Report for the Society of Energy Professionals and the Power Workers' Union

Comment on the Canadian Nuclear Safety Commission Draft Regulatory Document, 2.2.4: Human Performance Management, Fitness for Duty

By

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My background

Attached is my curriculum vitae, which provides a summary of various accomplishments over my career. My educational background includes degrees in Psychology (BSc, University of Victoria), Criminology (MA, University of Toronto) and Epidemiology and Biostatistics (PhD, University of Western Ontario). In 1978, I started work as a Research Assistant at the Addiction Research Foundation in Toronto. In 1985, I became a Scientist with responsibility for independent research. I remained at the Addiction Research Foundation (which later became the Centre for Addiction and Mental Health) until 2005, when I took on a new position as Assistant Director at the Centre for Addictions Research of BC and Associate Professor, School of Health Information Science, University of Victoria. In 2009, I was promoted to a Professor.

At all these positions, I conducted social epidemiological research related to substance use and abuse. A primary focus of my research has been on the relationships between substance use and injuries. These studies include injuries/accidents in the workplace and crashes. I have over 20 peer-reviewed publications on this subject and 8 peer-reviewed grants and contracts, specifically on this topic. I have considerable expertise in drug testing programs, which includes 18 published works, a peer reviewed grant from the Social Sciences and Humanities Research Council of Canada and contracts with the International Labour Office and Transport Canada. As well, I have conducted program evaluation studies of workplace programs. I recently published a book chapter on drug testing in the workplace in Workplace Wellness: Issues and Responses. I also have been an expert witness in three Canadian hearings involving drug testing in the workplace.

Social epidemiology is the study of the causes of diseases that have a social dimension. This discipline focuses on assessing the distribution and determinants of health-related states or events, including injuries, in populations and recommending approaches to alleviate these health problems (Last, 1995). A major purpose of epidemiology is to collect and analyze data that provide an accurate assessment of risks associated with diseases. Analytic epidemiology involves the assessment of risks

of diseases from various exposures – for example, the risk of job accidents from substance use. An emphasis of epidemiology is on methodological issues in the collection of data that could potentially bias findings, such as:

- Measurement error – Are the instruments/scales valid and reliable and measure what we wish to measure?
- Internal validity – Does the study design allow strong inferences of cause and effect?
- External validity – Do the results of the study apply to the “real world”?
- Selection bias – Does the study have systematic differences in how data was collected in the cases (e.g. injury subjects) and control (e.g. non-injury subjects) that may inflate or deflate the estimates of risks associated with exposure (e.g. alcohol or drug use)?
- Confounders – Are there other third variables that may better explain the findings?
- Threats to internal validity (i.e. the degree to which we can make strong inferences between cause and effect). Threats to internal validity represent various explanations of how the results of a study might not be internally valid, based on the designs. These include potential flaws, such as selection (differences found are due to fundamental differences in the group), history (competing interventions caused the change), experimenter bias, testing effects (both practice effects and Hawthorne effect) and statistical regression.

Introduction

This report contains my opinions of the discussion paper document in response to requests from Sonia Pylyshyn at the Society of Energy Professionals and Emily Lawrence, counsel for the Power Workers' Union. I was asked to report on the scientific literature on drug use and safety risk, issues of deterrence, and evaluation studies of

drug testing (with emphasis on job accidents). Finally, I was asked to comment on studies showing possible negative consequences of drug testing and alternatives to drug testing. My comments are directed to the random drug testing provisions in the Commission's draft Regulatory Document.

In this review, I will first examine the studies that address the issue of whether drug users represent a safety risk in the workplace (Section 1). Then the question of whether drug testing is a deterrent is addressed (Section 2). In the final sections, studies on the effect of drug testing on safety (Section 3), potential negative consequences of testing (Section 4) and alternative approaches (Section 5) are addressed. The report culminates in recommendations with respect to the Commission's draft Regulatory Document.

My main conclusions are as follows.

a. The draft Regulatory Document contains recommendations on random drug testing that will not achieve the stated goal of identifying individuals who are unfit for duty. Commonly used urine drug tests cannot identify whether employees are under the influence of a drug at the time of the test and therefore cannot be used to identify those unfit for duty. Positive results from a random urine test only identify workers who have used drugs in the past, not impaired workers. As such, to achieve the goals of the stated goal of identifying individuals who are unfit for duty, random drug testing must improve worker safety and/or deter workplace impairment. Drug testing has not been scientifically shown to do either of these things.

b. In most Canadian workplaces, drug use at work does not represent a major problem. I am not aware of any studies or data suggesting that drug use at work represents a significant problem in Canadian nuclear plants, and the Commission makes no reference to any.

1. Do drug users represent a safety risk in the workplace?

I have reviewed the conclusions of Professor Olaf Drummer. Since urine tests are only useful for detecting drug users (as opposed to detecting impairment), one question posed by many is whether drug users are more likely to have accidents and injuries than non-users. Two main types of epidemiological studies have been conducted to answer this question: (1) those comparing accidents/incidents of employees who test positive for drugs versus those who test negative; and (2) those comparing accident rates of people who self-report drug use versus those who do not. These studies have been conducted on two population groups, employees and drivers. Conclusions from these studies are summarized below. Overall, there is not enough research evidence to conclude that those who test positive for drugs from urine tests represent an increased risk for work injuries or accidents, which is a fundamental requirement of causation.

Some epidemiological studies were found that compared on the job accident rates of employees who tested positive versus negative for drug use. Several studies have failed to show a relationship between positive drug tests and accidents or injuries. In a longitudinal study of 5,465 job applicants, Normand et al (1990) found no significant differences between drug positives and negatives in terms of job injuries. Similarly, Crouch et al (1989) found that employees who receive drug positives did not have significantly higher rates of job accidents than those who test negative.

Only one study was found where those testing positive in pre-employment testing had significantly higher accident or injury rates than those testing negative (Zwerling et al., 1990). In this study, U.S. postal workers who tested positive for marijuana were significantly more likely to have reportable accidents and work injuries. Those who tested positive for cocaine had significantly more injuries, but no statistical difference was found for job accidents. After two years of follow-up, risks of adverse outcomes declined among drug positives (Ryan et al., 1992). The authors acknowledge a limitation of their study is that alcohol use associated with drug use was not investigated. In addition, the results may not be replicable in other countries or for other types of workers.

Some studies have compared job injuries of drug users and non-users as determined through self-reports. A U.S. study of 1,740 employed adults indicated that drug users were 1.7 times more likely to be involved in injuries on the job (Hingson et al., 1985). More recently, Shipp et al. (2005) found the odds of workplace injury increased with the frequency of drug use for marijuana and cocaine. By contrast Hoffman and Larison (1999) did not find a relationship between occupational injuries and use of either marijuana or cocaine. In a survey of Ontario adults using similar methods, those who used either illicit or licit drugs in the prior year were significantly more likely to have job injuries than non-users (Macdonald, 1995). However, additional analyses controlling for potential confounding variables, pointed away from illicit drug use as a causal agent in job injuries.

The existence of a statistical relationship between drug use and job injuries should not be interpreted that drug use causes job accidents/injuries. For example, illicit drug use is related to age and sleep problems, which in turn are significantly related to job injuries (Macdonald et al., 2009). Other researchers have suggested that risk taking behaviour is a plausible explanation for the relationship between drug use and accidents; we do not know whether drug users might have elevated rates of job accidents because they use drugs or because they tend to be risk takers, a characteristic also related to job accidents (Newcomb, 1994; Spicer, Miller & Smith, 2003).

In summary, some studies found drug users have a higher risk of job accidents, while other studies failed to find significant relationships. All studies failed to show that drug use was a cause of workplace accidents, as statistical relationships between drug users and accidents/injuries might be explained by other variables. One study suggested the relationship between drug use and job injuries could be explained by other factors correlated with drug use, such as sleep problems, smoking, shift work, and age (Macdonald, 1995). In most studies, several drugs with different pharmacological properties were grouped into one category (presumably to increase statistical power); consequently, very little is known about specific drugs (see Hingson et al., 1985, Normand et al., 1990; Crouch et al., 1989). The methods and operational definitions of

drug use used varied considerably, making it difficult to meaningfully compare the results of the studies.

To assess causality, the strength and significance of a statistical relationship between positive tests and job accidents/injuries should first be determined. This is typically accomplished by calculating odds ratios (OR) where the proportion of those who test positive in the accident/injury group is compared to the proportion in a non-injury control group. Factors such as sex, age or risk taking propensity (called confounders), should be ruled out as possible explanations for the results found. Confounders are typically addressed through matching of cases and controls in the design of a study, or through stratification or multivariate statistics in the analyses-procedures rarely used in the drug testing and job accident research.

2. Is drug testing a deterrent for drug use and drug related job accidents?

Quest Diagnostics is the largest provider of drug testing in the United States and conducted about 6.4 million tests in 2011 (Quest Diagnostics Incorporated, 2015) The proportion of employees who test positive has dropped considerably from about 13.6% in 1988 to 3.9% in 2014 (Quest Diagnostics, 2015). This decline might be interpreted as an indication of a deterrent effect of drug use among employees in companies where testing is conducted. However, other explanations are possible. As noted by Walsh (2008), there has been an exponential growth of alteration in substitution products developed to produce negative results (i.e. masking agents), which might help to explain the decline. The most experienced users may be the most likely to use such methods.

Although overall research indicates that companies that drug test generally produce a lower proportion of positive tests over time, this does not mean that fewer people are impaired by drugs at work. If some employees change their drug using behaviours, the intervention may have a greater effect on recreational users, who are unlikely to use at work. Wide-spread drug testing does not appear to have had any impact on overall drug use in the US population. In fact, US surveys indicate a 30% *increase* in drug use between 1988 and 2004 (Walsh, 2008). Various explanations are

possible for this discrepancy. First, employees who use drugs may choose to work in companies that do not test for drug usage. The lower rate of positive tests for pre-employment testing (3.5%) is suggestive that companies that drug test may deter prospective employees from applying to vacant openings.

Research has not shown that the decline in positive rates corresponds to safer workplaces. One approach that could be used to assess the likely impact on workplace safety is to compare the percentage of employees who test positive from random testing to those who test positive from post-accident testing. If drug use is a major cause of workplace accidents then one would expect that the percentage of employees testing positive after accidents would be much higher than those from random tests. From 2009 to 2011, 5.3% of the US employees tested positive with post-accident testing (Quest Diagnostics Incorporated, 2011). This compares with random testing at 5.4% in 2009, 5.3% in 2010, and 5.2% in 2011. Given that the percentages are nearly identical suggests that the causal impact of drugs on workplace accidents is negligible. The aforementioned evidence does not indicate that reductions in positive test results over the past decade have translated into fewer job accidents.

Although research has shown that *per se* laws for alcohol (i.e. laws prohibiting driving at certain BAC levels) and strong enforcement have been beneficial in reducing collisions caused by alcohol (Mann et al., 2001), it is not a good analogy to suggest that drug testing will achieve the same result among employees, as there are many differences between the two. First, there is a substantial difference between the prevalence of use for alcohol and illicit drugs in our society. For example the most recent 2013 Canadian survey shows that 76% of Canadians used alcohol in the past 12 months, which compares to 11% for cannabis, .9% for cocaine and .2% for methamphetamine (Health Canada, 2015). Second, these aforementioned percentages represent overall usage and not use at work. Alcohol and drug use in the workplace is much less likely than during leisure hours (Frone, 2006). Finally, the epidemiological research shows a strong link between BAC levels and collision risk. Virtually every large case-control study conducted has shown a strong relation between blood alcohol content (BAC) levels and the likelihood of collision. For example, compared to drivers

with BAC = 0, the adjusted relative risk of collisions was 1.4 for drivers with a BAC= 0.05%, 2.7 for drivers with BAC = 0.08%, 22.1 for BAC = 0.15%, and 81.8 for BAC = 0.20% (Bloomberg et al. 2009). By contrast, comparable road research using urinalysis has failed to find any relationship at all (see review of driver studies above).

3. Does drug testing improve workplace safety?

Many studies of the impact of drug testing on job accidents have methodological limitations (Macdonald, 1997; Kraus, 2001). Kraus (2001) noted that “despite the extensive use of and management support for worksite based drug testing, the published evidence for the effects, such as reduced injury or accident rates lacks scientific detail. Better studies and careful reassessment of the issue appear warranted.”

The research evidence on the effectiveness of drug testing in reducing job incidents has been recently reviewed (Pidd and Roche, 2014; Frone (2013). In a recent review by Pidd and Roche (2014) on the effectiveness of drug testing as a workplace safety strategy, the authors concluded: “The majority of studies reviewed contained methodological weaknesses including; inappropriate study design, limited sample representativeness, the use of ecological data to evaluate individual behaviour change and failure to adequately control for potentially confounding variables. This latter finding is consistent with previous reviews and indicates the evidence base for the effectiveness of testing in improving workplace safety is at best tenuous” (p.154). Frone (2013) concludes that "on the whole, research exploring relations of employee substance involvement to attendance and performance outcomes suggest that these relations are weak and inconsistent. The studies that have found statistically significant relations have methodological problems that undermine any conclusion regarding causal effects" (p. 141, Frone, 2013).

One common methodological limitation in such studies is that other safety initiatives were implemented at the same time as a drug testing program. Therefore, the specific impacts of drug testing on injury/job accident rates cannot be separated from

these other initiatives.[1] Drug testing, especially random drug testing, has not alone been demonstrated to result in safer workplaces.

One example is a study by Wickizer et al., (2004) occupational injury rates of companies enrolled in a “drug free work program” were compared to 20,500 companies without these programs. The drug free programs included formal written substance use policies, drug testing and Employee Assistance programs. Although the authors indicate the drug free program was associated with selective reductions in work injuries, we cannot conclude that the reductions were due to drug testing because the programs included other interventions, or whether companies had drug testing before or after the implementation of drug free programs. As such, it is impossible to draw sound conclusions. Furthermore, companies that enrolled in the program had substantially higher injury rates (21.18 per 100 person years after intervention) than the non-intervention group (13.82 per 100 person years).

Similarly, other studies using a cross-sectional design have been used; however, conclusions drawn from such designs should be considered tentative, due to the existence of possible alternative explanations for the findings. For example, in a study by Carpenter (2007), data from two U.S. national household surveys of 57,397 people was analyzed to assess whether drug testing was related to lower rates of marijuana use. Companies with drug testing programs, employee assistance programs, and written policies on substance use had lower prevalence of drug use among employees than those without these policies. Separation of the unique effects of drug testing from other programs was not possible.

Other studies had different methodological flaws. For example, in a study by Morantz and Mas (2008), occupational injury claims of divisions of a large retail chain

[1] See for example ie. Taggert (1989) reported substantial reductions in job accidents subsequent to drug testing being instituted; however, this study has been severely criticized because major safety improvements occurred at the same time that testing was implemented, making any conclusions unreliable (Jones, 1990); Ozminkowski et al. (2003) which concluded that there was a significant relationship between testing and decreased injury rates, but they did not control for other safety initiatives; another study failed to examine the impact of other safety programs and additionally had an extremely low response rate of 17% (Gerber and Yacoubian, 2001); a study of Peer Care training and random drug testing found reduced injuries (Miller et al., 2007) but the specific effects of drug testing could not be separated from other simultaneous interventions.

that implemented post-accident drug testing was compared to divisions without testing before and after program implementation. Although declines were noted for some types of compensation claims in divisions with testing, the rate of claims was still higher in the testing divisions (than non-testing) for 3 of 4 compensation indicators. For example, a rate of 9.63/100,000 hours first aid reports was found in the after period among drug testing divisions compared with 5.54/100,000 hrs in the non-testing divisions Such a finding raises the issue of regression to the mean, where sites with higher claims rates were chosen for implementation of post-accident testing. Reductions to the level of non-testing divisions may have occurred without implementation of the testing programs.

Feinauer & Havlovic (1993) found no differences in workplace accidents and injuries at companies with drug testing compared to 36 non-testing businesses. They report significant reductions in accident and illness rates for post-accident testing but no change for reasonable cause testing. A limitation of this study was that data was obtained through a self-administered questionnaire raising issues of both accuracy of the data and possible selection bias (companies with lower incident rates may be more likely to respond).

Marques et al (2014) recently conducted an evaluation study at a large Portuguese railway by comparing the number (and percent) of employees with work accidents after receiving at least one random workplace drug test to those employees never tested. This study concluded that drug testing at optimal frequencies will reduce accident victims by 59%. However, in my opinion, this conclusion cannot be justified by the methods used. The fatal flaw of this study is that count data of accidents were compared between groups of workers but those who were drug-tested were observed for a much shorter period of time (about 2.75 years versus 5.5 years for the non-tested group). It is not surprising that those who were observed for a longer period of time (i.e. the non-tested workers) had more job accidents than those observed for a shorter period of time (i.e. those tested). Comparisons between groups for **rates** of accidents should have been conducted and not absolute numbers. In order to properly compare the groups they should be expressed as rates per periods of observation, and not simply comparing the numbers.

A common practice of employers is to dismiss employees who test positive for drugs. Interestingly, no evaluation study has been located in the literature on the performance of such employees prior to their dismissal compared to matched control subjects.

Little research has been conducted that compares the different situations in which employees could be tested. The preponderance of the evidence I have reviewed does not indicate that measurable improvements in safety will be achieved with random testing. One conclusion drawn from existing research is that there is no credible evidence that drug testing programs reduce job accidents. Although some studies have noted reductions of work accidents/injuries following the implementation of drug testing programs, others have not. Methodological flaws are common – in particular, history (competing safety initiative at the same time as the drug testing program may have caused the change), and statistical regression (companies tend to implement drug testing when work accidents/injuries are particularly high) are common.

4. Potential negative impacts of drug testing

Few studies exist that investigate the potential negative consequences on employee behaviour or attitudes related to drug testing. Employee drug testing has been theorized to be an instrument of social control, a technique for defining and responding to the use of illegal drugs (Brunet, 2002). Conflict theorists see drug testing as an issue of power rather than one that relates directly to drug use in the workplace (Gerber et al., 1990). Most of the social control literature on drug testing is theoretical, and empirical studies that substantiate these theories could not be found. In experimental studies, subjects had a more positive attitude and intentions toward companies that did not have drug testing programs than ones that did (Crant and Bateman, 1990). A possible impact of testing, given this study, is a decline of the total number of job applicants (Macdonald and Wells, 1994). Others have argued that testing can produce declines in employee morale or undermine labour-management relations (see Macdonald and Wells, 1994). Overall, too little research has been conducted to provide conclusions regarding negative impacts of drug testing on employees.

5. Alternative approaches for addressing workplace substance use

An approach implemented in Canada for impaired driving by drugs is the Drug Recognition Expert (DRE) Program, also known as the Drug Evaluation Classification (DEC) Program. This program has evolved since initially being developed in the late 1970's by the Los Angeles Police Department, (Beirness et al., 2007; Porath-Waller, et al., 2009). A standardized procedure has been developed to identify both individuals under the influence of drugs, and the type of drug causing the observable impairment (Beirness et al., 2007; Porath-Waller, et al., 2009). The process involves a series of physical and psychomotor tests, and concludes with toxicological testing of a sample of a blood, urine or oral fluid (Beirness et al., 2007; Porath-Waller, et al., 2009). The procedures have been applied to other areas where identification of the drug-impaired individual is desirable (Porath-Waller, 2009).

Beirness et al (2007) conducted a review of existing studies evaluating the DRE program. Laboratory studies of subjects administered impairment doses of different drugs produced ranges (depending on the study) in terms of sensitivity of DRE assessments: (cannabis – 30.4 to 53.1%, cocaine – 13.2% (one study), amphetamines – 4.2 to 10%, opiates – 65.4 to 75.9%, PCP – 75.3%) and specificity (cannabis – 59.1 to 86.4%, cocaine – 61.1%, amphetamines – 79.2 to 91%, opiates – 90.3 to 97.9%, PCP – 89.5%) (see Beirness et al., 2007). After initial behavioural assessments of drug impairments, drug tests can be conducted. The DRE approach is advantageous over drug testing for assessing fitness of duty in that behavioural symptoms consistent with impairment are used rather than prior drug use.

In the early 1990's the Ontario Law Reform Commission (1992) recommended behavioural performance testing, such as computerized tests, to assess psychomotor skills in safety sensitive positions, rather than drug testing. In relation to work, a possible advantage of these tests is they can pick up a wider variety of performance deficits beyond those that are drug related, such as those caused by fatigue, and thus could potentially be more directly linked to overall fitness for work. At that time, a review of computerized behavioural testing approaches was conducted by Butler and Tranter

(1994). Behavioral performance tests have been developed to assess various dimensions of human functioning, such as psycho-motor skills, memory, divided attention, decision-making and critical tracking, which are often used to assess drug related deficits in laboratory studies. The importance of each dimension for the workplace will depend largely on task requirements and the specific job. The degree to which the test results accurately relate to varied complex requirements of different jobs is not adequately known, with the possible exception of some specialized positions (e.g. airline pilot). Additionally, practice effects with repeated administrations tend to create improvements of scores so the cut-off levels change over time. Another issue is that some individuals do better than others on these tests, necessitating the development of different baseline measures for each person. These variations in standards across and within individuals are inconsistent with the principle of specific requirements for each job.

Employee assistance programs (EAPs) are another approach used by a large proportion of Canadian employers to improve employee health and well-being, and to reduce performance problems (Macdonald et al., 2006). A few reviews have been conducted on the effectiveness of EAPs in achieving these objectives (McLeod, 2010; Macdonald et al., 1998, Normand et al., 1990) and all the reviews arrived at similar conclusions. Although definitive conclusions cannot be drawn based on the methodology of the studies in the heterogeneity of EAPs themselves, the preponderance of the evidence suggests that these programs are beneficial in alleviating psychological problems and can have a positive effect on work performance.

6. Overall assessment of the proposed alcohol and drug testing policy

In the draft Regulatory Document, “fitness for duty” is described as a condition in which workers are physically, physiologically, and psychologically capable of competently and safely performing their tasks. Several components of fitness are described as medical, psychological, occupational fitness and behavioural-performance. With respect to alcohol or drugs, nuclear power plant licensees will be required to take steps to prevent workers from bringing or consuming alcohol or illicit drugs at work, or

working while under the influence of alcohol or any drug that impairs their ability to perform his or her duties safely. The goal of an impairment-free workplace is reasonable as the acute (i.e. immediate effects) of alcohol and many psycho-active drugs cause decreases in job performance. However, urine tests cannot accurately determine whether employees are under the influence during work hours and therefore are not closely related to fitness for work. The exception is the breathalyzer for alcohol, which is an accurate device to assess whether employees are under the influence of alcohol at the time of the test. Furthermore, the urine tests cannot be used to assess whether employees have a substance use problem or dependence.

The Commission has not justified random drug testing and given the research evidence outlined in this report, there is not a strong evidence base to support this recommendation. Random drug testing has not been shown to reduce workplace accidents, deter drug impairment in the workplace or make workplaces safer. Urine tests, and the use of random drug testing in particular, will not achieve the goals of assessing fitness for duty in relation to substance use as defined by the Commission. These components do not have a sufficient evidence base to justify their use.

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