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Mindfulness-Based Safety: Increasing Attention to Task in Alberta's Oil and Gas Drilling and Completions Operations

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Keywords
Mindfulness, attention, safety, situational awareness, performance, hazard

Disciplines
Cognition and Perception | Cognitive Psychology | Ergonomics | Industrial and Organizational Psychology | Industrial Engineering | Other Operations Research, Systems Engineering and Industrial Engineering | Other Psychology | Other Social and Behavioral Sciences | Performance Management | Social Psychology and Interaction | Training and Development | Work, Economy and Organizations

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Advisor: Cory Muscara

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Disciplines
Health and Safety, Management, Human Factors Engineering, Positive Organizational Scholarship

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Introduction

Positive Psychology

What is the good life? What does it mean to be happy? And what can I do differently today to lead a better life tomorrow? Many great philosophers, religious leaders, and scientists who have walked before us, endeavored to provide clarity to the very same questions. However, there was a period of time, after Word War II, where we momentarily lost our way and sought more strongly to fix what was wrong whilst overlooking the value of building on what is working well for people (Seligman, 2002). Perhaps appropriate to the questions of the time, the creation of the Veterans Administration Act of 1946 prompted a proliferation of psychologists to dispense therapy in order to alleviate mental illness suffered by veterans (Seligman, 2002). Although the profession of psychology originated partly on the mission to cure mental illness, it was also intended to "make the lives of ordinary people happier, more productive, and more fulfilling" (Seligman, 2002, p. 19).

Despite this two-part purpose, the secondary aim was largely omitted from the study and application of psychology for many years. Martin Seligman, revered as the father of positive psychology, was an instrumental figure in bringing psychology back in balance with its originating mission. Mid-career, Seligman came to the realization that well-being was a continuum, whereby the elimination of mental illness did not equate to happiness, but a neutral state of being (Seligman, 2002). He came to conclude the absence of mental illness is not enough to lead to human flourishing. From this discovery, and within his newly appointed role of the President of the American Psychological Association in 1998, Seligman rallied for a paradigm shift towards a '*better psychology'*, one that would "guide us all along better paths to the good life" (Seligman, 2002, p. 29). This better psychology has been termed '*positive psychology'*.

"Positive psychology is the study of the conditions and processes that contribute to the flourishing or optimal functioning of people, groups, and institutions" (Gable & Haidt, 2005, p. 103). Although different researchers purport different theories and models of what flourishing is, Seligman (2011) suggests the goal of positive psychology should be to increase flourishing by increasing the five measurable elements of his well-being theory PERMA: (1) positive emotions; (2) engagement; (3) relationships; (4) meaning; and (5) achievement. These five tenets were derived through Seligman's observations and distillation of relevant research on well-being.

For instance, experiencing an optimal level of positive emotion has been shown to be protective against physical illness (Doyle, Gentile, & Cohen, 2006; Eichstaedt et al., 2015) and support flourishing mental health (Fredrickson, 2013). Engaging in strength-based activities can trigger *flow* experiences (Schueller, 2014)—a desired state of flourishing engagement where we are adequately challenged, capable of executing, and are working towards a goal (Csikszentmihalyi, 1990). Interpersonal relationships have been shown to buffer us from the harmful effects of stressful events by providing us with a variety of social supports (Peterson, 2006). Having a clear sense of meaning has been demonstrated to uncover dormant strength available to sustain motivation towards things that matter to us most (Steger, 2009). Lastly, humans engage in goal-directed action for survival (Locke, 1996), and in many countries, the pursuit of flourishing has replaced this goal; consciously setting a targeted outcome has been shown to enhance performance achievement (Locke, 1996).

Positive psychology has permeated beyond the field of psychology and into the disciplines of education (Linkins, Niemiec, Gillham, & Mayerson, 2014; Robertson-Kraft & Duckworth, 2013), healthcare (Feudtner et al., 2010; Prilleltensky, 2005), economic policy (Diener & Seligman, 2010) and the workplace (Dutton & Glynn, 2008; Jha et al., 2015;

Stephens, Heaphy, & Dutton, 2011; Wrzesniewski, Berg, & Dutton, 2010). Essentially the span of positive studies is limitless as any domain can learn to build on what is right or working well.

One particular area of application which positive psychology seems to have permeated to a lesser extent, is the domain of human operational safety. It is my opinion that many organizations in the Alberta oil and gas industry are missing out on the positive influence on safety and operational performance available to them. Greater employee engagement, motivation, mindfulness, and optimal mental and physical health are possible by giving greater attention to creating flourishing work conditions. This paper will consider the study of mindfulness, within the domain of positive psychology, as a consideration for improving attention to task. Secondly, it is believed the cultivation of mindfulness can positively influence the mental and physical well-being of oil and gas drilling and completions workers.

The Alberta Oil and Gas Industry

With a Bachelor's of Science degree in Industrial Systems Engineering and a gratifying career as a Sr. Drilling & Completions Engineer within the Canadian oil & gas industry, I'd consider myself an unusual candidate for a master's level education in Applied Positive Psychology. Despite my formal training converging on the optimization of processes, equipment, and operations, my time spent in capital project management and front-line coordination have illuminated a contributing factor to the success of operational and safety performance that I sense many engineers overlook - the minds of people. It seems to me, no matter how diligent our planning efforts, talented our personnel, or prompt our resolution to unforeseen technical challenges, the innate unpredictability of people (Stanley, 2016) continues to upset our aspirations of project perfection: below budget, under project schedule, exceeding quality metrics, and most importantly – without anyone getting injured. Fundamentally, our 'design to

perfection' methodology, in my opinion, has a significant flaw. We rarely seek to understand or give consideration to individual cognitive differences and how people's thoughts, emotional states, and social well-being influence operational and safety performance.

The oil and gas exploration and production industry embraces complex processes, work practices, and environments. All of these contain intrinsic hazards that have the "potential for catastrophic accidents involving: large-scale loss of life, harm to health and extensive environmental damage that need careful risk management" (Canadian Association of Petroleum Producers [CAPP], 2014, p.1). The measures and conduct needed to control these hazards and promote safe behavior are similarly complex and not well understood. Regardless of the industry, the human condition presents us with a profound dilemma in trying to encourage safe work behaviors in that we are an aggregate of observable exterior behaviors concurrent with a series of interior private experiences. As such, we do not always have the capacity to monitor crew behavior to advise reasonable modification for risk, error, or accident reduction because we are unable to monitor their inner monologues. Our inability to independently discern another's inner private experience prevents us from being able "to generate a comprehensive grasp of behavior" (Singer, 1974). My argument, in taking Health and Safety Management Systems (HSMS) to the next level of effectiveness, is that employers must expand their circle of concern to include the private experience of workers – essentially their presence, attention, and psychological and emotional competence.

Within Alberta, the most commonly referenced safety metrics include: (a) the loss-time-claim rate - "the probability or risk of an injury or disease to a worker during a period of one-year work, which will result in time lost from work"; and (b) the disability injury rate - "the probability or risk of disabling injury or disease to a worker during a period of one year of work"

(Government of Alberta, 2014, p. 27). From 2006 to 2010, the lost-time claim rate for the Upstream Oil and Gas industries decreased by 49.5% and the disabling injury rate decreased by 49.0%" (Government of Alberta, 2011, p. 2). The decline of the overall industry rate appears to have plateaued in recent years. Of the 8 identified sub-sectors, well servicing (completions) with service rigs continues to hold the highest disability injury rate and the third highest lost-time claim rate; drilling of oil and gas wells has the second highest disability injury rate and the second highest lost-time claim rate (Government of Alberta, 2011). In effect, post-incident statistics reveal drilling and completions operations have potential to improve the safety of their operations, but there is uncertainty on where and how to devote their efforts. Regrettably, within Alberta there is no regulated authority accountable to tracking and trending the root cause of injury and deaths, nor is there available any guidance on mental state and functioning as an inherent risk to operations.

Let's explore a drilling related scenario that highlights the importance of situational awareness as part of a worker's inner private experience. The drilling of an oil or gas well entails adherence to a technical program outlining a detailed step-by-step procedure. Any one step may be completed a number of times within each procedure, and the job task within a step can be very repetitive. Wells are most commonly made up of three wellbore sections: surface, intermediate, and production. Each wellbore section requires the act of drilling, to make a hole with a bit rotating on the end of drill pipe to the desired depth. As the hole depth increases, additional connections of drill pipe are made until the desired section depth has been reached. At this point, all of the drill pipe in the hole at the completion of a section must be pulled to surface, termed 'tripping'. Before the most recent industry downturn, 10,390 wells totaling 24,248,511 meters were drilled in western Canada (CAPP, 2016). Assuming a standard range 3 joint (12.5

meters) and the typical oil bitumen average well length of 1300 meters (CAPP, 2016), for the final and longest section of the wellbore, a crew would consecutively trip at minimum 104 joints of drill pipe out of the ground.

Depending on the rig design, equipment available, and expertise of the drilling crew, this repetitive activity could be sustained for a duration of 3 to 5 hours. The issue with this is two-fold: First, well-rehearsed activities generate habits, and habit reduces the conscious attentions with which our actions are executed (James, 1892/1984); second, the reduction in processing demands whilst executing tasks which are well practiced, boring or repetitive, such as tripping, are known to increase the incidence of mind-wandering (Mason et al., 2007). In the onset of mind-wandering, the focus of our attention shifts away from our external environment to that of our inner consciousness and stream of task-unrelated thoughts (Smallwood, 2013). Mind-wandering is not directly observable at this time, and I do not believe we fully understand its workings or appreciate its influence on how personnel conducts themselves in a drilling and completions operation.

Application of Positive Psychology within the Alberta Oil and Gas Industry

In this paper, I will provide a literature review of mind-wandering: how it works, why we do it, the impacts it has on our situational awareness, meta-awareness and task performance. I will identify researched mindfulness-based interventions, a field of study within positive psychology. These interventions have been shown to effectively reduce mind-wandering. Lastly, I will I invite the oil and gas industry to incorporate the supplemental element of *Mindfulness-Based Safety* into their HSMS, as driven by the development and assessment of attention and mindfulness competencies that influence individual and organization conduct. In support of this, I will provide a suggested plan for creating awareness and implementing mindfulness into

operations to reduce mind-wandering and therefore increase the amount of time employees spend with their minds on task.

The Competency of Attention

The survey results of a questionnaire completed by 200 Offshore Installation Managers (OIMs), or front-line leadership, operating on the United Kingdom Continental Shelf from 157 off-shore oil and gas installations and 36 organizations reports "31% of OIMs recognize the need for behavioral programs to tackle unsafe acts, complacency, general inattention at work, and carelessness" (Dea & Flin, 2001, p. 51). 'Not thinking on the job, 'carelessness', and 'failure to follow the rules were ranked as the "top three behaviors which are most likely to be the cause of an accident" (Dea & Flin, 2001, p. 47). Accidents were also more often attributed to a person rather than job factors (Dea & Flin, 2001).

Of particular interest, the supervisors highlighted their concerns with worker's inattention and not thinking on the job. Experience sampling has shown that it is not uncommon for between 30% (Kane, Kwapil, Mcvay, & Myin-germeys, 2007) and 50% (Killingsworth & Gilbert, 2010) of our daily thoughts to be unrelated to the task at hand, or stimulus-independent thought. That being said, it is likely the case that workers are both attentive and thinking, but that their mind is focusing their attention on something other than their primary task.

Components of Attention

Attention is made up of three components: (1) alerting; (2) orienting; and (3) conflict monitoring (Tang, Hölzel, & Posner, 2015). The alerting component is essentially our readiness for forthcoming stimulus. From a multitude of available sensory stimuli, orienting selects the specific information to be the focus of attention, while conflict monitoring, or the executive attention functions, block and filter potentially distracting sensory stimuli (Tang, Hölzel, &

Posner, 2015). To measure the efficiency of these foundational components of attention, the Attention Network Test (ANT) can be used (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Participants being administered the test are asked to respond by pressing either a left or right arrow key indicating the direction of a central arrow flanked by similar, dissimilar, or neutral direction arrows on the screen.

Our human consciousness has evolved in such a way that our biological programming does not exclusively control our thoughts, emotions, and behaviors. Our nervous system is able to operate "to a certain extent functionally independent of its genetic blueprint and of the objective environment" (Csikszentmihalyi, 1990, p. 24). To achieve control over our consciousness (awareness) supervenes the ability to choose our own thoughts and emotions. As mentioned previously, our processing capacity is limited. To a certain degree, we are the gatekeeper to which information is received for processing and which is disregarded. Where we choose to place our attention determines which information is allowed through the gates and into our consciousness. Effectively it is our attention that shapes our situational awareness or what we take notice of in our external environment.

Elements of Situational Awareness

Situational awareness, born from within the community of human factors engineering, is often theorized and researched as a means to better understand how environments (equipment, processes, and systems) can be designed to reduce or prevent error in high-risk industries. Endsley (1988) defines situational awareness as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" (p. 97).

Let's take a look at an example scenario to illustrate Endsley's position on situational awareness. A driller (lead operational position on the rig) notices the trip tank digital volume indicator is climbing slightly. Understanding the increase in the digital count signifies an increase in drilling fluid volume into the system, he assumes the derrick-hand (accountable for the fluid system) will perform a flow-check. A flow-check should determine if the volume influx is flowing at a rate which indicates normal drilling conditions for the current operation and geographical formation, or alternatively might indicate the presence of a kick. A kick is a gas or fluid influx into the wellbore which may result in a well-control issue or loss of hydrostatic pressure balance in the system. Early warning of hydrostatic imbalances in the system is imperative for prevention and management of kicks and necessitates high-quality situational awareness. In this illustration, a loss of situational awareness for the driller or derrick-hand may have resulted in an oversight of significant informational data from their external environment and led to a potentially catastrophic outcome.

The cognitive mechanisms for situational awareness are deemed to be a combination of attention, memory structures, and decision-making (Endsley, 1988), all three of which have cognitive limitations (Csikszentmihalyi, 1990; Kahneman, 2002; Schwartz, 2004). By design, we are unable to process all of the information available to our sensory system at any given moment (Csikszentmihalyi, 1990), and our experience, is thus, what we attend to (James, 1892). This paper will later detail the ramifications of shifting attention from the external environment to the internal thought stream (mind-wandering) on the effectiveness of situational awareness.

Self-Regulation and Attention-Regulation

The sustainment of any activity requires self-regulation - our ability to exert control over our thoughts, feelings, impulses, and task performances (Baumeister, Gailliot, DeWall, & Oaten,

2006). Believed to be essential to the success of all positive interventions, "evidence-based, intentional acts meant to increase well-being" (Pawelski, personal communication, October 4, 2015), self-regulation requires the exercise of attention control (Baumeister et al., 2006). Research supports self-regulation and attention-regulation to be cognitive muscles which can be strengthened through exercise (eg. *focused meditation* - Menezes et al., 2013) or progressed to a state of *ego depletion* through application (Baumeister, 2006). For example, focusing our attention to continuously defend our cravings for a cigarette, may weaken our ego and reduce our power of self-regulation available to control or sustain our attention to our work task (Sayette, Schooler, & Reichle, 2016). However, it has been shown that applying and building self-regulation in one domain can enhance its application in another (Baumeister, 2006). Strengthening our self-regulation wards off ego depletion and gives rise to greater ability to control our mind-wandering, and to better behave as expected by an organization, community, or society.

Self-regulation also plays an important role in the development of self-efficacy and psychological well-being. The most significant source of self-efficacy comes through our own attempts to control our environments (Bandura, 1997). Maddux (2009) states "believing that you can accomplish what you want to accomplish is one of the most important ingredients – perhaps the most important ingredient – in the recipe for success" (p. 335). Thus, the greater the belief in our ability to carry out a task or goal, such as sustained attention during task performance, the more likely we are to accomplish what we have set out to do. Self-regulation is believed to be the single most influential aspect of personality, powerful enough to overcome all other personality traits, past experiences, and inclinations such that we do the right thing (Baumeister et al., 2006).

The right thing in a high-risk environment is paying diligent attention to your external environment and the task you are carrying out.

Implications

Within the oil and gas industry, the capacity of attention ought to be viewed as a significant constraint on situational awareness (Endsley, 1988), and for this reason, be a substantial domain of interest in the development of HSMS. At present, many organizations within the Alberta oil & gas industry rely on reporting processes aimed at increasing worker attention to the hazards of their environment. However, on-site supervision has identified a need to address general inattention (Dea and Flin, 2001), and not specifically attention to hazards. If attention to task were viewed as a competence to be trained and assessed rather than the result of a complacent attitude, what would we do differently in response to general inattention? Would we supplement reporting processes with training programs that teach the skill of attention to prevent our mind from wandering off task?

Literature Review: Implications of Mind-Wandering

Mind-Wandering Theory

Have you ever experienced that unnerving moment of arriving home from a drive without any recollection of how you got there? Which exit did you take from the parking lot? How much traffic was there? Was the radio on or off? Even in the face of complex demands, daydreaming, mind-wandering, or "engaging in cognitions unrelated to the current demands of the external environment" (Schooler et al., 2011, p. 319) are pervasive throughout our day. In seeking to further appreciate the potential implications of mind-wandering in generating unsafe human behaviors or interactions, we need to understand the processes that influence the occurrence of

self-generated thought, and how the mind sustains focus on these reflections unrelated to environmental perception.

The working hypothesis that neurologists and psychologists base their mind-wandering research on is the apparent ebbs and flows of external attention during task performance (Smallwood, 2013) as depicted in *Figure 1*.

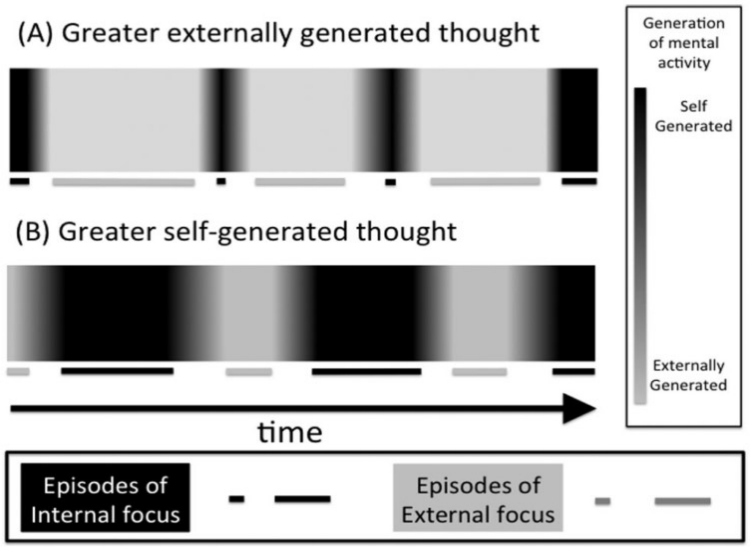

Figure 1. Ebbs and Flows of Attention. This figure illustrates two conditions, greater externally generated and greater internally (self) generated thought (Smallwood, 2013).

As shown above, the generation of mental activity originates from both an internal and external focus during a working task, with variances in the frequency and duration of thought from each condition. The greater amount of external focus, as shown in panel A, infers greater mind on task than that depicted in Panel B where the majority of thoughts in the time period shown are self-generated. Thus, mind-wandering research concerns itself with determining (a)

the events that control the prevalence of shifts between internal and external attention, and (b) the processes that maintain the present focus of attention over time (Smallwood, 2013).

The literature lends itself to four dominant psychological hypotheses on the cognitive source of the state of mind-wandering, of which Smallwood (2013) argues the first three: *current concerns* (Klinger,1999), *executive failure* (McVay & Kane, 2010) and *decoupling* (Smallwood & Schooler, 2006) distinguish the *how*, and the fourth - *meta-awareness* (Smallwood & Schooler, 2006) describes the *why*. *Current concerns hypothesis*, one of the original conceptions of mind-wandering, posits that our mind gives attention to content that is most salient for our individual goals and desires. Imagine a worker who has the long-term objective of having a family one day. If they encounter a considerable disagreement with their partner the evening prior on the phone, there may be a tendency for internal thought focus while performing a familiar, straightforward, repetitive task. As illustrated, the frequency of self-generated thought and subsequent mind-wandering will be more prevalent when the external stimulus has low incentive value to the individual (Smallwood, 2013).

McVay & Kane (2010) have more recently viewed mind-wandering as an executive or cognitive failure; specifically, a breakdown in the ability to effectively manage attentional control in the face of task-irrelevant internal generated stimuli. Within the executive failure hypothesis "mind-wandering-associated mental content is viewed as a form of distraction" (Smallwood, 2013, p. 523) and mind-wandering ensues when we are unable to sustain external attention.

The majority of research reviewed, however, presents an amalgamation of the decoupling and meta-awareness hypotheses to view mind-wandering as natural cognitive cyclic activity of disengaging attention from the external experience (perceptual decoupling) and taking notice of

the internal contents of consciousness (meta-awareness) (Smallwood et al., 2007). When left to its own devices, it is believed the mind generates stimulus-independent thought as influenced by external cues and attention to our own thought (Singer, 1974). In the onset phase of mind-wandering, we withdraw direct attention from our external environment. We then re-direct attention towards the internal thought to either (a) notice and disregard the stimulus-independent thought which is unrelated to what we are doing, or (b) sustain attention to our inner thoughts and enter the maintenance phase of mind-wandering (Smallwood, 2013). It is unknown what triggers awareness to our own mind-wandering or our meta-awareness, "one's explicit knowledge of the current contents of thought" (Schooler et al., 2011, p. 321).

A temporary failure in meta-awareness is thought to lead to zoned-out mind-wandering, where we are unaware that our thoughts are no longer focused on the task. Alternatively, we can notice our thoughts have strayed from a focus on our external environment but consciously decide to remain attentive to them, effectively tuning-out (Smallwood et al., 2007). It has not yet been determined whether being zoned-out and tuned-out are attained via different means. It is possible that one may lead to the other. One speculation is that we perhaps momentarily give attention to our stream of consciousness, follow the thoughts with awareness (zoned-out) at first, but subsequently increase attentional resources as we are further consumed by them and eventually tune-out from our task or environment (Schooler et al., 2011).

Imagine the consequences of an individual or working team's failure to maintain focus on the primary task while monitoring an airspace, nuclear facility, underbalanced drilling operation, or even the volunteer directed cross-walk at the elementary school in your neighborhood. One day, the discovery of an independent marker for off-task occurrences could prevent incidents thought to be caused by worker neglect of the presence and the monopolization of their limited

attentional resources by mind-wandering. The more we can understand how and why our minds go off-task, the greater position we will be in creating environments or training programs to sustain attention to task.

Testing Methodologies

At the time of preliminary investigations, there was no methodology for independently identifying if someone's mind has wandered off-task, and studies relied solely on verbal reports. Self-caught/probe-caught methodology is one approach to establishing the extent to which meta-awareness takes place (Schooler et al., 2011). By this practice, participants press a response key each time they notice an occurrence of mind-wandering, in combination with sample probes by the experimenter in asking whether or not in that moment their mind was wandering. The amount of meta-awareness can then be determined by observation if the experimenter was able to identify mind-wandering in advance of the participant noticing.

A second methodology used to determine variations in meta-awareness of mind-wandering is experience sampling of aware/unaware mental states (Schooler et al., 2011). In this procedure, the experimenter intermittently questions the participant whether at the moment of probe if they were mind-wandering or not. If the participant acknowledged at the time of probe they were mind-wandering, they are asked to report if they were aware or unaware of their mind-wandering prior to probe. In such experiments, participants routinely report being unaware of mind-wandering until the moment of probe (Schooler et al., 2011). As previously mentioned, the differing awareness states have been termed zoning out (unaware of mind-wandering) and tuning out (aware of mind-wandering, but choosing to do it anyway).

A more recent development to overcome the methodology limitations of thought probing, and allow for continuous tracking of attentional states, has shown an increase in response time

variability to be predictive of mind-wandering (Bastian & Sackur, 2013) during simple cognitive tasks. However, further research is required to understand if the variability of response times during sustained attention to response tasks (SART) may also be indicative of mind-wandering while performing more cognitively complex activities ((Bastian & Sackur, 2013). Comprehensive studies might utilize thought probes and variability in response time as they investigate our mind's peculiar tendency to wander off. A recent meta-analysis tested the various methods of mind-wandering assessment as a moderator and showed the negative relationship between mind-wandering and task performance to be stable across studies (Randall et al., 2014). In this way, testing methodology selection does not appear to influence the experimental effects.

Researched Outcomes

Having a foundational comprehension of attention as a skill that can be assessed, and influenced by both our external environment and internal experience brings us to an important question – what influences of mind-wandering should we concern ourselves with in assessing the safety implications of off-task thoughts? Minimal research seems to be available for off-shore oil and gas operations, and even less was discovered for on-shore operations. The forthcoming researched outcomes, unfortunately, have not been assessed specific to the execution of tasks in oil and gas environments, but I believe many of the factors investigated are transferable.

Diminished situational awareness. Loss of situational awareness and poor situational awareness are prominent terms "within accident investigations and have been identified as causal factors in all manner of incidents" (Salmon & Stanton, 2013, p.1). The construct of situational awareness locks us into a hopeless dualist ontology of there being an external world and an interior experience of the mind; the mind is simply an imperfect mirror of the outside world (Dekker, 2015). With respect to actions that lead to a negative outcome, such as not noticing the

trip tank indicator rising, we can easily point out the critical information that was missing from the person's mental mirror of the world such that they experienced a loss of situational awareness (Dekker, 2015). Although considered a critical factor to safe and efficient operations in the drilling industry, very little research has been carried out with a focus on situational awareness (Sneddon, Mearns, & Flin, 2013). Unlike other high risk sectors situational awareness training is not provided or tested regularly.

Aviation is one industry that concerns itself with attentiveness and situational awareness of its pilots. Casner & Schooler (2015) were interested in assessing whether attentiveness is a reasonable prospect given distraction and mind-wandering. They devised a laboratory experiment to observe the monitoring pilot's non-task related behavior and non-task related thought in relation to a specified cockpit monitoring of verbal callouts of a plane's ascending and descending altitude values. The experimenters made observation of their task behavior as well as prompted them every two minutes for a self-report on whether their current thoughts were task or non-task related. The participants, sixteen active Boeing 747-400 pilots (7 captains, and 9 first officers) missed 25 % of the altitude call-outs tasked to them in the simulation exercises. According to the self-reports, pilots allocated "43% of their available monitoring time to task-unrelated thought" (Casner & Schooler, 2015, p. 40), and several occurrences of mind-wandering were identified in proximity of the altitude call-out misses. Within their conclusion, despite efforts of diligent monitoring, varying the monitoring tasks with other activities, and taking mental breaks, monitoring mistakes still occur. Casner & Schooler (2015) suggest a future direction of researching and training people in better ways to manage internal and external distractions to reduce mind-wandering. Fundamentally, they conclude that we need to learn how to train people to pay better attention.

Perhaps we are not all able to relate to pilots in a cockpit, but chances are most of us have sat behind the steering wheel of a vehicle. Driving is the most dangerous activity one engages in each day. This next study will illuminate mind-wandering as a lesser known driving hazard. In a responsibility case-control study, Galéra et al. (2016) questioned 955 drivers both responsible and not responsible for a motor vehicle crash, to recall their thoughts immediately prior to the incident. Then they categorized the content of the driver's thoughts as: on task, un-related to task, or without thought. Mind-wandering of highly disruptive thought content was shown to be independently associated to a responsibility of the vehicle collision (Galéra et al., 2016). The study concluded that dissociation of attention from visual and auditory recognitions can threaten road safety by way of compromising the driver's ability to effectively incorporate cues from the environment (Galéra et al., 2016). Simulator studies have also suggested impairment in monitoring the environment as indicated by diminished variability in horizontal gaze, less time checking side mirrors (He, Becic, Lee, & McCarley, 2011), longer breaking response times, driving at greater velocities, and longer time to respond to a peripheral event such as a pedestrian stepping onto the road (Yanko & Spalek, 2013), during mind-wandering episodes in comparison to on task episodes.

Moderated meta-awareness. It appears the act of mind-wandering gives rise to undesirable consequences to our situational awareness. However, the effects of mind-wandering itself are influenced by meta-awareness or the extent to which we are aware of our own awareness. Let's take a look at an example study for a better understanding. Smallwood, McSpadden, et al., (2007) measured response time in combination with experience state sampling (aware/not aware) on a group of 55 under-graduate students divided into two groups of either high probability or low probability target occurrence within a go/no-go response inhibition

activity (eg. response inhibition - children's game *Simon Says*). The target stimuli 'XXXXX' was embedded 40% within a word list for the high probability group and 20% for the low probability group. A go/no-go response inhibition activity of 60-90 second durations was administered to determine the response inhibition as measured by a) likelihood of failing to withhold response in the occurrence of the target stimuli and b) duration of response time.

The experience-samplers probed throughout to ask the participants if their current focus was on task or on internal thoughts, and if they were mind-wandering at the moment of the probe if they were aware of it or not. Mind-wandering was associated with failure in response inhibition, but only in the absence of awareness suggesting ineffective supervision of task (Smallwood et al., 2007). The response times were also greater in duration but not associated with poor response inhibition when the participants were aware of their mind-wandering. Inhibition of response time may be detrimental to the health and safety of workers when executing the activity safely requires a quick and appropriate reflective reaction. Effectively, mind-wandering has been shown to have a greater hindrance to psychological processes, as shown by poor response inhibition and response time, but to a lesser degree when we have a cognitive awareness of our mind-wandering.

Inferior task performance. We can now appreciate the loss of attention to our external environment and the influential role of meta-awareness, but when it comes to safe operations we must also understand how mind-wandering affects our ability to adequately perform a task.

Randall et al. (2014) produced a meta-analysis on 49 articles, as a subset of the 593 studies reviewed meeting the eligibility criteria of being: (1) adult samples; (2) available data for computation of correlations between "cognitive resources and mind-wandering or task-related thoughts or between mind-wandering or task-related thoughts and task performance" (p. 1417);

and where (3) mind-wandering was assessed after task completion with which it was being correlated. The subsequent findings were pulled from "40 published peer-reviewed articles, two dissertations, one thesis, one technical report, one conference paper, two manuscripts under review, and two manuscripts in preparation" (Randall et al., 2014, p. 1417).

As one would expect, results indicated a positive association between cognitive resources and successful task performance. Upon reviewing the data, Randal et al. (2014) derive that people with greater cognitive resources (general mental ability and working memory capacity), tend to direct their attention toward task-related thoughts and away from superfluous or task-irrelevant thoughts. Inversely, people with less cognitive resources are more likely to engage in mind-wandering (Randall et al., 2014). Secondly, increases in mind-wandering while accomplishing a task are accompanied by impaired task performance levels: the more complex the task, the greater the reduction in performance as a result of a wandering mind (Randall et al., 2014). Conversely, performance levels improve when thoughts are task-related.

> Across all studies, and without a consideration of the task environment, mind-wandering accounted for roughly 6% of the variance in task performance. [Randall et al.] believe this statistic holds practical significance beyond its statistical significance due to the potential for inefficiency, error, and even danger to be introduced as a failure to maintain one's attention on task performance (Randall et al., 2014, p. 1424).

As it turns out, there is ample research implying that mind-wandering "occurs at a significant cost to performance" (Mooneyham & Schooler, 2013, p. 11) and situational awareness. Naturally, our next question should be what can we do to regulate or reduce the occurrence of mind-wandering?

Role of Individual Differences in Regulating Mind-Wandering

It is obvious that people differ from each other. Research on individual differences seeks to understand the lesser evident - how and why people differ. When it comes to mind-wandering, there appear to be major disparities in our individual propensity, although gender differences do not appear to be a factor (Singer, 1974). Even some of the earliest pioneering research suggests we are able to adequately self-categorize whether or not we have the predisposition to be lost in thought. One rapid auditory signal detection experiment, self-categorized high-frequency day dreamers, reported themselves as having task-irrelevant thoughts for 76% of the trials in contrast to a 44% response rate for the low-frequency day dreamers (Antrobus, Coleman, & Singer, 1967).

Overall, the construct of mind-wandering does not have a particularly captivated audience of individual differences researchers. The studies that follow are meant to give the reader a taste of how complex the mechanisms of regulation and individual influencing tendencies may truly be.

Self-regulation of addictive habits. Using the self-caught/probe-caught methodology, both alcohol consumption (Sayette, Reichle, & Schooler, 2009) and cigarette cravings (Sayette et al., 2016) were observed to "simultaneously increases mental lapses while reducing the metacognitive capacity to notice" (Schooler et al., 2011). This data is also suggestive of why cigarette cravings and alcohol consumption are correlated to the failure of self-regulation. In drilling operations, alcohol consumption is forbidden during working hours, and in many cases, there is a zero tolerance for the possession of alcohol on worksites or work accommodations. However, smoking is very prevalent, with the mining and oil and gas sectors reporting the second highest employee smoking rate in Canada in 2011 (29 percent) (The Conference Board of Canada, 2013). Very often, if you are not a smoker when you arrived at an oil and gas drilling

site, you will be one by the time you leave due to the influences of relational networks (Christakis & Fowler, 2008). In drilling operations, smoking is not permitted on a drilling work location, within 25 meters of the wellbore (Alberta Energy Regulator, 2006). Workers must take a break from their job task and walk over to the designated smoking location on site to enjoy a cigarette. Although the research specific to drilling crew member's cigarette craving frequency or severity is unavailable, we could assume many workers experience zoning-out as influenced by smoke cravings given a worker's availability for a smoke break is driven by the operation schedule.

Glucose regulation. Given glucose is the primary energy source for our brains, one should not be surprised that cognitive studies have found increasing blood glucose concentration to boost cognitive functioning. The effects of glucose facilitation have shown positive outcomes on verbal episodic memory (Smith, Riby, Eekelen, & Foster, 2011), speed of recognition (Owen, Scholey, Finnegan, & Sünram-Lea, 2013), and a diminishing effect on mind-wandering (Birnie, Smallwood, Reay, & Riby, 2015). Researchers, however, emphasize the importance of understanding individual differences in glucose regulatory efficiency in further understanding the subsequent benefit of glucose facilitation on cognition.

For instance, the consumption of a glucose drink was predictive of improvement on immediate word recall accuracy in poorer glucose regulation participants in comparison to placebo. However, those with better glucose regulation showed performance decline in relation to the placebo, suggesting the preferential cognition enhancement from glucose loading for those with poorer glucose regulation (Owen et al., 2013). The methodology in the only study found observing glucose facilitation on mind-wandering did not give attention to glucose regulation variability in participants. At any rate, glucose facilitation was shown to increase the number of

task-related thoughts suggesting glucose provides the additional energy during high demand tasks to facilitate effective control and monitoring of performance (Birnie et al., 2015). This is consistent with findings that glucose is associated with better performance in tasks requiring uninterrupted attention (Benton, Owens, & Parker, 1994).

Involuntary body impulses. In further exploration of an involuntary mind-body relationship, Carriere, Seli, & Smilek (2013) surveyed three independent samples, for a combined total of over 700 participants from an international general population to reveal a correlation amongst spontaneous (non-intentional) mind-wandering, fidgeting behavior and decreased attention. Given the association only holds true for spontaneous mind-wandering, they propose the interaction is driven by a third variable introducing involuntary mind and body impulses. The *variability mechanism*, as they have termed it, possibly a general adaptive property of the neural system, is thought to enhance the body's ability to process information by introducing a moderate amount of *noise* into the system (Carriere et al., 2013). The variability mechanism is aligned with existing neural theories and research on stochastic resonance, that the introduction of noise can give visibility or detection to a signal normally too weak to be detected (McDonnell & Ward, 2011).

Mindfulness. Mindfulness is a state of heightened awareness and attunement to one's present moment experience, including wandering thoughts. It is respected as a psychological state of mind, as well as an individual trait that can be measured and compared between people. The second section of this paper will provide a review of both the state and trait of mindfulness in terms of its relevance to understanding the individual differences of mind-wandering and as a potential regulating mechanism.

Implications

With studies demonstrating off-task thought to be associated with failure to perform monitoring procedural steps (Casner & Schooler, 2015), a deficiency in being able to call information to mind (Smallwood et al., 2003; Smallwood et al., 2007), more false alarms (Smallwood, Baracaia, Lowe, & Obonsawin, 2003), and a reduction in task performance (Randall et al., 2014), we cannot afford to continue to overlook the impact mind-wandering has on human behavior in high-risk environments.

Within this literature review, the research finds mind-wandering to be a natural cognitive occurrence, influenced by a variety of personal differences Mind-wandering has detrimental impacts on one's ability to sustain attention and maintain situational awareness. It seems conceivable we may one day discover the underlying mechanism influencing an individual's tendency for their mind and body to spontaneously wander away. In the meanwhile, we must ask ourselves what can we gain in terms of assessment or detection to support a safe work environment? Are there roles we would be better off to staff with low propensity mind-wanderers or is it the accountability of an employer to provide mindfulness or situational awareness enhancing training similar as other industries do? The second literature review explores how mindfulness may be one key way to teach workers how to be better at paying attention.

As an aside, I fully acknowledges mind-wandering may be beneficial in the context of some desirable outcomes including autobiographical planning, creative problem solving (Mooneyham & Schooler, 2013), and delayed gratification (Smallwood, Ruby, & Singer, 2013), but these effects are beyond the consideration of this paper as they are thought to be more or less irrelevant in the context of safe behavior in field operational positions.

Literature Review: Effects of Mindfulness Meditation on Mind-Wandering

Mindfulness Theory

Rooted in ancient Buddhist philosophy, mindfulness is being hailed as one of the most surprising and promising trends in business (Gelles, n.d.), healthcare, education, and as a rapidly ascending theme in scholarship research (Sutcliffe, Vogus, & Dane, 2016). Organizations such as Target and Google have adopted mindfulness training and practices into their employee's workday (Gelles, n.d.). Online searches for mindful retreats, mindful teacher training, mindful meditation courses, and the like return plentiful web page results. Mindfulness meetup groups are gathering. Cellphone applications and technologies (eg. Muse headband) are blowing up in consumerism to accommodate the public's hungry demand for anything mindful (Wells, 2016). Mindfulness is unfolding everywhere and being revered as the solution to all that ails us – as individuals and as organizations.

So what exactly is mindfulness? William James (1911/1924) proclaimed the average human to have a peculiar state of consciousness in that "compared to what we ought to be, we are only half awake" (p. 237). As James was alluding to, so much of our day is spent less *awake* in automatic functioning or operating habitually on auto-pilot: driving familiar roads, navigating the same conversations at work, and pushing through the exact workout we completed the day before. Of course, there are benefits of habituating certain tasks as completing an act several times simplifies our movements and economizes the amount of nervous and muscular energy (James, 1982/1984). Like most things, there is an optimal application of habit in our lives, and too much habituation or mindless living can be detrimental. As a result of living life *mindlessly*, we overlook a great deal of sensory information. A particular challenge, in a review of the research, to understanding mindfulness is that it does not have a universally accepted definition.

In fact, Vogus & Sutcliffe (2012) have cited fourteen variations of individual mindfulness, and thirteen different definitions of collective mindfulness.

Individual mindfulness has been referred to as 'a state of consciousness in which attention is focused on present-moment phenomena occurring both externally and internally (Dane, 2011, p. 1000), as "being attentive to and aware of what is taking place in the present" (Brown & Ryan, 2003, p. 822) and "a mental state with the characteristics of present-focused awareness and attention" (Zhang & Wu, 2014, p.24), to name a few. We can breathe mindfully, eat mindfully, walk mindfully, work mindfully, be mindful in our relationships and essentially, anywhere else we so choose. When we breathe mindfully, for example, we might hold the intention to feel the air flow past our nostrils and through our airway, to notice the rise and fall of our chest, and to be conscious of other sensations which arise.

Notwithstanding a single definition, research has found mindfulness may play a significant role in fostering self-sanctioned behavioral regulation (Brown & Ryan, 2003) by helping individuals disengage from a life on auto-pilot. Autonomous regulation of our inner state of mind and external behavior is imperative to healthy behavioral and psychological functioning (Brown & Ryan, 2015). Thus, learning to be more mindful can have a profound impact on our well-being and happiness (Brown & Ryan, 2003).

With the growing number of tangible benefits emerging from empirical research, it is not surprising mindfulness has gone mainstream. "Through a combination of survey, experimental, neurocognitive, and inductive methods (e.g., conversation analysis, ethnography), researchers have placed mindfulness under the microscope, putting centuries-old claims about its benefits to the test" (Sutcliffe et al., 2016, p. 56). The research topics and results are widespread. Mindfulness has been shown to be inversely correlated with impulsiveness, self-consciousness,

depression, and anger-hostility (Brown & Ryan, 2003), to positively influence safety compliance and safety participation behaviors (Zhang & Wu, 2014), to increase task-performance by inhibiting distracting thoughts (Andrews, Kacmar, & Kacmar, 2014), and notably as a desirable trait in effective leadership (Lewis, 2013). Intervention outcomes have shown mindfulness training to have a positive influence over bottom line contributors of an organization such as emotional exhaustion, job satisfaction (Hülsheger, Alberts, Feinholdt, & Lang, 2013) and work engagement (Leroy, Anseel, Dimitrova, & Sels, 2013). Other studies have demonstrated reductions on mind-wandering occurrence (Jha et al., 2015), and improvements to task performance (Dane, 2011) and attention functioning (eg. Jha, Krompinger, & Baime, 2007; Tang et al., 2007; van den Hurk, Giommi, Gielen, Speckens, & Barendregt, 2010). Studies suggest mindfulness to be an overarching resource of exhaustive potential.

Albeit a crowd-pleasing theme to the general public and a compelling business strategy, there exists critique of the "scientization of mindfulness" (Sutcliffe et al., 2016, p. 56) and an acknowledgement of a relatively strong positive bias in published studies on the effects of mindful meditation (Holzel et al., 2011). It is only fair to any argument to dutifully disclose existing limitations in meta-analysis and reviews of empirical studies (Fox et al., 2014; Keng, Smoski, & Robins, 2011). To start, the results of most studies have yet to be replicated, many consist of small sample sizes, and few are control longitudinal applications (e.g. van den Hurk et al., 2010). The bulk of research has been cross-sectional comparing the cognitive capacities and neurology of meditators to non-meditators. Cross-sectional studies, however, preclude causal attribution. For instance, it is possible pre-existing differences prevail within the brains of experienced meditators which may be related to their interest in meditation (Tang et al., 2015). Lastly, longitudinally designed studies comparing the data from random assignment groups,

including a control condition group, at numerous points in time are somewhat isolated (e.g. Jha et al., 2015).

Organizational Collective Mindfulness

A slightly different view on mindfulness has transpired in organizational behavior – the attribute of collective mindfulness (Weick, Sutcliffe, & Obstfeld, 1999). In this context, mindfulness has been defined as "a psychological state in which individuals engage in active information processing while performing their current tasks such that they are actively analyzing, categorizing, and making distinctions in data" (Krieger, 2005, p. 137). Collective mindfulness then refers to the degree to which an organization engenders a rich awareness and detail of emerging threats and has the capacity to respond quickly (Weick et al., 1999). Alternatively, it has been defined as "a way of working marked by a focus on the present, attention to operational detail, willingness to consider alternative perspectives, and an interest in investigating and understanding failures" (Ndubisi, 2012, p. 537).

In expanding on the primary analysis of High-Reliability Organizations, which were based on structure and technologies, Weick, Sutcliffe, & Obstfeld (1999) put forward a process based interpretation. By taking a closer look at the ways in which cognitive processes interrelate and lend themselves to the detection and correction of errors, Weick et al (1999) suggest collective mindfulness to be defined by five interrelated processes: (1) a preoccupation with failure; (2) reluctance to simplify interpretations; (3) sensitivity to operations; (4) commitment to resilience; and (5) deference to expertise (Vogus & Sutcliffe, 2012, p. 723). Resilience, a recurrently studied construct in positive psychology, is the ability of an individual, community, organization or institution to grow and thrive when faced with adversity (Reivich & Shatté, 2002).

High-Reliability Organizations, or mindful organizations, expect errors and failures to transpire and are prepared to manage them. One way of doing so is to ensure the workforce has the required "mental skills to enhance risk awareness" (Reason, 2016, p. 88). Mindful organizations are sensitive to and constantly modifying their behaviors and processes to tiny cues in their environment which, if left unaddressed, could compile and interact with other parts of the organizations' systems to amount to much larger problems (Leveson, 2011).

I conceive organizational mindfulness as being akin to positive organizational scholarship (POS) on the grounds that is a particular way of thinking that creates patterns of excellence to achieve extraordinary outcomes (Dutton & Glynn, 2008): improved reliability, quality, and safety (Sutcliffe & Vogus, 2007); a flourishing safety culture (Hopkins, 2002); and greater customer satisfaction (Ndubisi, 2012). Comparably, POS and collective mindfulness researchers ask: "do the factors that underlie negative, problematic or undesirable conditions or states in organizations" (lack of compliance to safety procedures, inattention and disengagement from task, decline in safety performance metrics) also explain "positively deviant states" (safe behavior through self-agency, thriving teams and operational performance, collective mindfulness) (Dutton & Glynn, 2008, p. 694)? POS places an emphasis on investigating what is generative or life giving to the organization (Dutton & Glynn, 2008). Whereas most companies track their safety performance through reporting on lagging indicators (eg. injury frequency), mindful organizations have well-developed reporting systems that give attention to leading indicators or success metrics (eg. positive observations, on-site leadership contact hours) (Hopkins, 2002). They have come to recognize post-accident analysis as an inadequate model of learning and believe prospect lies within progressing their understanding of preventative actions and processes (Leveson, 2011).

The general assumption has been that accidents can be prevented by increasing the reliability of the individual components within a system (Leveson, 2011). Many are of the opinion, we must expunge this dangerous false assumption that accidents are caused by the failure of components and take the view that safety is a systems problem (DeJoy, 2005; Hopkins, 2002; Leveson, 2011; Reason, 2016; Weick et al., 1999), one that deserves our heightened attention. “Individual mindfulness of dangers needs to be sustained and supported by a collective mindfulness of the operational risks” (Reason, 2016, p. 89). All too often the workers comply by doing their part, but the organization process is not in place, or if it is in place, the role of management is not well understood. The high reliability and low incident benefits that come along with being a mindful organization (Weick et al., 1999) are not achievable when supervisors continue to assign workers as the primary source of incidents (Dea & Flin, 2001). On-site supervision must be willing to engage their own management in a conversation to discuss what they can do differently going forward to prevent reoccurence. Regularly, management wipes their hands clean by pointing their finger directly back at the supervisor, similarly as the supervisor does to the worker. Perhaps it is a learned pattern to impugn the man or woman down the chain.

Considering collective mindfulness as a method of sustaining attention on one’s environment and factors that may interfere with the safety of the environment (Sutcliffe et al., 2016), I suggest worker’s individual mindfulness and capacity for self and situational awareness (as established by attentional functioning) to be a contributing factor to collective mindfulness. Unfortunately, the relationship between individual and collective mindfulness is yet to be empirically understood; however, Sutcliffe et al., (2016) have recently implored researchers to give it consideration.

One way in which organizations attempt to make the present moment more focal is through programs which ask workers to stop and take a moment to assess the potential hazards of the job they are about to carry-out (Reason, 2016). Often workers are told to 'stop and think' or to keep their 'mind on task'. The argument of this paper is that workers must first be educated on the construct of mindfulness and instructed how it is cultivated, thereby increasing attention to task, and decreasing the duration their attention is off-task (mind-wandering). "A company whose employees were all individually mindful of risks would be a dream come true for many employers" (Hopkins, 2002).

Cultivating Individual Mindfulness

Mindful cultivation can be embraced through a diverse range of awareness enhancing practices including mantra meditation, mindfulness meditation, and mindful movements such as tai-chi, qi-gong, and yoga. The frame of reference for this section of the paper will be the potentiality of mindfulness meditation for enhanced individual attention functioning and curtailment of mind-wandering.

Theorized as both a state and measurable trait, a variety of scales and questionnaires have been designed to capture individual mindfulness empirically (eg. the Five Facet Mindfulness questionnaire - [Baer, 2006]; the Freiburg Mindfulness Inventory (FMI) - [Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006]; the Mindful Attention Awareness Scale (MAAS) - [Brown & Ryan, 2003]). These scales ask participants of experiments to report on how mindful they were before, during, and after completing a task. Sutcliffe et al., (2016) formulate a framework of measures as guidance for researchers' individual mindfulness measurement selection. Alternatively, thought-probe methods (as previously outlined in reference to mind-wandering) can be used to assess real time mindfulness or awareness.

Typical mindfulness training programs provide lectures and practices on how to steady and focus attention to present moment experiences to offset our natural tendencies to "neglect the presence in favor of ruminations on the past…or what may yet come to pass" (Smallwood, 2013, p. 519). Mindfulness as a self-regulation intervention has the advantages that it can be practiced autonomously, as a stand-alone intervention, without the addition of technological assistance. The most significant drawback in the use of mindfulness training for cultivating individual mindfulness and cognitive functioning improvements has been the length of time devoted to practice in the bulk of empirical studies (e.g. Jha et al., 2007; Orzech, Shapiro, Brown, & McKay, 2009).

Qualification of short-form mindfulness meditation training programs as a successful attention strengthening intervention is growing (Jha et al., 2015). The effectiveness of abbreviated approaches has shown significant improvements in concentration (e.g. single 8-minute mindful breathing exercise - [Mrazek, Smallwood, & Schooler, 2012]) and participants perception on their ability to focus on class materials (e.g. 60-90 second body/breath awareness exercise - [Crumleyn & Schutz, 2010]). Other studies, some to be detailed later in this paper, have found short duration programs effective at reducing mind-wandering, and enhancing cognitive functioning, of particular interest – attention regulation.

Meditation. Meditation has been recognized as a secular practice and a rigorous system of "mental training that aims to improve an individual's core psychological capacities, such as attentional and emotional self-regulation" (Tang, Hölzel, & Posner, 2015, p. 213). It is often used to cultivate a state of mindful awareness. In an effort to provide researchers and neuroscientists with a practical framework to consider, Holzel et al. (2011) hypothesize four mechanisms through which they believe mindfulness meditation works: (1) attention regulation; (2) body

awareness; (3) emotion regulation; and (4) change in perspective on the self. The framework has since been simplified and depicted as follows:

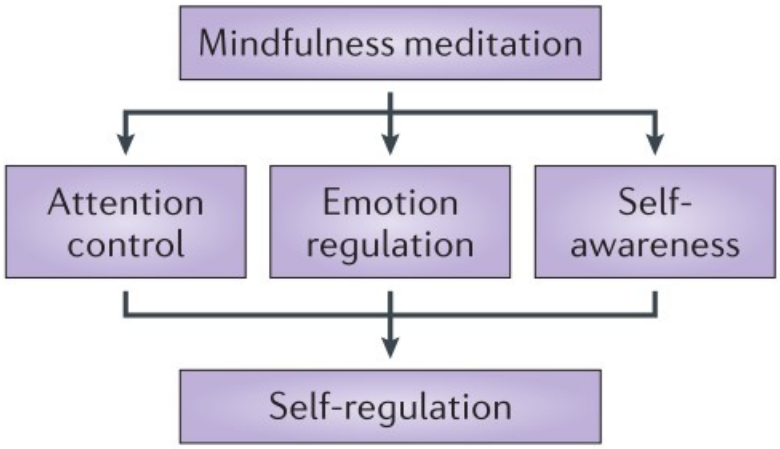

Figure 2. Mechanisms of Mindfulness. Mindful meditation is theorized to positively contribute to attention control, emotion, regulation, and self-awareness for an outcome of improved self-regulation (Tang et al., 2015).

Numerous meditation methods stress the ability to cultivate attention regulation as paramount to a practice and recommend a focused attention meditation before advancing to open monitoring practices (Lutz, Slagter, Dunne, & Davidson, 2008). While taking part in open monitoring meditation, there is no fixed target for attention. The intention is to simply notice, without reactivity or judgment, the incoming thoughts, and emotions. "The 'effortful' selection or 'grasping' of an object as the primary focus is gradually replaced by the 'effortless' sustaining of an awareness without explicit selection" (Lutz et al., 2008, p. 164). Many mindfulness practices exercise a combination of attention focused and open monitoring styles of meditating.

In a focused attention meditation (e.g. Shamatha or concentration-based meditation), one may be instructed to concentrate on a single object such as the inflow and outflow of the breath.

When the practitioner notices their awareness has shifted from the breath, they are encouraged to non-judgmentally return the focus of their attention back to the breath (Hasenkamp & Barsalou, 2012). Regular practitioners of focused attention meditation report an enhanced ability to sustained targeted attention over a period of time (Jha et al., 2015). On numerous accounts, meditation and mindfulness practices, have been shown to enhance attention functioning (eg. Jha et al., 2007; Tang et al., 2007; van den Hurk, Giommi, Gielen, Speckens, & Barendregt, 2010) and more accurate visual attentional processing (Hodgins & Adair, 2010). Research over the past two decades strengthen claims that mindfulness meditation positively contributes to cognitive performance and our mental and physical health (Tang, Hölzel, & Posner, 2015). Be that as it may, neuroimaging studies have yet to determine the underlying neural mechanisms believed to facilitate these positive effects (Holzel et al., 2011).

With its resultant advantages on attentional functioning and overall cognitive performance, mindfulness has become a bourgeoning area of study. In hopes to gain a better understanding of neurological networks in mindfulness and in mind-wandering, Hasenkamp, Wilson-Mendenhall, Duncan, and Barsalou (2012) present a model of how the mind shifts attentional states between mind-wandering and sustained focus during meditation. The four cognitive states, established in observation of brain region activation whilst performing attention-focused meditation, are advised to be: (1) mind-wandering; (2) awareness of mind-wandering; (3) shifting attention; and (4) sustained focus (Hasenkamp et al., 2012).

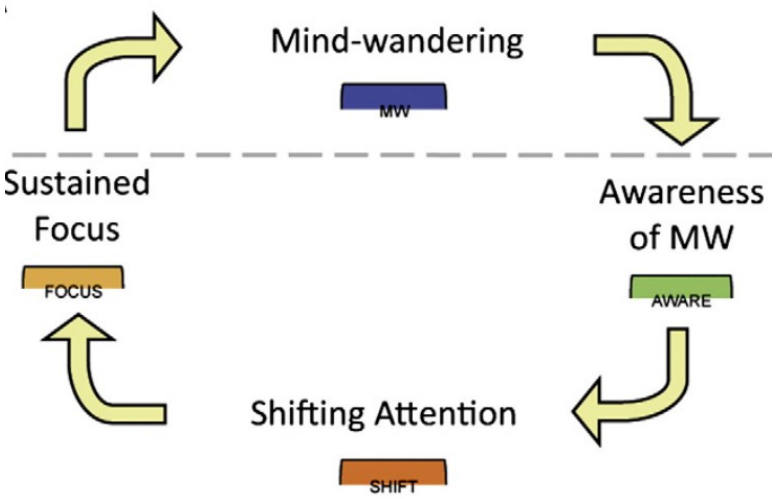

Figure 3. Cognitive States of Mindful Meditation. While engaged in meditation, the mind is theorized to be fluctuating in a pattern of sustained attention, mind-wandering, awareness of mind-wandering, and shifting attention back to focus.

The model, although conceived during observation of active meditation, could feasibly be applied with respect to any activity requiring sustained attention. Recollecting the example in the introduction of a drilling crew tripping pipe out of the hole, imagine a crew member's attention to be focused on the task while everyone is getting themselves into position. For a short duration the activity of tripping may demand sustained attention, but as the pipe count increases, the repetition of the activity can induce mind-wandering (Mason et al., 2007). Presuming the crew member's mind unintentionally drifted to task-unrelated thoughts, at some point, they will recognize their mind has wandered (meta-awareness), and likely shift their attention back to the activity of tripping. Sustained attention will be recovered, until their internal thought stream entices their attention off-task again and the cycle ensues (Hasenkamp et al., 2012).

Researchers have only begun to explore the tip of the iceberg in determining the brain regions which are altered by meditative practices, and further studies are needed to disentangle how the changes in neural structure are interrelated to changes in behavior and psychological well-being (Hasenkamp et al., 2012). The definitive long-term impact of meditation on the brain remains to be uncharted.

On attention processes. Studies have demonstrated better attentional functioning in experienced meditators, as implied by smaller error scores on Attention Network Testing (ANT), in comparison to non-meditators (Jha et al., 2007; Tang et al., 2007; van den Hurk et al., 2010). ANT is used to evaluate the influence mindful meditation practices have on the efficiency of attentional elements: alertness, orienting, and conflict monitoring. In contrast to control groups, Jha et al. (2007) revealed improved orienting in seventeen participants of an 8-week mindfulness-based stress reduction (MBSR) course, (3 hours weekly class, assigned 30 mins of daily meditation course), and improvements in the alerting component for a 1-month residential mindfulness retreat group (10-12 hours of mindfulness meditation a day). In a cross-sectional study, van den Hurk et al. (2010) demonstrated better orienting and executive attention as observed in a group of 20 expert mindful meditators (14.5 years mean period experience, 60 – 420 mins per week) in comparison to an age and gender matched control group. The ANT results for a group of 40 undergraduate students suggest 5 days of 20-minute integrative body-mind training can lead to improved conflict monitoring scores (Tang et al., 2007). In this way, findings indicate mindfulness training may "improve attention-related behavioral responses by enhancing the functioning of specific subcomponents of attention" (Jha et al., 2007, p.109). As is the case with most studies, contradictory outcomes can be found. For instance, another longitudinal randomized control group trial showed no sustained attention differences after an 8-

week MBSR course (3 hour weekly class, 45 mins assigned daily meditation) (MacCoon, MacLean, Davidson, Saron, & Lutz, 2014).

Chiesa, Calati, and Serretti (2011) reviewed twenty-three mindfulness studies providing measures of attention, memory, and executive function; eight of the studies were case-controlled and fifteen were controlled or controlled randomized. Although they urge the evidence to be considered with caution, noting methodological limitations, lack of standardized mindful meditation instruction and programs, as well as differences in study design, duration, and participant population, findings provide preliminary evidence indicating mindfulness meditation practices may enhance cognitive functions. Results suggest mindfulness training having to do with the development of focused attention "could be associated with significant improvements in selective and executive attention" (Chiesa et al., 2011, p. 449).

On mind-wandering. There has been an increase in research investigating the function and effects of mind-wandering. In fact, a recent meta-analysis observed 55% of the studies included were published within the last 3 years (Randall et al., 2014). Of particular interest to this paper is the empirical research related to the usefulness of applied mindfulness to counteract the frequency and loss of meta-awareness present in mind-wandering. As previously mentioned, mind-wandering can be harmful to the individual, organization, and society alike.

Mind-wandering redirects our attention from our external environment to our internal thought stream, and shifts the content of information the short term memory attends to (Jacobson, 2010). Besides a reduction in attention to the primary task, when our mind shifts to an internal focus, it consumes short term memory and reduces its availability to assist us in the completion of the task (Jacobson, 2010). Accordingly, mindfulness research aimed at reducing mind-wandering often measure working memory capacity (Mrazek, Franklin, Phillips, Baird, &

Schooler, 2013; Zeidan, Johnson, Diamond, David, & Goolkasian, 2010), and task performance which requires sustained attention (e.g. reading comprehension, Mrazek, Franklin, Phillips, Baird, & Schooler, 2013), as well as processing speed (Zeidan et al., 2010), and executive attention (Jha et al., 2007; Tang et al., 2007; van den Hurk et al., 2010).

Despite the apparent requirement in the workplace for workers to refrain from unconstrained self-generated mental activity during high hazard potential tasks, few workplace mindfulness mitigation interventions have yet to be empirically validated (Jha et al., 2015; Zhang, Ding, Li, & Wu, 2013; Zhang & Wu, 2014). Much of the psychological research is completed on undergraduate university students partaking in the study as a course requirement. Regardless, studies of varying training duration and lengths of mindfulness practices can be reviewed in consideration of how transferable the results may be to a workplace environment. Let's take a closer look at a few example interventions of varying program length.

Eight weeks. Although beneficial to well-being, meditation interventions such as the eight-week MBSR course are significantly time-consuming and can pose financial limitations. One workplace study gave consideration to mindfulness training as a means to enhance cognitive control capacities, specifically to reduce attentional performance lapses (mind-wandering), and build resiliency, in active-duty military service members (Jha et al., 2015). A total of 134 participants were involved in the program, 45 civilians (external control), 19 military personnel assigned to a *no training control* group, 33 military personnel administered an experiential based mindful training program, and 37 military personnel administered an educational mindfulness training program. Both training programs were delivered over 8 weeks, with 2-hour class sessions weekly for the first four weeks. During the fifth week, participants attended 15-minute individual practice sessions with an instructor and were provided information for individual

practice for the final three weeks. Participants in both training programs, in addition to their class time commitment, were provided audio CDs and assigned 30-minutes of apportioned daily mindfulness exercises. The programs differed in instruction content and class duration allocated to experiential training or mindfulness practice. Course content in the experiential program linked mindfulness to concrete applications in the military work environment to encourage mindfulness practice beyond the classroom. Content modules included topics on how mindfulness "may strengthen attention, situational awareness, emotion regulation, and decision-making" (Jha et al., 2015, p. 7). The didactic or educational based group were instructed on mindfulness principles of "neuroplasticity, stress, resilience, and self-regulation of the autonomic nervous system" (Jha et al., 2015, p. 7) for 7 hours and received one single hour of introduction to mindfulness training exercises.

The findings suggest that in-class mindfulness training exercises may promote cognitive resilience better than instructional training by sustaining better attentional capacities (Jha et al., 2015). Results were founded on the variation observed in attentional performance on a sustained attention to task – response time, and task performance accuracy. Additionally, the 'no training control' group reported being significantly less aware via self-reports of being off-task during the SART than both mindful intervention groups.

A prior study offering Mindfulness-Based Mind Fitness Training (MMFT) as a 24 hour, eight-week program, suggested protective benefits of mindfulness training on working memory – a correlated mental capacity with mind-wandering – proportionate to the time spent on mindfulness practices out of class. Roughly twelve minutes of daily meditation exercise maintained or improved working memory capacity of the test group relative to the control group

and those marines who opted to practice less or not at all (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010).

Although the military investigation of mindfulness training programs discussed involves significant in-class time commitments, the results are valuable empirical evidence that the nature of the training may have exceptional significance to the anticipated program influence (Jha et al., 2015). Thus we can continue to expect a diverse range of effect on increased attention to task through a reduction in mind-wandering when testing non-standardized training programs. Furthermore, no two organizations or operational teams have members of identical cognitive competency, and each work environment possesses its own unique constraints on our attentional capacity and our minds' tendency to wander off-task. Nonetheless, one conception seems to remain the same throughout the studies, and that is the notion that "the opposite of an inattentive mind may be a mindful one" (Jha et al., 2015, p. 4).

Two weeks. Consider a controlled study where a group of 48 undergraduate students were randomly assigned to either a nutritional class (control group) or a mindfulness class to meet four times a week for 45-minute sessions for a total of two weeks. The mindful practice of focused attention meditation, giving attention to breathing sensations, were shown to elicit "increased working memory capacity and superior reading comprehension" (Mrazek et al., 2013, p. 780). Mind-wandering occurrence was evaluated with both thought sampling and participants' self-reports. Findings suggest mindfulness training as a mechanism to dampen distracting thoughts and enhance performance (Mrazek et al., 2013).

A few days. A random assigned control group study tested the mindfulness and cognitive influences of a four-day mindfulness training to book listening (Zeidan et al., 2010). The FMI (Walach et al., 2006) and various cognitive task tests were administered prior to the first session

and after the fourth session. The test and control groups had no previous meditative experience and did not differ on any of the measures at baseline testing. Results indicated “four days (20-minutes per day) of mindfulness training was effective in significantly increasing mindful scores in comparison to an active control group” and “promoted significant effects on several cognitive tasks that require sustained attention and executive processing efficiency” (Zeidan et al., 2010, p. 602). One of the explanations provided by the researchers for the improved cognition is the enhanced ability to control mind-wandering as a result of mindfulness training. However, this particular study did not entail thought probing, just the FMI.

Mindfulness Summary

As the available longitudinal studies examining the development of mindfulness training and practices have “revealed changes in behavior, brain structure, and function” (Tang et al., 2015), mindfulness is believed to hold a wellspring of untapped psychological nourishment. Regardless of the recognized limitations and the associated challenges in devising executable randomized control group investigations, researchers and the general public alike, continue to be increasingly fascinated in further determining the potential improvement mindfulness may have on our cognitive capacities, functioning, and well-being. Based on the empirical findings, I have come up with a potential implementation plan to increase awareness of the risks associated with attentional lapses (mind-wandering) in the Alberta oil & gas industry and encourages advancement on existing hazard assessment reporting to include the risk of mind-wandering, and the positive observation of mindfulness. It is my opinion that teaching mindfulness techniques, such as attention focused meditation, could support the reduction of attentional lapses, thereby increasing sustained attention to task, and hopefully preventing injury or incident cited from not having ‘mind-on-task’.

"The antithesis of a mind 'at attention' is a wandering mind"

(Jha et al., 2015, p. 2)

Positive Psychology Application: Mindfulness-Based Safety - Focused Attention for Increased 'Mind-On Task'

Personal Story

One particular winter drilling season I held the position of field drilling coordinator responsible for the overall operational performance and safety of a five rig exploration drilling program. Often I attended the safety meetings which are held at each shift change and before the start of a new task. One particular evening the rig manager (on-site leadership) read through the job safety analysis provided in a binder at the location that details the upcoming tasks' procedure step by step. It also provides caution to the known hazards and preventable measures for each step. He systematically recited the procedure utilizing profanity to emphasize its importance. As he led the meeting, I attentively watched his crew. Many of them were staring at the floor or their safety boots, some exchanged in short conversations with each other, and others stared directly at him for a good portion of his five-minute talk. Afterward, as a means to assess their attentiveness, I asked the crew to each state the one task step that was most applicable to their role in the upcoming procedure. The entire crew of seven men stared blankly at me and their rig manager, to which their rig manager followed up with further profanity in his disappointment that none of them had paid attention to what he was saying (even with all of the profanity emphasis). From this scenario, I started to question how often the minds of our crews were disengaged from the moment and wandering elsewhere in safety meetings and while performing their tasks. A well-known quote in the industry is to keep your "mind on task", but telling

someone to pay attention and teaching someone the skills of paying attention are two different things. I wondered, had we ever taught the skills of awareness as a preventative safety measure?

"There is considerable evidence to show that mental preparedness – over and above the necessary technical skills - plays a major part in the attainment of excellence."

(Reason, 2016, p. 89)

Health & Safety Management: Alberta Governance

The health and safety in Alberta oil and gas workplaces are governed by the Alberta Occupational Health & Safety (OH&S), as well as acts, regulations, and rules outlined by the Alberta Energy Regulator (AER). The Alberta OH&S is accountable for the enforcement of the health and safety laws per the OH&S Act (Government of Alberta, 2016), and the principle purpose of the AER is to provide "for the safe, efficient, orderly, and environmentally responsible development of energy resources" (Alberta Energy Regulator, 2013, p.1). As it relates to safety, the Government of Alberta has granted the AER authorization to inspect oil and gas activities in Alberta to ensure applicable requirements are met in accordance with government policies, including the OH&S Act.

Health and Safety Management Systems

Alberta guidance. Created over 50 years ago by six industry associations, the not-for-profit organization Enform, operates from the mission to "serve as the hub of safety for the upstream oil and gas industry" (Enform, n.d. a). Enform works collaboratively with the Canadian government, regulatory bodies, and partner associations to advance "health and safety practices through safety management planning" (Enform, n.d. c). With offices across Canada, Enform provides training, certifications, and a diverse range of services and resources to support industry associations and workers to get the job done safely.

Enform has developed the Certificate of Recognition (COR) program which compels employers to create and implement a HSMS in fulfilment of provincial standards. In order to obtain or maintain the COR credential, an organization must have an annual audit or quality assurance review of their HSMS and achieve an overall score of 80%. A HSMS, as defined by Enform, is "a systematic approach put in place by an employer to minimize the risk of injury and illness. It involves identifying, assessing, and controlling risks to workers in all workplace operations" (Enform, 2015, p. 2). The seven elements of an HSMS, as outlined by Enform (2015), include: (1) Management Involvement and Commitment; (2) Hazard Identification and Risk Assessment; (3) Hazard Control; (4) Training; (5) Emergency Response; (6) Incident Reporting and Investigation; and (7) Communications.

In addition, Enform's Drilling and Completions Committee (DACC) has published 16 publicly available Industry Recommended Practices (IRPs) to "provide recommended practices in upstream technical operations and in health and safety management operations" (Enform, n.d. b). In my opinion, the only publication applicable to this paper is IRP 7 – Standards for Wellsite Supervision of Drilling, Completions, and Workovers (Enform, 2008) as it outlines the recommended training courses for well-site supervisors. The list entails four courses developed by Enform to meet industry standards: (1) Safety Management and Regulatory Awareness for Wellsite Supervision (SARA); (2) Second Line Supervisor's Well Control; (3) Well Service Blowout Prevention; and (4) Detection and Control of Flammable Substances. The IRP-7 also recommends training in Workplace Hazardous Materials Information Systems (WHMIS), Standard First Aid, Transportation of Dangerous Goods, and H2S Alive® which are not developed by Enform.

SARA was created in response to recommendation #18 in the Upstream Petroleum Industry Task Force on Safety report issued in 1988 following a major safety review conducted in the 1980s by the oil and gas industry. Recommendation #18 identified the requirement to (a) ensure the wellsite supervisors "understand OH&S regulations, are competent in the tasks performed and have safety training"; and (b) the need to "develop standard training, safety and experience levels for wellsite supervisors" (Enform, SARA, p. ii). SARA is the only industry recommended training for well-site supervisors I know of that details the elements of HSMS, and more specifically management and leadership skills. It is my opinion, as inferred by the training requirements and personal experience, that the Alberta oil and gas industry regulators and associations inadvertently place a greater emphasis on technical capabilities of their employees and supervisors than on soft-skill abilities or leadership skills.

A study which supports my view found even though on-site management identified a transactional leadership style of "developing good quality participative and open relationships with subordinates" (Dea & Flin, 2001, p. 54), 57% of those surveyed appear to prefer dictatorship leadership approaches. Another indicator there may be a lack of soft-skills development was shown in that the "less experienced managers and those with more directive styles appear to overestimate their ability to influence and motivate the workforce" (Dea & Flin, 2001, p. 54).

Although an organization is free to decide on their own approach in guiding their HSMS, I turned to Enform's materials to see if I could infer the underlying attitude of whether safety is considered to be a people or a systems accountability. From within the publicly available *Introduction to Health and Safety Management Systems – Program Development Guideline* I found the messages "incident prevention is a people issue" (Enform, 2015. p. 6). As well, the

training workbook for SARA specifies unsafe actions as a combination of unsafe practices and human factors and that "unsafe actions are essentially what people did or did not do to cause or contribute to an accident" (Enform, SARA, p. 4-11). The page immediately following, however, details a number of unsafe actions which could be attributed to an individual or organization accountability: inadequate training, poor hiring practices, poor supervision, low self-esteem, worker fear, fatigue/boredom, and so on. Interestingly it notes family problems (financial, marital, medical), which are not *unsafe actions*. Perhaps it would be better to state 'mind-wandering' as the unsafe action as it is the state of mind we are likely to be in when we have family problems.

In summary, Enform more or less identifies that people's thoughts, emotional states, and social well-being contribute to unsafe behaviors, but do not provide additional guidance or tools on how to implement support programs within an HSMS to prevent injury as a result of these risks.

Proposed guidance. Before a hazard can be controlled, and the associated risk mitigated, it must be identified. I am proposing, from their position in industry, that Enform provide guidance to employers within the Alberta oil and gas industry on the importance of understanding how people's thoughts, emotional states, and overall social well-being may be contributing to unsafe actions. Specifically, there is sufficient evidence that mind-wandering is an inattentive state which may result in reduced situational awareness and task performance. Within this application of positive psychology proposal, I am inviting the Alberta oil and gas industry to incorporate the element of *Mindfulness-Based Safety* into their HSMS. The aforementioned component addressed in this paper is how people's thoughts and inattention may impact unsafe actions. In the appendixes to follow I provide preliminary guidance specific to

increasing awareness of the detrimental impacts of mind-wandering, teaching the skill of attention and mindfulness, and a recommendation for assessing the ongoing identification of mindfulness for safety prevention. If we provide our workers with positive psychology researched mindfulness training to have greater attentional awareness and regulation, we may effectively be giving them the tools to support optimal functioning on the job-site.

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Appendix A

Application Plan Outline: Attention Skills to Enhance 'Mind on Task'

A. Seek Collaboration from Industry for an Awareness Campaign

a. Recommendation: Update Enform industry documentation and training
    i. Introduction to Health & Safety Management Systems – Program Development Guide
    ii. Supervisor's Safety and Regulatory Awareness
    iii. IRP 7 –additional training course for well-site supervisors on mind-wandering and the skill of mindfulness
b. Recommendation: Topic of Enform's 2017 Annual Safety Stand-Down
c. Recommendation: Keynote topic at Enform's Petroleum Safety Conference 2017

B. Ideas for Implementation

a. AWARENESS
    i. 'Mind on Task' awareness video (eg. provided as artifact to paper)
    ii. Individual assessment of mindfulness trait: Mindful Awareness Assessment Scale (Brown & Ryan, 2003)
b. SKILL
    i. Drilling & Completions inspired meditation podcasts to teach attention control (2 minute for use in safety meetings; 3, 10 and 15 minute for individual use)
    ii. Guidance sheet for drillers to lead rig crew through attention exercises during safety and cross-over meetings, and post man-down drills
c. ASSESSMENT

i. Hazard Identification Cards

1. Update to include mindfulness as a positive observation
2. Update to include ‘mind-wandering (aware)’ and ‘mind-wandering (unaware)’ as risk items to be assess via co-worker thought probe

Appendix B

Monitoring and Assessment

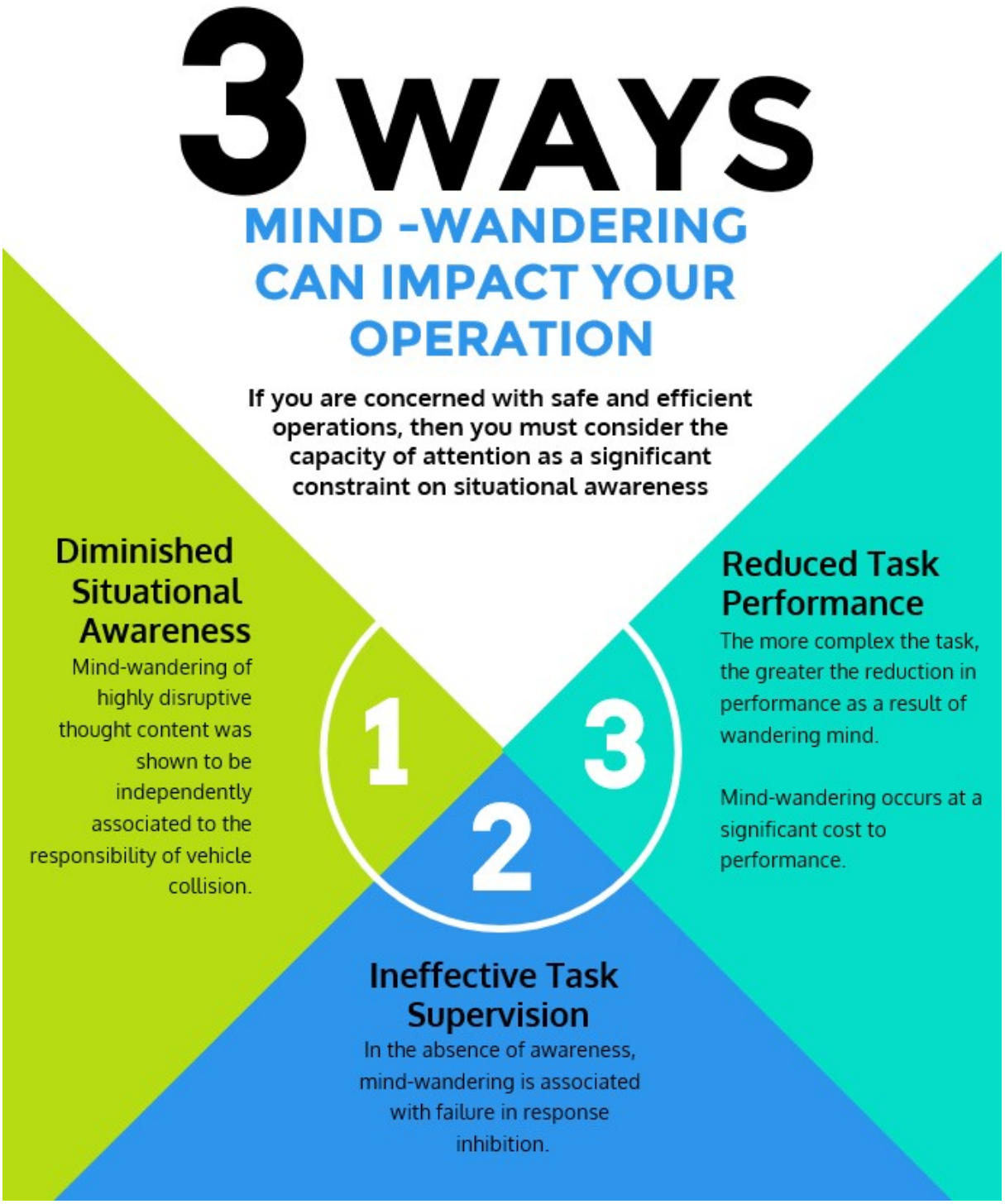
It is my opinion that the frequency of occurrence, and potentially the impacts as well, of mind-wandering, is a blind-spot for many oil and gas organizations. I am consciously aware many mindfulness-enhancing techniques (eg. guided imagery; music therapy; yoga) are not likely to go over well with the masculine identities propagated in the oil and gas drilling operations. “The traditional oilfield worker values power, toughness, competitiveness, and self-interest” (Filteau, 2014, p. 400). There are companies committed to creating and enforcing policy to foster a newly defined masculinity (Filteau, 2014), ones which aspire to cease the continuation of hegemonic masculinity and personifying industry’s frontier dominant man, the cowboy (Miller 2004). Even these companies, which have “re-defined safe, collective actions as the new dominant masculinity” (Filteau, 2014, p. 411), will face challenges to effectively implement mindfulness interventions if workers’ effeminate mindfulness practices.

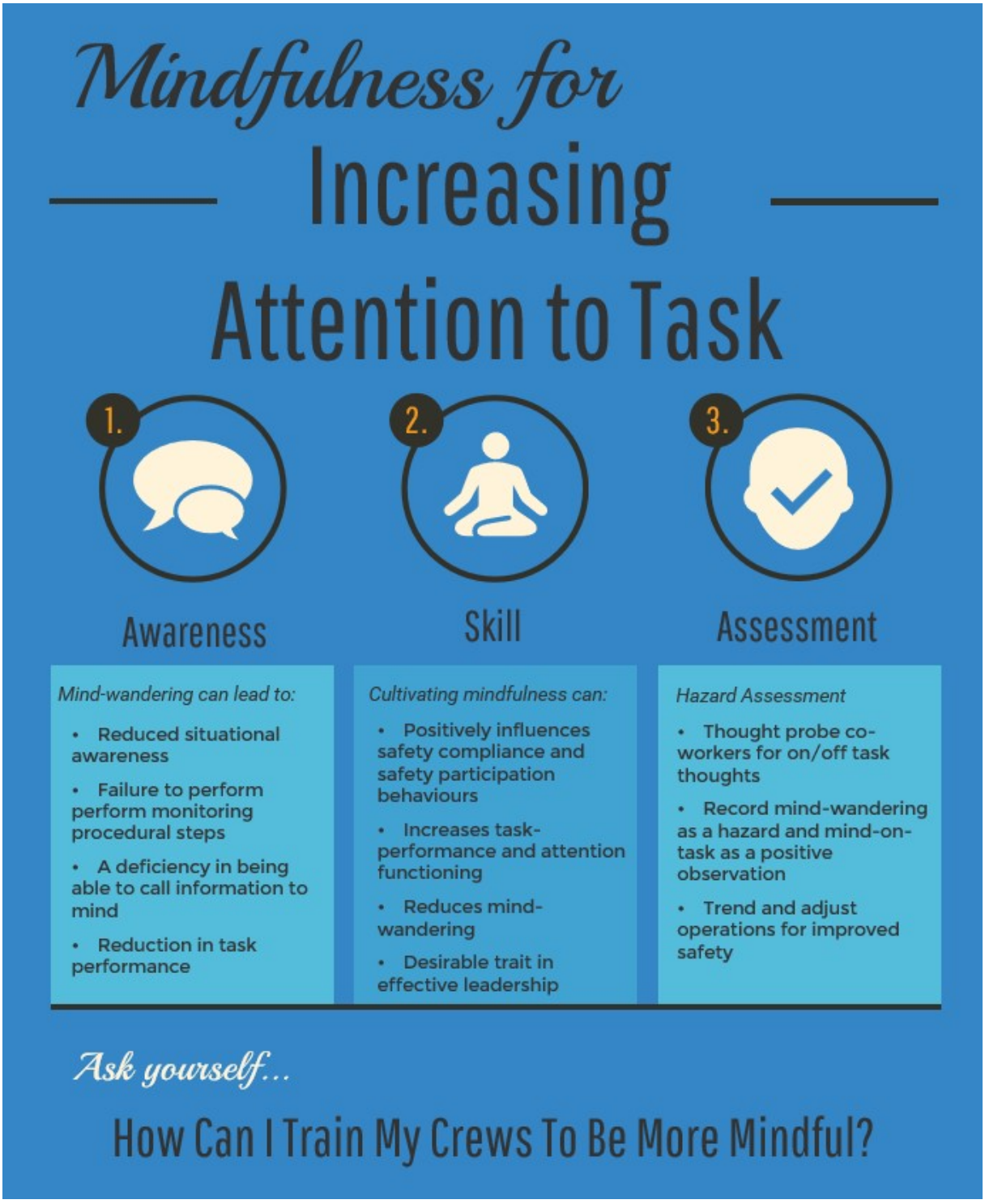
Nevertheless, research has shown that helping employees to be more self-aware and encourage a culture of healthy feedback could also support and improve the organization’s overall performance (Zes & Landis, 2013, p. 3). One way, I recommend to assist workers in becoming more aware of their off-task thoughts is to include mind-wandering as a risk in the industry standard hazard identification processes. It is possible the current hazard identification and positive observation reporting system in the industry could be enhanced through educating workers to ask their fellow crew members of their awareness mental state. Physiological and neurological research has shown that when prompted, people can accurately report if they were mind-wandering or not (Schooler et al., 2011). If in the moment of assessment, a worker was identified to have not been mind-wandering it could be reported as a positive observation, and

had they been mind-wandering it could be recorded as a hazard – zoned out or tuned out. Many organizations use an electronic tracking system for hazard reporting that also provides slick analysis for determining the most frequently reported hazards, as well as the associated operational task. Essentially an organization could implement tracking for mental state checks or as a measure of an intervention aimed at reducing mind-wandering. The implementation of mind-wandering as a hazard itself may prove to be a successful awareness intervention.

Appendix C

Info Graphics




Mindfulness for
Increasing
Attention to Task
1.
2.
3.
Awareness
Skill
Assessment
Mind-wandering can lead to:
• Reduced situational awareness
• Failure to perform perform monitoring procedural steps
• A deficiency in being able to call information to mind
• Reduction in task performance
Cultivating mindfulness can:
• Positively influences safety compliance and safety participation behaviours
• Increases task-performance and attention functioning
• Reduces mind-wandering
• Desirable trait in effective leadership
Hazard Assessment
• Thought probe co-workers for on/off task thoughts
• Record mind-wandering as a hazard and mind-on-task as a positive observation
• Trend and adjust operations for improved safety
Ask yourself...
How Can I Train My Crews To Be More Mindful?

Appendix D

Attention Focused Meditation Script

Operational Status: Start of safety meeting

Delivered by: Rig manager or driller

Duration: 4 minutes

Alright guys, we now know attention is a skill and in order for us to keep safe out here we need to get good at paying attention to our surroundings and being able to identify when our mind has wandered off task. We are going to do a very short attention focused exercise to start building on this skill. This exercise is best done with your eyes closed or keeping them fixed on one spot. We are going to bring our awareness first to our surroundings.

Let's take three deep breaths in and out. One – breathing in deeply. Release. Two – see if you can fill your lungs and belly. Release. Three – hold for a moment . . . . and release. I'll be guiding you through this process. You may notice other distractions and sounds come up. When this happens watch what your mind does. Does it wander away from my voice? Does it become curious about something else? Does it start tuning me out? When you observe this happen, you don't need to beat yourself up over it, that's just what the mind does. Instead, bring your full attention back to my voice and keep doing this each time your mind wanders.

[*Sounds: rig operations*]

Now let's take our awareness to the sounds of the rig – I want you to bring your attention to the engine. What else can you hear in the background? Can you hear the sound of the engine? Scan for another sound. Can you hear the pistons working back and forth on the mud pump? How about the shaker? Find a sound other than the engine and keep your focus there for a moment.

[*Sensations: feet in boots*]

Great, now I want you to bring your attention to your feet. Without moving them, can you feel the bottom of your feet in your work boots? What do they feel like? Are they comfortable? Sweaty? Do they have a lot of space in there or are they cramped up and you need to buy a larger pair? How about your socks – can you feel your socks on your feet?

[*Sensations: squeezed fingers*]

Now I want you to interlace your fingers and clasp your hands. Squeeze them tight. One by one can you bring your attention to each finger, where it rests on the back of your hand, and the compression you feel holding them tightly. Count your awareness through each finger starting at your pinkie – 1, 2, 3, 4, thumb, 6, 7, 8, 9, thumb. Now release them and let your hands hang to your side and pay attention to any tingling sensation they might have.

Let's all bring our attention back to the breath and take three deep breaths in and out through your nose. One – breathing in deeply. Release. Two – try and fill your lungs as full as you can. Release. Three – feel the air as it passes through your nostrils. And release.

I want to thank you for being open to this exercise and supporting yourself and your team in improving our skill of attention. You may now open your eyes.

Note: This script can be used in its entirety or shortened in length by reading out one of the three attention focusing exercises: (1) rig operations; (2); feet in boots; or (3) squeezing fingers.

Appendix E

Awareness Video

Available at: Mindfulness-Based Safety – Mindfulness for Increased Attention to Task

Password to view: capstone

Concept and script by: Darrah E.M Wolfe

Art work by: Donna McKay, Art & Design (http://onceuponadonna.blogspot.ca/)

INTRODUCTION

Researchers surveyed 200 offshore supervisors from 157 off-shore oil and gas installations and 36 different companies to learn the supervisor's biggest safety concern is worker's inattention. They ranked 1) not thinking on the job, 2) carelessness, and 3) failure to follow the rules as the top three behaviors most likely to be the cause of an accident. Thirty-one percent of them recognized the need for behavioral programs to tackle unsafe acts, complacency, and general inattention at work.

Reflecting on the supervisor's concerns, the workers are likely both attentive and thinking, but about something other than their primary work task. Experience sampling has shown we can spend 30% to 50% of our day thinking about things unrelated to what we are presently doing, or effectively mind-wandering. Mind-wandering is when our mind is not engaged in thoughts related to the current demands of our external environment and it can interfere with our situational awareness.

AWARENESS

Mind-wandering is thought to be a natural occurrence within our cognitive processes for which we have varying tendencies. Some of us get lost in our internal thoughts a little bit and others of us mind-wander frequently and for longer periods of time. Mind-wandering is theorized to be a

cyclical pattern. We start out working away focused on our task, then out of nowhere a non-task related thought captures our attention and poof we are mind-wandering. At some point, we will come to recognize we have stopped paying attention to our external environment, shift our attention back to what we were doing and carry on until our attention is distracted once again. While mind-wandering we can be zoned-out and not aware we are mind-wandering, or tuned out and consciously aware and choosing to not pay attention. Being zoned-out has greater negative impacts on our situational awareness.

Research studies have demonstrated mind-wandering to be associated with:

- reduced situational awareness,
- failure to perform monitoring procedural steps,
- a deficiency in being able to call information to mind, and
- a reduction in task performance.

When it comes to the safety of ourselves and our coworkers, we cannot afford to overlook the impact of mind-wandering on human behavior in high-risk environments.

SKILL

Every moment, our attention is being bombarded by a multitude of sounds, smells, sensations, and data about our external environment. As humans, we are not designed to be able to process all of this information and we rely on our attention regulating mechanisms to help us sort out what information to pay attention to and what to filter out. Essentially, controlling our attention is a skill, and we can learn to get better at controlling what our mind gives attention to through cultivating mindfulness - “being attentive to and aware of what is taking place in the present” ~ Brown & Ryan, 2003

It is believed that teaching mindfulness techniques such as meditation could support the reduction of attention lapses, thereby increasing sustained attention to task, and subsequently preventing injury or incident from worker inattention or mind-wandering.

Mindfulness has been shown to:

Positively influence

- safety compliance and safety participation behaviors,
- job satisfaction and work engagement
- to increase task-performance and attention functioning
- reduce mind-wandering occurrence
- as a desirable trait in effective leadership

ASSESSMENT

In the oil and gas industry, chances are your organization has some form of reporting process to identify hazards, near misses, and positive observations. They want to know what risks you face while at work so they can help to eliminate or reduce your exposure.

When you think about hazards in your work place – what comes to mind?

- contact with chemicals
- high temperatures
- falling objects
- improper personal protective equipment: PPE

Have you ever seen ‘mind-wandering’ or ‘mind-not on task’ identified on your hazard assessment card? Like many hazards in your workplace, mind-wandering is NOT directly observable and chances are no one has ever told you, before now, how it can influence your safety and task performance. The inability to monitor a coworkers’ inner thought dialogue leaves

us oblivious to its influence on overt behaviors and the effect on risk assessment, hazard identification, and unsafe behavior.

The good news is people are reasonably accurate in reporting when asked if they were thinking task-related thoughts or not. One way to increase awareness of mind-wandering as a risk to situational awareness and potentially reduce accidents is by probing coworkers on their state of mind when it is safe to do so. Perhaps pick a task that seems boring or repetitive to check-in on your coworkers' state of mind. The reduction in processing demands while executing tasks which are well practiced, boring or repetitive, are known to increase the incidence of mind-wandering. It is possible, with good reporting and data collection, your company could determine which tasks lead to the most mind-wandering and assess whether or not to intervene in ways to make the task more engaging.

There you have it folks - teaching mindfulness for increased attention to task!