and post-test study design involving 5 schools with a total sample size of 151 primary school children from standard 3 and 4 (age 9 – 10 years). A pre- and post-intervention evaluation was conducted using an adapted scoring questionnaire to evaluate the level of awareness towards OSH. The changes in mean score pre- and post-intervention was analyzed to determine the effectiveness of the puzzle in promoting awareness on occupational safety and health.

Results:

Four of the five schools showed marked improvement in post-test scores with changes in mean score ranging from 0 (no improvement) to 2.14. There was only one statistically significant difference found between the pre- and post-intervention scores for one of the schools (School A) with a p value of 0.014.

Conclusion:

This OSH gamification intervention is effective in raising awareness regarding OSH among school children.

APOSHO-Poster-006

Reducing Musculoskeletal Pain in Ceramic Workers: The Power of Self-Stretching Exercises

Wanpen Songkham
Kunlayanee Tantranont
Weeraporn Suthakorn

Background:

Musculoskeletal pain is a prevalent occupational health issue among ceramic workers, significantly impacting their quality of life. Implementing stretching exercise interventions may offer a practical solution to mitigate this pain. This quasi-experimental study aimed to investigate the effectiveness of a self-stretching exercise program in reducing musculoskeletal pain among ceramic workers.

Methods:

A purposive sampling method was used to select ceramic workers experiencing musculoskeletal pain. A total of 47 workers were randomly assigned to either an intervention group (n = 21) or a control group (n = 26). Both groups were matched in terms of age, working conditions, years of work experience, and baseline musculoskeletal pain scores. The intervention group participated in a self-stretching exercise program, supported by a record book and a stretching exercise poster. The control group did not receive any intervention. Follow-up assessments were conducted over six weeks.

Results:

The intervention group demonstrated a significant reduction in musculoskeletal pain post-intervention compared to pre-intervention levels ($p < .001$). Additionally, the intervention group reported significantly lower pain scores compared to the control group at the end of the study period ($p < .001$).

Conclusion:

The findings suggest that a structured self-stretching exercise program, accompanied by educational materials such as a record book and a poster, is effective in reducing musculoskeletal pain among ceramic workers. This intervention could be a valuable addition to workplace health promotion strategies.

Emotional Labor and Job Stress Among Nurses in Private Hospitals.

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Wanpen Songkham
Weeraporn Suthakorn

Background:

Emotional labor and job stress among nurses in private hospitals are significant in relation to their quality of life and work performance. This descriptive correlational research aimed to investigate emotional labor, job stress, and the association between emotional labor and job stress among nurses working in 2 private hospitals in Bangkok.

Methods:

The study included 386 participants. A simple random sampling technique was used to reach the study sample according to the proportion of nurses in each hospital. Data was collected during May 2023. The research instruments were questionnaires, the Emotional Labor Scale for Nurses, and the Korean Occupational Stress Scale-Short Form (KOSS-SF), translated into Thai. The research instruments were tested for reliability, with acceptable results (0.84 and 0.94, respectively). Data analysis was using descriptive statistics and the Point Biserial correlation coefficient.

Results:

The results revealed that the overall level of emotional labor among the sample group was moderate (80.31%), with an average score of 61.82 (SD = 5.52). Regarding specific aspects of emotional labor, the sample group also showed a moderate level of emotional labor in terms of emotional pretense by norms, patient-focused emotional suppression, and emotional control effort in profession, with percentages of 84.20%, 82.64%, and 76.94%, respectively. Regarding job stress, the sample group experienced high stress levels, with an average score of 57.80. When examining specific dimensions of job stress, the highest average scores were found for job demand (81.76), followed by job insecurity (72.52). There was a significant positive correlation between overall emotional labor and job stress at a low level ($r = 0.176$, $p < 0.001$). When considering specific dimensions, emotional control effort in profession and patient-focused emotional suppression showed a significant positive low-level correlation with job stress ($r = 0.241$, $p < 0.001$ and $r = 0.134$, $p < 0.001$, respectively) and emotional labor related to emotional pretense by norms showed no correlation with job stress ($r = -0.020$, $p > 0.05$).

Conclusion:

The results of this study indicate that occupational health nurses and related personnel should recognize the development of awareness about emotional labor and job stress among nurses in private hospitals with appropriate mental health promotion activities. This can lead to improved efficiency in their work performance and overall well-being.

APOSHO-Poster-008

Effect of a 3-Minute Mindfulness on Compassion Fatigue of Nurses in Intensive Care Units.

Muansak Takabkho
Wanpen Songkham
Thanee Kaewthummanukul

Compassion fatigue has an impact on nurses' quality of life and work quality; 3-minute mindfulness is widely accepted as an effective measure to reduce compassion fatigue. The purpose of this quasi-experimental research was to assess the effect of 3-minute mindfulness on compassion fatigue among nurses in intensive care units.

The 54 participants were randomly assigned into an experimental group (27) receiving 3-minute mindfulness and a control group (27) receiving routine care. Data was collected from January to March 2024. The tool used for data collection was the Compassion Fatigue Questionnaire with a content validity value of 0.81. This questionnaire had been validated for reliability, yielding a value of 0.90. Data were analyzed using descriptive and inferential statistics.

The results of the study found that after 4 weeks of intervention, the experimental group had a lower mean score for compassion fatigue, both for the burnout and secondary traumatic stress, compared to their pre-intervention status, with statistical significance ($p < .01$). When comparing between groups, it was found that after 4 weeks of intervention, the experimental group had a lower mean score for compassion fatigue, in both the burnout and secondary traumatic stress, than the control group, with statistical significance ($p < .01$). The findings of this study indicate that 3-minute mindfulness can reduce compassion fatigue. Therefore, this technique should be promoted among nurses in intensive care units.

Characterization and Health Risk Assessment of Particulate Matter (PM)-Bound Heavy Metals from Traffic Intersections.

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Aduldatch Sailabaht
Sudjit Karuchit
Kiattiasak Batsungnoen

Background:

Particulate matter (PM) originating from traffic contains heavy metal components, which pose significant health concern. This study aims to investigate the characteristics of PM and assess the health risks associated with exposure to PM-bound heavy metals.

Methods:

The study focused on high-risk locations in urban areas of Nakhon Ratchasima, characterized by traffic congestion. PM was measured using a Portable Aerosol Spectrometer Dust Detector (PAS), and samples of PM-bound heavy metals were collected using an IOM Sampler. Subsequently, these samples were analysed using a Field Emission Scanning Electron Microscope with Energy Dispersive Spectroscopy (FESEM-EDS). Additionally, a total of 106 individuals were randomly selected to assess health risks following the methodology of the US Environmental Protection Agency (US EPA).

Results:

The results showed that PM generated from urban traffic exhibits a size distribution between 0.253 to 2.53 µm. The average concentrations of PM were highest for TSP at 176.37 µg/m³ and Inhalable dust at 139.53 µg/m³. The majority of the studied population were male (56.60%), with an average age of 43.46 ± 16.02 years, and approximately 3.8% of participants used respiratory protective equipment, specifically N95 masks. Regarding health risk assessment from exposure to PM-bound heavy metals, Chromium (Cr) and Aluminium (Al) had Hazard Quotient (HQ) values above the acceptable limit (>1) at 5.11 and 1.35, respectively. Chromium (Cr) and Arsenic (As) had Cancer Risk (CR) values above the acceptable limit (> 1×10^{-6}) at 6.88×10^{-6} and 3.68×10^{-6}, respectively. The highest HQ and CR values were notably found among motorcycle and delivery drivers.

Conclusion:

This finding highlights the need of implementing mitigations in high-risk population exposed to particulate matter. For examples, limiting exposure duration whilst employing adequate respiratory protection, such as N95 masks. Furthermore, advocating the campaign's policy of using green energy in vehicles.

APOSHO-Poster-010

Indoor Air Quality for Risk Assessment of Health Care Workers in One Hospital of Thailand.

Chananya Panikhom
Sunisa Chaiklieng

Background:

This cross-sectional descriptive study aimed to assess indoor air quality in a hospital.

Methods:

Air quality measurements were conducted in 11 areas or 11 departments of one hospital in Northeastern Thailand, evaluating 10 parameters: temperature, relative humidity, air movement, carbon dioxide, carbon monoxide, particulate matters (PM2.5, PM10), formaldehyde, total bacteria, and total fungi. Self-administered questionnaires were used for data collection using environmental surveys among 159 health workers from 11 departments. Descriptive statistics were used for data analysis.

Results:

The assessment covered 11 areas where were 4 inpatient departments (n=74), 1 outpatient department (n=15), 3 care procedure rooms (n=40), and 3 laboratories (n=30). Four parameters exceeded the standard values which were air temperature (22.2-30.0 °C) in 5 areas (45%), relative humidity (39.5-73.0%) in 7 areas (63%), PM2.5 (3-66 µg/m^3) in 10 areas (90%), and PM10 (5-71 µg/m^3) in 8 areas (72%). Other parameters, including air movement, bacterial and fungal counts met the indoor air standards. Carbon dioxide and carbon monoxide concentrations met the air quality standards. Formaldehyde concentration was below the 8-hour occupational exposure limit (min-max: 0.0004-0.006 ppm). Risk assessment on long-term exposure to formaldehyde and potential risk of cancer after 10 years exposures were unacceptable risk (3.26 x 10^{-6}) for 54% of working areas.

Conclusion:

The study revealed that indoor air quality issues that may cause the long-term health effect of health care workers. Regular indoor air quality assessments and health risk assessments are recommended for prevention of sick building syndrome and the health surveillance among health care workers.

APOSHO-Poster-011

The mobile application of FERA ergonomics program for Musculoskeletal Disorders risk assessment in Para rubber tappers.

Sureerat Bunkobkaew
Sunisa Chaiklieng

Farmers Ergonomics Risk Assessment (FERA) was previously developed in paper form for ergonomics risk analysis. This study aimed to develop an online program via mobile application to assess ergonomic risk with FERA tool among para rubber tappers in the name of Ergo Work Healthy program on smartphones.

Farmers can assess FERA ergonomic risk by importing all variables related to FERA ergonomic risk, then develop the program to calculate, analyze, and report the level of ergonomics risk in real time. Musculoskeletal disorders Severity and Frequency was also evaluated via the program which was conducted among 30 para rubber tappers who entered into the study program of the Ergo Work Healthy on smartphones.

The program was reliable from the results of the FERA ergonomic risk level analysis comparing between using FERA paper form and the online program. There was the reliability of those results evaluated by both researchers input and the farmers' self-assessment input FERA program of ICC values = 1.00, 1.00, respectively. This FERA assessment program showed that 60% of rubber tappers had high- ergonomics risk level, followed by very high-risk level (40.00%) of rubber tapping posture. The perception of musculoskeletal discomfort was at very severe level on different areas which showed the highest prevalence in knee (23.33%), followed by feet and ankles (20.00%) and lower back (16.67%). Farmers had overall satisfaction scores with various aspects including satisfaction with the program, utilization, and efficiency of the program at the very high satisfactory level (mean (SD) = 4.50 (0.73).

In conclusion, the finding showed that the program was effective in reporting ergonomics risks and the reliability of the risk report which can be used for self-assessment of farmers' working postures to monitor the work ergonomics posture and prevention of musculoskeletal disorders

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Smart Application for Safety Observation Index.

Thitaphorn Matad
Worawan Poochada

Background:

Effective data acquisition and analysis in the safety departments are crucial for informed decision-making of organization implementation planning program. However, challenges arise due to fragmented data collection processes and limited access for site owners, leading to inefficiencies. This study aimed to streamline data acquisition for the Safety Observation Index by developing a unified application that enhances access and reduces processing time.

Methods:

The application, namely Smart Application, was developed by using Share Point, Power Apps, Power Automate, and Power BI and was conducted usability testing to compare the original data collection process with the newly developed application, that the original method required 15,960 minutes per week for operations. The measurement of operational time and feedback were gathered from 303 participants regarding accuracy and ease of use after implementation.

Results:

The Smart application significantly reduced operational time by 8,080 minutes, resulting in a new total of 7,380 minutes per week, that was a 54% decrease. Participants feedback revealed that 93.75% of that feedback were satisfied with the accuracy of data analysis of the Safety Observation Index, and 92.74% appreciated the application's usability.

Conclusion:

The implementation of the unified Smart application not only reduced the time required for data processing of but also enhanced the user satisfaction. These improvements highlight the potential for optimized workflows in safety data management, facilitating more effective data-driven decision-making.

APOSHO-Poster-013

Enhancing Value through Segregation of Molding Waste from the FFP/BMS Process.

Arunporn Susena A
Yuparat Limmongkol
Worawan Poochada

Background:

Waste management is a critical issue in the company's manufacturing process, particularly due to improper disposal of mixed waste. This has resulted in Molding waste, which includes Mold resin, Cull resin, and Stainless resin, each requiring distinct disposal methods. These discrepancies affect disposal costs and the sale value of materials. This project aimed to enhance waste management efficiency by adding value to Molding waste by segregating and Cull resin and Stainless resin from Mold resin, targeting a 70% annual reduction in disposal costs and a 4% increase in revenue from sales. Additional objective was to seek improvement of waste management standards by promoting proper waste segregation as part of the organization’s sustainability initiatives.

Methods:

Data was collected monthly on the types and quantities of waste generated, compared to the products produced, to forecast future waste volumes and establish project targets. Consultations with buyers facilitated the sale of Stainless and Cull resin, and informational materials were created to educate employees on correct waste segregation practices.

Results:

The analysis revealed that the segregated waste comprised 63% Cull resin, 28% Mold resin, and 9% Stainless resin. Notably, disposal costs for Mold resin decreased by 72%, from 22,136 THB to 6,198 THB, while revenue from the sale of Cull and Stainless resins increased by 4% annually, enhancing the organization’s cost savings.

Conclusion:

Effective waste segregation helps reduce disposal costs and adds value to waste materials. It supports a circular economy and establishes sustainable waste management standards. This approach can be applied to other manufacturing processes, allowing for continuous monitoring and improvement of waste management practices.

APOSHO-Poster-014

Analysis of Exposure Levels for N-Hexane in S. Korea

HyeYoung Byun
HeaDong Park

Background:

This study aims to identify the status of work environment measurement data of n-Hexane, a hazardous substance subject to annual periodic work environment measurement and a hazardous substance subject to management, for 6 years.

Methods:

Through the work environment measurement data of n-Hexane (2018~2023), we analyzed the number of work environment measurements by year, exposure level, measurement status by company size, and measurement status by industry.

Results:

Over the six-year period, the total number of work environment measurements of n-Hexane was 154,181, which showed an increase every year, then decreased in 2020 and 2021, and has been increasing again since 2022.

According to the results of the measurements by exposure level, the highest number of cases was less than 1% of the exposure standard (90.32%), followed by more than 1% to less than 10% of the exposure standard (7.88%), more than 10% to less than 50% of the exposure standard (1.73%), more than 50% to less than 100% of the exposure standard (0.05%), and exceeding the exposure standard (0.01%). The number of measurements by company size was dominated by businesses with more than 5 to less than 50 employees (34.0%) and more than 50 to less than 300 employees (33.7%). The number of measurements by standard industry classification was 101,492 (65.83%) in manufacturing, which was significantly higher than non-manufacturing (52,689, 34.17%).

The geometric mean of the exposure index for the manufacturing industry excluding N.D. was found to be the highest in the chemicals and chemical products manufacturing industry (26.3%), followed by apparel, clothing accessories, and fur products manufacturing industry (2.220), other products manufacturing industry (1.898), and furniture manufacturing industry (1.862).

Conclusion:

This data can be used as a basis for establishing occupational health policies to improve the working environment through more detailed analysis.

APOSHO-Poster-015

Improving Accuracy in Gravimetric Analysis of Volatile Coal Tar Pitch

Eun ji Lee
Ji Won Ro

Background:

To enhance microgram (μg) level accuracy in gravimetric analysis of volatile coal tar pitch, we conducted experiments on weighing cup weight changes. Methods included comparing weight changes based on drying methods, syringe types during benzene filtration, and syringe filter use.

Methods:

The weighing cups used in the gravimetric analysis were made by cutting aluminum foil into circles with a diameter of 3.8 cm and shaping them into cylindrical forms with a base diameter of 1.5 cm. Factors influencing accuracy were drying methods (15 min at room temperature or 90°C oven), syringe types (plastic or glass), and syringe filter use. Each cup was measured thrice to calculate pre- and post-process average differences.

Results:

Results showed room temperature drying for 15 mins yielded a 6.8±4.5 μg(AM±SD) weight difference. Oven drying for 20 mins yielded a 6.6±2.4 μg. Benzene filtration with glass syringes increased cup weight by 3.1 μg, plastic syringes by 237.7 μg. Without a syringe filter, the weight difference averaged 0.5 μg, with a filter, 31.3 μg.

Conclusion:

After acetone and hexane cleaning, room temperature drying resulted in a 6.8 μg weight change, slightly higher than the 6.6 μg from oven drying. However, the larger standard deviation in room temperature drying suggests inconsistent cup drying. Plastic syringes showed a 234.6 μg higher cup weight than glass, implying plastic dissolution in benzene. When using a syringe filter, approximately 31 μg of benzene extract is released with the filter, which should be considered during weighing. Additionally, maintaining consistent shape and weight when making weighing cups and conducting the preparation and cleaning of weighing cups on the same day under the same temperature and humidity conditions are crucial factors for improving the accuracy of gravimetric analysis.