

## **Safety impacts of alcohol and other drugs in the construction industry: A research methodology**

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### **ABSTRACT**

Anecdotal evidence from the infrastructure and building sectors highlights issues of drugs and alcohol and its association with safety risk on construction sites. Operating machinery and mobile equipment, proximity to live traffic together with congested sites, electrical equipment and operating at heights conspire to accentuate the potential adverse impact of drugs and alcohol in the workplace. While most Australian jurisdictions have identified this as a critical safety issue, information is limited regarding the prevalence of alcohol and other drugs in the workplace and there is limited evidential guidance regarding how to effectively and efficiently address such an issue. No known study has scientifically evaluated the relationship between the use of drugs and alcohol and safety impacts in construction, and there has been only limited adoption of nationally coordinated strategies, supported by employers and employees to render it socially unacceptable to arrive at a construction workplace with impaired judgement from drugs and alcohol. A nationally consistent collaborative approach across the construction workforce - involving employers and employees; clients; unions; contractors and sub-contractors is required to engender a cultural change in the construction workforce – in a similar manner to the on-going initiative in securing a cultural change to drink-driving in our society where peer intervention and support is encouraged. This study has four key objectives. Firstly, using the standard World Health Organisation AUDIT, a national qualitative and quantitative assessment of the use of drugs and alcohol will be carried out. This will build upon similar studies carried out in the Australian energy and mining sectors. Secondly, the development of an appropriate industry policy will adopt a non-punitive and rehabilitative approach developed in consultation with employers and employees across the infrastructure and building sectors, with the aim it be adopted nationally for adoption at the construction workplace. Thirdly, an industry-specific cultural change management program will be developed through a nationally collaborative approach to reducing the risk of impaired performance on construction sites and increasing workers' commitment to drugs and alcohol safety. Finally, an implementation plan will be developed from data gathered from both managers and construction employees. Such an approach stands to benefit not only occupational health and safety, through a greater understanding of the safety impacts of alcohol and other drugs at work, but also alcohol and drug use as a wider community health issue. This paper will provide an overview of the background and significance of the study as well as outlining the proposed methodology that will be used to evaluate the safety impacts of alcohol and other drugs in the construction industry.

**KEY WORDS:** Construction, occupational health and safety, alcohol and other drugs<sup>1</sup>

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## **INTRODUCTION**

While it is estimated that 640,700 persons suffered a work-related injury or illness in 2009-2010 [1], and 444 persons lost their lives as a result of a work-related traumatic injury in 2008-2009 in Australia, [2] very little is known about what proportion of such accidents are directly attributable to the effects of alcohol and other drugs (AOD). This is despite AOD consumption being relatively prevalent within the Australian community [3] and the clear link between such consumption and subsequent declines in cognitive and behavioural performance [4]. Nevertheless, the impact of employees' AOD consumption on workplace safety and performance is an on-going issue for Australian employees, particularly within the construction industry [5]. This documented concern is reflected in the increasing array of workplace policies being developed to improve construction site safety through addressing the issue of employee impairment. Improving workplace health and safety is particularly important for this arena given the current size, economic value and expanding nature of the Australian construction industry. It is proposed that the development of such initiatives should firstly be grounded in an accurate understanding of the aetiology, impact and consequences of AOD within the construction workplace. This should then be followed by the development and implementation of tailored and effective interventions designed to specifically target the extent and severity of the problem within the cultural and operating context of the construction industry. It is argued that developing a nationally consistent, contemporary and collaborative approach across the construction workforce is needed to engender a cultural change in the workforce. Such an approach may take a similar form to the on-going initiative in securing a cultural change to drink-driving in our society where peer intervention and support is encouraged and appears integral to maintaining such change [6].

The current research aims to scientifically evaluate the relationship between the use of AOD and the safety impacts within the Australian construction industry to engender a cultural change in the workforce- to render it unacceptable to arrive at a construction workplace with impaired judgement from AODs. A nationally consistent and collaborative approach across the construction workforce- involving government representatives; employers and employees; unions; and other key industry stakeholders and experts will be adopted. An evaluation of the extent and nature of the problem, through an AOD consumption and behaviour audit, will inform the development of an appropriate industry policy and cultural change management program. The study builds on the credibility and networks developed through the CRC for Construction Innovation's landmark achievements in safety including the Construction Safety Competency Framework [7], Guide to Best Practice for Safer Construction [8], A Practical Guide to Safety Leadership [9], and the Safety Effectiveness Indicators [10;11].

### **AOD in the workplace: the Australian context**

Consideration of AODs in the workplace is pertinent for a number of reasons, not least because of the acute effects of AOD impairment on workplace health and safety. In addition to the personal and social costs, the economic costs associated with workplace fatalities and injuries continue to be substantial. For example, the

economic cost of work-related injuries in Australia is estimated to be approximately \$38.3 billion, based on the number of work-related injuries for July 2005 to June 2006 [12]. Substance abuse and the potential dangers it poses in the workplace are well documented with links to absenteeism, interpersonal problems, disciplinary problems and poor job performance and productivity. It is associated with impaired coordination, judgement and the ability to perceive and respond to hazards [13; 14; 15; 16]. There may also be increased staff turnover and the associated costs of training replacement workers, increased incidence of lateness for work, machinery damage and litigation costs [17]. The prevalence, patterns and nature of AOD consumption in the Australian workplace however are not reliably or accurately understood.

Contributing to this lack of understanding is the paucity of existing data regarding AODs in the workplace, which are problematic for several reasons. Firstly, data regarding the use, and harmful use of AODs by employed individuals, does not necessarily extrapolate to the use of AODs (and impairment) in the workplace [18; 19; 20]. Secondly, the evidence for the role of AODs in workplace injuries is inconclusive, fraught with methodological issues surrounding the interpretation of results and the under-reporting to employers by employees for fear of detection, and cannot be generalised across industries [21; 18; 22]. These issues have contributed to limited and inconclusive evidence being gathered regarding both the extent of the AOD problem in the workplace and the impact of existing workplace AOD management programs, policies and practices, despite their increasing use. Such limitations have clear implications for the development of effective programs and highlight the need to gather accurate and reliable data on AOD use in the workplace, not the workforce.

While reliable data that provide an overall estimate of the prevalence of AOD use or impairment at work are not available; several studies have attempted to estimate the prevalence of workplace substance use in Australia. [20] report the results of the 2001 National Drug Strategy Household Survey which found that riskier patterns of alcohol consumption were associated with a higher prevalence of self-reported, negative, work-related behaviours and work absences. As the frequency of drinking at short-term risky or high-risk levels increased, so did the percentage of employed recent drinkers who reported having missed at least one work day in the past 3 months due to their alcohol use; attending work under the influence of alcohol in the past 12 months and missing at least one work day in the past 3 months due to illness or injury. Based on data from the National Occupational Health and Safety Commission's second Work-Related Traumatic Fatalities Study, alcohol was a contributing factor in an estimated 4% of work-related fatalities and drugs estimated to contribute to 2% of work-related fatalities [23].

In a study that aimed to assess the AOD consumption patterns of adolescent new entrants to the Australian workforce, it was found that more than 40% of apprentices surveyed (building and construction trades) reported cannabis and alcohol patterns that placed them at risk of potential harm. In addition, 19% reported drinking alcohol and 6.7% reported using cannabis during work hours [24]. [17] explored the prevalence of AOD problems among building workers in the Australian Capital Territory (ACT). High levels of tobacco, cannabis and methamphetamine use were reported and 19% reported self-diagnosed alcohol problems, 11.5% gambling problems and 18% problems in their family life. A study of recreational drug use among workers in the mariculture and seafood industry revealed high rates of cannabis and alcohol use during the shore-based

fish farming season. Among the respondents, 50% had used cannabis in their lifetimes and 44.2% were using or had used cannabis within the preceding year. A concerning number of workers smoked 'bongs' and consumed alcohol within the 48-hours prior to completing the questionnaire [25]. [26] examined the consumption patterns of 4,193 Australian police officers. While 26% of police reported occasionally drinking at work, nearly double (48%) reported drinking with colleagues after work. Each of these studies highlights the need for further investigation into the relationship between AOD and the workplace and indeed the development of industry-specific prevention and rehabilitation strategies.

### **What has been done?**

Concern for the prevention of harm in Australian workplaces for AODs has led to the widespread development and implementation of workplace AOD policies in large organisations, and where 'safety-sensitive' work is undertaken [22]. Preliminary research suggests that any improvement may be associated with employee perceptions of the policy and the manner in which the policy was developed and implemented. Others have recommended consulting with employees and union representatives to establish agreements on the rationale for an AOD policy in order to maximise policy acceptability, and the corresponding perception of "fairness" may determine the impact of the policy [27]. A range of questions remain regarding how interventions should be developed and implemented, and the corresponding effectiveness of the initiatives on key safety performance indicators e.g., accidents and "near misses". Importantly, there appears considerable merit in examining the feasibility and effectiveness of more contemporary approaches that extend beyond traditional workshops and education-based methods and embrace techniques similar to internet e-therapy which have demonstrated positive preliminary results [28]. Furthermore, the examination of how other industries have tackled AODs and their 'journey' to achieving successful and accepted practise is paramount.

**Mining** Each state in Australia has its own mining legislation which specifically mandates the development of AOD policies which support a regime of testing (including voluntary self testing), education, and support for problem AOD users [29; 30]. The mining industry in Australia led the introduction of compulsory AOD testing to ensure that no individual is on site while impaired by AOD [31]. Mining companies maintain strict jurisdictional workplace AOD policies for AODs and offer assistance and rehabilitation support when appropriate as well as training and education-based awareness programs.

**Aviation** In 2008, new regulations came into force, aligning the aviation industry with other sensitive sectors such as mining. Administered by Civil Aviation Safety Authority (CASA), aviation organisations are now required to implement detailed drug and alcohol management plans (DAMPs) covering pre-employment testing, reasonable suspicion testing, and post-accident testing, as well as education, training and rehabilitation. The use of random testing to audit these programs is also required by CASA, and while not mandated under the DAMPs, the organisation may choose to undertake such testing under their own internal policy. The regulations cover pilots, engineers, cabin crew, flight instructors, re-fuelers, dispatchers, load controllers, baggage handlers, air traffic controllers and CASA staff that perform duties airside [32].

**Rail** Australia currently has seven rail safety regulators operating across eight states and territories (ACT is regulated by New South Wales), and a third of the rail industry operates in multiple states and deals with two or more regulators. The current state-based legislation prescribes that all rail operators implement an AOD management plan. In 2009, the Council of Australian Governments agreed to establish a national rail safety regulator to modernise Australia's rail safety regulatory system. The regulator will be operational from January 2013 and will administer a single national Act encompassing all aspects of rail safety [33].

**Power generation** Energy specific technical and safety regulation is a state and territory responsibility and is implemented through separate state-based OHS legislative instruments [34]. While, under the state-based OHS 'duty of care' there is no prescription for AOD management programs, the trend in recent years for many power generation companies, is for the implementation of an AOD management program involving education, testing and rehabilitative support.

### **The Australian construction industry**

The construction industry is high-risk for work-related death, injury and illness [35; 36; 37; 38]. It involves people working in a dynamic and ever-changing environment. Hazards and risks change frequently on a site as construction work progresses and as workers move from project to project. A large majority of the industry's workforce is employed by sub-contractors who undertake work on many different sites managed by different contractors, and often within different sectors of the industry [39; 36]. The construction industry is governed by state-based workplace health and safety legislation that places a 'duty of care' on the employer. As such, the adoption of an AOD management program is at the discretion of the employer, and is not prescribed under any specific legislation. While many companies do maintain an AOD policy and associated procedures, questions remain as to what is the best approach.

Almost universal across the Australian construction industry is the adoption of the theoretical construct of organisational safety culture. There are a variety of definitions and academic interpretations of safety culture or other terms such as climate [40, 41, 42]. When considering predominant pathways to create behavioural change in the workplace, there are two main pathways to ensure compliance: (1) the extrinsic pathway, governed by systems and rules with rewards and punishments; and (2) the intrinsic pathway, establishing voluntary compliance via individual commitment to safety [42]. While workplace alcohol and drug programs are common in industry, there is still tremendous variety across different types of industries and within industries in regards to content and outcomes. For example, in the mining industry the extrinsic pathway with a legislative framework governing mining operations and the implementation of AOD policy and programs has resulted in a heavy focus on testing. However, within the construction industry across Australia, there is generally not as extensive or explicit AOD workplace legislation and there is also wide variability between organisations, sites and practices. In general the construction industry relies heavily on an educative approach built around the intrinsic motivation of individuals to operate safely when it comes to AOD use. Furthermore

there is strategic strength in this approach particularly as establishing intrinsic commitment in organisational members results in more sustainable and reliable behavioural changes [41; 43].

Currently, there is no clear evidence on the prevalence and risk of AOD use among Australian construction workers [17]. With a continued reliance on an educative approach to this topic, there is now a national need to develop sound scientific research, based on a safety culture framework, to assist the industry in delivering appropriate, up to date, soundly researched and evaluated strategies and materials targeted at the unique needs and characteristics of the construction industry. A call for new innovations in construction site safety management and a general shift away from the traditional 'reactive approach' to risk management is apparent.

## **METHODOLOGY**

This research will make an evidence-based evaluation of the extent of AOD use in the Australian construction workforce; determine policy and practise and develop a cultural change management program to improve the safety of Australian construction sites. The project will be led by an Academic Project Leader in partnership with a senior Industry Project Leader from a major Australian construction company. The project team will collaborate with academic leaders and experts in applied research in the area and will be guided strategically by an Industry Steering Committee with membership comprising representatives from key government, industry and union groups. The project will be achieved through a four-step process:

### *(1) Drugs and alcohol consumption and behaviour audit.*

Using the standard World Health Organisation Alcohol Use Disorders Identification Test (AUDIT) and other standardised measures customised through mutual agreement with the key stakeholders, a national qualitative and quantitative assessment of the use of AODs will be carried out. Corporate headquarters and operational sites of the industry partner organisation will be visited to both distribute and collect the survey and to collect information from appropriate managers on (1) perceived effectiveness and feasibility of current policies and practices in relation to the impact of AODs on worker safety, (2) situations and work environments that are considered to be particularly challenging, (3) characteristics of past incidents involving AODs and, (4) the feasibility of trialing some of the proposed initiatives. It is expected that the survey will be distributed to approximately 1500 employees (including sub-contractors) at selected construction sites in Queensland, New South Wales, Victoria and Western Australia. Individual structured interviews or group face-to-face structured focus groups interviews will also be conducted with both management and employees and thematic analysis techniques used to identify major issues and themes. Interviewee numbers are expected to be 200.

### *(2) Development of an appropriate industry policy.*

After analysis of the quantitative and qualitative data collected from both management and employees, a just culture, non-punitive and rehabilitative approach will be developed in consultation with employers, employees, and unions across the infrastructure and building sectors, with the aim being that the program will be adopted nationally for construction workplaces. Integral to this process will be a number of workshops designed to

inform all stakeholders as to current research and best practice in the domain. This is essential so as all players in the policy development process have factual information and a similar content knowledge base to work from.

*(3) Development of a cultural change management program.*

Together with the Australian Government, lead industry associations and key stakeholder groups, the research team will initiate an industry-wide nationally consistent collaborative approach to reducing the risk of impaired performance on construction sites and increasing workers' commitment to AOD safety. Previous work by [9; 44; 10 and 7] provide a significant starting point for the developing a cultural change management program that is directly tailored to the construction industry. It is also anticipated that partnership arrangements with industry education and skills organisations may be developed to disseminate the outcomes of this industry research and cultural change program.

*(4) Development of an implementation plan.*

An implementation plan will be designed and developed stemming from the initial data collected from both managers and construction employees. This process will include the development of clear recommendations of this research for industry use e.g., the form, content and process of implementing contemporary and targeted interventions. The implementation plan would be educative in focus and will develop a range of comprehensive stepped interventions for use in the corporate organisational environment, including face-to-face delivery of work site programs and web-based programs.

## **CONCLUSION**

Together, these objectives are designed to contribute to a change in culture towards improving safety, both within the industry partner's workforce and more broadly among the general infrastructure and building construction workforce. As highlighted above, no known study has scientifically examined the strength of the relationship between the use of AODs and corresponding safety impacts in the construction sector. Furthermore, little scientific research has investigated effective approaches to embed AOD workplace interventions within the theoretical field of safety culture while simultaneously considering appropriate intrinsic and extrinsic environmental factors. As a result, there has been only limited adoption of nationally coordinated strategies that are supported by both employers and employees to render it socially unacceptable to arrive at a construction workplace with impaired judgement from AODs.

This study is of major significance for Australia within the context of harmonisation of industrial legislation in occupational health and safety and Federal and State Government investment to improving workplace safety and overall population health. The Federal Government has committed to improvements in construction worker safety and will enable more productive delivery of the major economic and health benefits that will arise, in addition to the benefits of reducing the costs of injuries and deaths to workers. As well as enhancing safety outcomes for construction workers, it is anticipated that the project, through an educational and web-based support intervention, would lead to a reduction in the economic, health and social costs associated with injuries

to workers, not only within the industry partner and the industry as a whole, but also in other industrial sectors as information and intervention programs developed in this project will be made available to other sectors with much of the anticipated outcomes being highly applicable across the workforce. A reduction in the social and economic cost to the families of injured workers is also anticipated. Importantly, it is anticipated that the project will result in an overall enhancement of the internal safety culture within the construction industry.

This project will fundamentally contribute to a greater understanding of the impact of AODs in the Australian infrastructure and building industry and, critically, bring together the employer and employee groups nationally. Never before has this level of collaboration been possible at a national level, and the expected outcome has never been more needed as the Nation moves to harmonise industrial legislation and occupational health and safety practice to provide optimum safeguards for the national workforce.

## REFERENCES

- [1] Australian Bureau of Statistics (2010). *Work-related Injuries Australia 2009-10*. ABS catalogue number 6324.0. Canberra: ACT. Retrieved 27/05/2011. [http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/189182D4C8EF0518CA2577F5000C53DE/\\$File/63240\\_2009-10.pdf](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/189182D4C8EF0518CA2577F5000C53DE/$File/63240_2009-10.pdf)
- [2] Safe Work Australia (2011). *Work Related Traumatic Injury Fatalities, Australia 2008-2009*. Report prepared by Safe Work Australia. Canberra: ACT.
- [3] Holland, P., Pyman, A., & Teicher, J. (2005). Negotiating the contested terrain of drug testing in the Australian workplace. *The Journal of Industrial Relations*, 47(3), 326-338.
- [4] Elliot, K., & Shelley, K. (2006). Effects of drugs and alcohol on behaviour, job performance, and workplace safety. *Journal of Employment and Counselling*, 43, 130-134.
- [5] Berry, J.G., Pidd, K., Roche, A.M., Harrison, J.E. (2007). Prevalence and patterns of alcohol use in the Australian workforce: findings from the 2001 National Drug Strategy Household Survey. *Addiction*, 102, 1399-1410.
- [6] Ferguson, Megan and Schonfeld, Cynthia C. and Sheehan, Mary C. and Siskind, Victor (2001) [The impact of the "Under the Limit" drink driving rehabilitation program on the lifestyle and behaviour of offenders.](#) ATSB Monograph, CR187. Australian Transport Safety Bureau. Canberra: ACT.
- [7] Dingsdag, D. P., Biggs, H.C., Sheahan, V. L. and Cipolla, D. J. (2006) *A Construction Safety Competency Framework: Improving OH&S performance by creating and maintaining a safety culture*, Cooperative Research Centre for Construction Innovation, Brisbane: Icon.Net Pty Ltd, ISBN 978-0-9775282-9-5.
- [8] Fleming, T., Lingard, H., & Wakefield, R. (2007). *Guide to best practice for safer construction principles*. Cooperative Research Centre for Construction Innovation, Brisbane: Icon.Net Pty Ltd, ISBN 978-0-9803503-6-4.
- [9] Biggs, H. C., Dingsdag, D. P., and Roos, C. R. (2008) *A Practical Guide to Safety Leadership: Implementing a construction safety competency framework*, Cooperative Research Centre for Construction Innovation, Brisbane: Icon.Net Pty Ltd, ISBN 978-0-9804262-4-3. 1- 34.



- [10] Cipolla, D, Biggs, H. C., Dingsdag, D. P. & Kirk, P. J. (2009). *Safety Effectiveness Indicators Project Workbook*. Cooperative Research Centre for Construction Innovation, Brisbane: Icon.Net Pty Ltd, ISBN 978-0-9804262-2-9 Building the Education Revolution
- [11] Biggs, H. C., Dingsdag, D. P., Kirk, P. J., & Cipolla, D. (2010). Safety Culture research, lead indicators, and the development of safety effectiveness indicators in the construction sector. *The International Journal of Technology, Knowledge and Society*, 6(3), 133-140.
- [12] Australian Safety and Compensation Council (2009) *The Cost of Work-related injury and illness for Australian Employers, Workers and the Community*. Canberra: ACT.
- [13] Miller, T.R., Zaloshnja, E., Spicer, R.S. (2007). Effectiveness and benefit-cost of peer-based workplace substance abuse prevention coupled with random testing. *Accident Analysis and Prevention*, 39, pp 565-573.
- [14] Gee, G.C., Curbow, B., Ensminger, M.E., Griffin, J., Laflamme, D.J., McDonnell, K., LeGrande, D., Agnew, J. (2005). Are you positive? The relationship of minority composition to workplace drug and alcohol testing. *Journal of Drug Issues, Fall 2005*, 755-778.
- [15] Seijts, G.H., Skarlicki, D.P., Gilliland, S.W. (2002). Reactions to managing counterproductive behaviour through the implementation of a drug and alcohol testing program: Americans and Canadians are more different than you might expect. *International Journal of Selection and Assessment*, 10 (1-2), 135-142.
- [16] Wickizer, T.M., Kopjar, B., Franklin, G., Joesch, J. (2004). Do drug-free workplace programs prevent occupational injuries? Evidence from Washington State. *Health Services Research* 39(1), 91-110.
- [17] Banwell, C., Dance, P., Quinn, C., Davies, R., Hall, D. (2006). Alcohol, other drug use, and gambling among Australian Capital Territory (ACT) workers in the building and related injuries. *Drugs: education, prevention and policy*, 13(2), 167-178.
- [18] Frone, M. R. (2004) Alcohol, drugs, and workplace safety outcomes: a view from a general model of employee substance use and productivity. In: Barling, J. & Frone, M. R. (Eds.) *The psychology of workplace safety*. Washington, DC, APA.
- [19] Frone, M. R. (2006) Prevalence and distribution of alcohol use and impairment in the workplace: a U.S national survey *Journal of Studies on Alcohol*, 67, 147-56.
- [20] Pidd, K., Berry, J. G., Harrison, J. E., Roche, A. M., Driscoll, T. R., & Newson, R. S. (2006) Alcohol and work: patterns of use, workplace culture and safety. *Injury Research and Statistics Series Number 28 (AIHW cat no. INJCAT 82)*. Adelaide: AIHW.
- [21] Ryder, D., Walker, N. & Salmon, A. (2006) *Drug use and drug-related harm: a delicate balance*, Melbourne, IP Communications.
- [22] Allsop, S. & Pidd, K. (2001). The nature of drug-related harm in the workplace. In: Allsop, S., Phillips, M. & Calogero, C. (Eds.) *Drugs and work: responding to alcohol and other drug problems in Australian workplaces*. Melbourne, IP Communications.
- [23] Work-related fatalities study team. *Work-related traumatic fatalities in Australia, 1989 to 1992: Summary Report*. National Occupational Health and Safety Commission, Sydney, 1998.
- [24] Pidd, K. Boeckmann, R., Morris, M. (2006). Adolescents in transition: the role of workplace alcohol and other drug policies as a prevention strategy. *Drugs: education, prevention and policy*, 13(4), 353-365.
- [25] Evans, A.R., Tait, R., Harvey, P., Newbury, J. (2005). Recreational drug use within the employees of the mariculture and seafood industry in South Australia. *Drug and Alcohol Review*, 24, 67-68.
- [26] Davey, J., Obst, P., & Sheehan, M. (2000). Work demographics and officers' perceptions of the work environment which add to the prediction of at risk alcohol consumption within an Australian police sample. *Policing: An International Journal of Police Strategies and Management*, 23(1), 69-81.

- [27] Brown, S. K., Bain, P. & Freeman, M. (2008) Employee perceptions of alcohol and drug policy effectiveness: policy features, concerns about drug testing, and the key role of preventative measures. *Drugs: education, prevention and policy*, 15, 145-60.
- [28] Ritterband, L. M., Thorndike, F. P., Cox, D. J., Kovatchev, B., & Gonder-Frederick, L. (2009). A behavior change model for internet interventions. *Annals of Behavioral Medicine*, 38, 18-27.
- [29] Queensland Government (1999). *Coal mining safety and health act 1999*. In Government, Q (Ed).
- [30] Queensland Government (2001). *Coal mining safety and health regulation 2001*. In Government, Q (Ed).
- [31] Pierce, A. (2007) Workplace drug testing outside the U.S. In: Karch, S. B. (Ed.) *Drug abuse handbook*. Boca Raton, FL, CRC Press.
- [32] Australian Government. (2008). Civil Aviation Safety Authority. Retrieved, 22/03/2011. [http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD:1555276055:pc=PC\\_91041](http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD:1555276055:pc=PC_91041)
- [33] National Transport Commission (2008). National Transport Commission. Retrieved, 8/04/2011. [www.ntc.gov.au](http://www.ntc.gov.au)
- [34] Australian Government (2008). Department of Resources, Energy and Tourism. Retrieved, 14/3/2011. [http://www.ret.gov.au/energy/energy\\_markets/energy\\_technical\\_and\\_safety\\_regulation/Pages/Energy\\_TechnicalandSafetyRegulation.aspx](http://www.ret.gov.au/energy/energy_markets/energy_technical_and_safety_regulation/Pages/Energy_TechnicalandSafetyRegulation.aspx)
- [35] Kines, P., Andersen, L., Spangenberg, S., Mikkelsen, K., Dyreborg, J., Zohar, D. (2010). Improving construction site safety through leader-based verbal safety communication. *Journal of Safety Research*, 41, 399-406.
- [36] Laitinen, H., & Paivarinta, K. (2010). A new-generation safety contest in the construction industry- a long term evaluation of a real-life intervention. *Safety Science*, 48, 680-686.
- [37] Lingard, H.C., Cooke, T., Blismas, N. (2009). Group-level safety climate in the Australian construction industry: within-group homogeneity and between-group differences in road construction and maintenance. *Construction Management and Economics*, 27, 419-432.
- [38] Choudhry, R.M., & Fang, D. (2008). Why operatives engage in unsafe work behaviour: Investigating factors on construction sites. *Safety Science*, 46, 566-584.
- [39] ASCC (2007). *National Code of Practice for Induction for Construction Work*. Australian Safety and Compensation Council. Canberra: ACT.
- [40] Reason, 2000, Reason, J. (2000). Human error: models and management. *Western Journal of Medicine*, 172(6), 393-396.
- [41] Guldenmund, F.W. (2000). The nature of safety culture: a review of theory and research. *Safety Science*, 34, 215-257.
- [42] Glendon, A. I. (2003). Managing Safety Risks. In M. O'Driscoll, P. Taylor, & T. Kalliath, (Eds.), *Organisational Psychology in Australia and New Zealand* (pp. 212-238). Australia: Oxford University Press.
- [43] Sully, M. (2001). *When rules are not enough: Safety regulation and safety culture in the workplace*. Paper presented at the Insurance Commission of Western Australia Road Safety Conference, Perth, WA.
- [44] Biggs, H. C., Dingsdag, D. P., & Kirk, P. J. (2009). Development of safety effectiveness indicators for use in the construction sector. Proceedings of the *CIBWO99 Conference 2009: Working together; Planning, designing and building a healthy and safe construction sector*, Hyatt Hotel, Melbourne, Australia, 21-23 October 2009.