



Human Performance

Discussion Paper DIS-16-05

October 2016



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Preface

Discussion papers play an important role in the selection and development of the regulatory framework and regulatory program of the Canadian Nuclear Safety Commission (CNSC). They are used to solicit early public feedback on CNSC policies or approaches.

The use of discussion papers early in the regulatory process underlines the CNSC's commitment to a transparent consultation process. The CNSC analyzes and considers preliminary feedback when determining the type and nature of requirements and guidance to issue.

Discussion papers are made available for public comment for a specified period of time. At the end of the first comment period, CNSC staff review all public input, which is then posted for feedback on the CNSC website for a second round of consultation.

The CNSC considers all feedback received from this consultation process in determining its regulatory approach.

Table of Contents

Executive Summary	1
1. Why Does Human Performance Matter?	2
2. Human Performance	2
3. Human Performance and Human Factors	4
4. Human Performance Programs.....	4
5. Elements of a Human Performance Program	5
6. CNSC Considerations for Regulating Human Performance	6
7. Human Performance and Management Systems.....	7
8. Graded Approach	8
9. CNSC Expectations of a Human Performance Program	9
10. Human Performance Tools	10
11. Human Error.....	10
12. Conclusions.....	11
13. How To Participate.....	11

Executive Summary

The Canadian Nuclear Safety Commission (CNSC) recognizes that safe nuclear operations rely on effective human performance, through which people carry out their work safely and effectively, and that human performance is influenced by a range of factors. To develop a shared understanding of human performance, the CNSC has issued this discussion paper to open dialogue with interested stakeholders about how it considers human performance in its regulatory framework, and to inform potential future updates. This is part of the CNSC's commitment to continuous improvement.

As part of its "human performance management" safety and control area (SCA), the CNSC currently requires its nuclear power plant licensees and other specified nuclear facilities to implement and maintain human performance programs. A human performance program enables the organization to appropriately support workers to perform routine work, as well as to respond to potential accident and emergency conditions. Human performance programs include: continual monitoring of human performance influences and outcomes; identification of human performance strengths and weaknesses; and implementation of improvements to reduce the likelihood of safety events with human performance-related causes. Effective human performance management supports workers in performing their tasks safely and effectively by systematically considering the capabilities and limitations of humans.

Nuclear power plant licensees draw guidance for their human performance programs from organizations such as the Institute of Nuclear Power Operations, the World Association of Nuclear Operators and the Electric Power Research Institute. Although the CNSC has some requirements and guidance on specific human performance-related topics (such as those outlined in REGDOC-2.2.2, *Personnel Training*, and REGDOC-2.2.3, *Personnel Certification Programs*), guidance for the overarching human performance program for some nuclear facilities has been limited to material contained in licence conditions handbooks. During their regulatory activities, CNSC staff have identified variations in the emphasis, approach, scope and content of human performance programs, so further clarification is warranted.

This discussion paper explains why human performance matters in the context of nuclear safety. The human factors-related elements that can constitute an effective human performance program are presented, and the consideration of human performance within the CNSC's regulatory framework is discussed. The paper also discusses the relationship between a human performance program and a management system, and discusses the application of a graded approach to implementing a human performance program, where licensees may tailor their program to the specific risks and characteristics of the individual facility or activity. Finally, the CNSC's expectations for human performance programs are presented.

The CNSC seeks feedback from all interested stakeholders on the human performance considerations that are presented in this discussion paper. The CNSC intends to use this feedback to inform its approach to regulating human performance. Before incorporating expectations for human performance into its regulatory framework, the CNSC will provide stakeholders with further opportunities to provide feedback about any specific measures that may be proposed.

Human Performance

1. Why Does Human Performance Matter?

Various sources estimate that human performance plays a key role in up to 80 percent of events.^{1 2 3} This high percentage suggests that human performance is an area that deserves consideration by the nuclear industry. Human performance is also an important aspect of defence in depth for nuclear facilities.

When something does not go as planned, it is not unusual to trace the problem to actions of a front-line worker, to classify the cause as a human error, and to stop there. However, a problem's root causes often lie elsewhere in the organization. Further investigation generally reveals that some aspects of the workplace may be misaligned with what is needed for the desired performance. Examples of these aspects include equipment designs that unintentionally predispose a worker to carrying out inappropriate actions, or that interfere with the worker's ability to carry out their tasks to a required standard; the quality of work procedures; or adverse site conditions. The front-line workers themselves are only one aspect of ensuring safe and effective work performance.

This broad view of human performance considers the range of factors that can both strengthen and impair human performance across the organization. Human performance is an important consideration across the whole range of work tasks and work environments, in both routine activities and potential accident and emergency conditions.

During the Fukushima Daiichi accident in 2011, mitigation and recovery efforts depended largely on the capabilities and adaptability of people to carry out activities. While human performance is a crucial part of routine work, it is also important when people need to carry out infrequent or novel actions, especially under the challenging and stressful work conditions following the Fukushima Daiichi accident.

2. Human Performance

Human performance deals with people carrying out their work, and can be considered as “the behaviours and the results of human activities when carrying out work tasks”.^{2 4 5}

How an individual worker carries out their tasks (the behaviours) and the outputs of the work performed (the results) are both important. They are both important because desirable results, which have positive value for the organization, could be produced by undesirable behaviours; e.g., when taking shortcuts to complete a task quickly. Therefore, both the behaviours **and** the results of human performance provide degrees of value to the organization in terms of how they align with organizational goals, including safety.

¹ U.S. Nuclear Regulatory Commission. NUREG/CR-6753, INEEL/EXT-01-01166, *Review of Findings for Human Performance Contribution to Risk in Operating Events*. Washington: U.S. NRC, 2002.

² U.S. Department of Energy, DOE-HDBK-1028-2009, *Human Performance Improvement Handbook: Volume 1: Concepts and Principles*. Washington: U.S. Department of Energy, 2009.

³ Flin, R., O'Connor, P., and Crichton, M. *Safety at the Sharp End*. Ashgate, 2008.

⁴ Institute of Nuclear Power Operators. INPO 06-003, *Human Performance Reference Manual*. 2006.

⁵ Gilbert, T.F., *Human Competence: Engineering Worthy Performance*. 1978.

Human performance relates to the actual behaviours and actual results of work tasks within the organization⁶, as opposed to an idealized or abstracted view of what workers should do. What is done in practice, and the real actions or outcomes achieved may not be the same as those anticipated by supervisors or managers. Actual work practices may also differ from what was intended by the designers of equipment and authors of procedures that are used to carry out the work. There are various reasons for this, including the concept of “drift into failure”⁷, where the cumulative effect of many adaptive decisions can lead to a gradual, unidentified erosion of safety margins, and where seemingly normal activities and decisions can produce adverse events. When things go wrong, it is common for event reports to cite the gap between the expected outcome and what actually happened.⁸ Human performance is concerned with what actually takes place in the workplace on a day-to-day basis. By systematically considering the capabilities and limitations of humans, effective human performance management supports workers in performing their tasks safely and effectively.

The term “behaviours” includes expected human actions (such as those described in task procedures) as well as human actions that are assumed but not documented, and unexpected human actions that occur. Many facets of work can shape behaviours, such as the organization’s procedures, work environment, management system, culture, resources, and technical systems. To ensure the safe operation of a nuclear facility, continual improvement of provisions that influence human performance should be considered at all organizational levels. Such an approach helps to ensure that organizations effectively support people in carrying out work successfully, including under challenging work conditions. The aim is for workers to perform tasks to the required accuracy and reliability, without excessive effort, discomfort or exposure to risk.⁹

Nuclear structures, systems and components that are important to safety have low probabilities of failure and can typically be counted on to perform their intended functions. With advances in equipment reliability, humans now make up the largest source of known variability in nuclear systems. For example, in performing identical tasks, humans will vary the exact actions and activities in minor, but potentially significant ways. This variability can have negative results, yet may also make very positive contributions to safety and performance because people are resourceful and flexible – an essential contributor to helping things to go right.¹⁰ Humans can detect and adapt to small changes in their environments and adjust their actions accordingly to achieve successful outcomes, even under challenging and uncertain conditions. As such, people are vital components of safe operations, and human adaptability should not necessarily be constrained.

The CNSC proposes to define human performance as follows:

Human performance is the behaviours and the results of human activities when carrying out work tasks.

⁶ Hollnagel, E., Woods, D. and Leveson, N. (eds.) *Resilience Engineering: concepts and precepts*. Ashgate, 2006.

⁷ Dekker, S. *Drift into Failure: From Hunting Broken Components to Understanding Complex Systems*. Ashgate, 2011.

⁸ McLeod, R.W. *Designing for Human Reliability: Human Factors Engineering in the Oil, Gas and Process Industries*. Ashgate, 2015.

⁹ McLeod, R.W. *Designing for Human Reliability: Human Factors Engineering in the Oil, Gas and Process Industries*. Ashgate, 2015.

¹⁰ Eurocontrol. “From safety-I to safety-II: A white paper”. Eurocontrol, 2013.

Q 1. Do you agree with the definition of human performance as stated above? Are there changes or alternative definitions you would propose?

3. Human Performance and Human Factors

The CNSC has established the following definition^{11 12} of human factors:

Human factors are those factors that influence human performance.

Examples of these factors include work procedures, workers' fitness for duty, organizational culture, training, and the design of equipment for operability and maintainability. The inherent characteristics of humans in general, and the specific characteristics of individuals or groups of workers, can also influence work behaviours and results.

Various human factors combine to influence how workers carry out their tasks and the results that they achieve. For example, deploying a mobile emergency generator safely and effectively depends on a range of human factors working together, such as:

- sufficient number of workers available to carry out the task
- sufficient levels of training, worker competencies, and amount of practice provided on the task
- workers who are fit to carry out the cognitive and physical work involved, so that they are not unduly fatigued, stressed, sick or otherwise impaired while doing so
- procedures in place that are correct and easy to follow
- sufficient provision and availability of necessary tools, protective clothing and equipment
- the appropriate amount of supervision and direction
- consideration of the physical environment in which the worker is expected to perform; e.g., in snow, rain, extreme cold, high winds, darkness or surrounded by debris
- an emergency generator and its couplings that have been designed to be used by people in the environment where the deployment occurs

Consideration of relevant human factors enables the organization to appropriately support workers in performing their tasks safely and effectively. While this support applies to routine work, it is also important when planning difficult or important tasks, or in potential emergencies.

Q 2. Do you propose any changes or alternatives to the CNSC's existing definition of human factors? Please provide rationale for any proposed changes or alternatives.

4. Human Performance Programs

A human performance program is a set of coordinated activities and processes that considers the performance of workers carrying out their tasks. The high-level objective of the human performance program is to achieve desirable performance and safety outcomes across the range of conditions, from routine activities to potential accidents and emergencies.

¹¹ CNSC regulatory policy P-119, *Policy on Human Factors*. October 2000.

¹² CNSC regulatory guides G-276, *Human Factors Engineering Program Plans*, June 2003; and G-278, *Human Factors Verification and Validation Plans*, June 2003.

The CNSC expects nuclear facility licensees' human performance programs to achieve the following objectives:

- active support of human performance through managing human factors, to achieve safe and effective outcomes
- integration of good practices for managing human performance throughout the organization's activities
- a human-centred focus that considers and supports people carrying out their work
- a systemic¹³ approach to managing human performance, which considers the individual, technology and organization
- a continuous focus on considering the people in the organization when managing organizational, operational, and technical matters

The CNSC considers that the following practices can help to achieve these objectives:

- consideration of human performance as the work actually carried out by individual workers (as opposed to an idealized view of work as anticipated or designed)
- provision of appropriate resources to support human performance
- consideration and management of the broad range of human factors across the organization to achieve continual system improvement
- consideration of the roles of all levels and departments to achieve the desired human performance outcomes
- assurance that human error is considered as a potential symptom of deeper issues, instead of the sole cause of failure
- identification of problems affecting human performance using a variety of methods¹⁴, and correction of the problems
- continual effort to improve the organizational system that governs, manages and guides human performance

Q 3. Do you agree with the objectives and practices of a human performance program listed above? Are there items that you would add to or remove from the lists? Please explain.

5. Elements of a Human Performance Program

A human performance program provides an integrated overview of the coordinated activities and processes (i.e., elements) that explicitly consider and shape human performance. A broad range of these human factors-related elements interact dynamically, and **collectively make up a human performance program**. The CNSC already considers many of these process elements (e.g., personnel training and certification programs) in its regulatory framework.

¹³ Systemic: system-wide, affecting or relating to a group or system as a whole (such as a safety system, a plant or an operating organization), instead of its individual members or parts (not to be confused with “systematic, which means methodical).

¹⁴ For example: review and analysis of tasks by human factors specialists; structured observations of work being performed; focus groups; performance metrics; trending; reporting of problems up the line; structured walkdowns of tasks to identify areas for improvement; pre- and post-job briefings; self-assessments; and audits and external assessments by industry organizations and the regulator.

Elements considered by a human performance program may include:

- management and supervision
- organization (structure and processes)
- organizational culture
- personnel training
- personnel certification
- work organization and job design
- fitness for duty
- procedures (development and use)
- physical design (human factors in design)
- performance assessment, improvement and management review
- operating experience and lessons learned
- safety analysis (human actions)
- reporting and trending

When these elements are considered individually, they may need to compete for resources and find their own places in an organization. The human performance program can provide a balanced, overall consideration of a range of elements that influence human performance, which are optimized and integrated among themselves. For example, an organization may have a capable and well-resourced training program, which regularly provides inputs to solve identified performance problems. However, while robust and systematically developed training is critical to safety, an emphasis strictly on training is not sufficient on its own. Other elements, such as human factors in design or fitness for duty, must also be addressed. Seeing a human performance program from an overarching, integrated perspective provides a balanced viewpoint of the various elements that influence human performance. This viewpoint is used to drive the organization's strategies and priorities.

The elements of a human performance program remain as separate entities, but their relationship and how they integrate are considered. Since each individual element considers a different perspective of human performance, the full picture cannot be seen from the standpoint of one element alone. A systemic consideration of the elements in a human performance program is needed because the relationships between the elements are as important as the elements themselves.

Q 4. Do you agree with the elements of a human performance program listed above? Are there items that you would add to or remove from the list above? Please explain.

Q 5. Do you agree with the concept of a human performance program described above? If you would propose other ways of viewing a human performance program and its elements, please describe them.

6. CNSC Considerations for Regulating Human Performance

The CNSC has the authority to make regulations related to human performance under sections 44(1)(h) and (k) of the *Nuclear Safety and Control Act*. Human performance-related requirements have been made in regulations, such as in sections 12 and 17 of the *General Nuclear Safety and Control Regulations*. Canada is also a member of the International Atomic Energy Agency (IAEA) and a signatory to the *Convention on Nuclear Safety* (CNS), which was adopted in 1994. Canada, through the CNSC, is therefore committed to ensuring "... that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation" (CNS Article 12). In addition, regulation of the Canadian nuclear industry is aligned with IAEA Safety Fundamentals No. SF-1, *Fundamental Safety*

Principles, which identifies the need for an integrated approach to human performance (sections 3.12 and 3.14).

The IAEA promotes approaches to safety that consider interactions between humans, technology and organizational factors¹⁵, and it is working to develop strategies and mechanisms for regulatory oversight of human and organizational factors – to encompass the broad scope of human and organizational factors across nuclear facilities.¹⁶ The IAEA Energy Series Technical Report NG-T-2.7, *Managing human performance to improve nuclear facility operation*, published in 2013, provides a useful summary of good practices for managing human performance.

The CNSC requires that specified licensees, including nuclear power plants, have management systems that comply with the CSA Group (CSA) N286, *Management system requirements for nuclear facilities*. This standard indicates that “... to support safe operation, management is expected to define and implement practices that contribute to excellence in worker performance”. The most recent version of this standard, CSA N286-12,¹⁷ requires that management systems provide “...the means by which the business supports workers in carrying out their tasks safely and successfully, by taking into account the interactions between individuals, technology and the organization”.

The requirement for specified licensees to implement and maintain human performance programs is stated in their respective licences. Associated licence condition handbooks provide guidance statements on the content of effective human performance programs. Current guidance recommends that initiatives to improve human performance address and integrate the broad range of human factors, across all organizational functions and activities, to ensure that workers are fully supported in carrying out their work safely.

The CNSC’s existing regulatory policy on human factors, P-119, published in 2000, was developed to clarify that the CNSC considers human factors issues in its regulatory activities – including its licensing and compliance, and support for standards-development activities. The CNSC recognizes that human factors can affect the performance of the facilities and activities that it regulates. The policy therefore states that the Commission will consider the human factors that could impact its mandate, and will evaluate the measures implemented.

7. Human Performance and Management Systems

A management system, as described in CSA N286-12, is the framework of processes, procedures and practices used to ensure that an organization can achieve the tasks performed to meet the organization’s objectives, including for safe and reliable operation. The management system applies across the entire organization, and it covers all managed activities and departments. It covers all aspects of management, and spans an organization’s policies, planning, operational activities, performance assessment, review activities and improvement activities in a single, coherent system. The management system applies to all licensed activities, so that safety requirements are established and applied coherently with other requirements, including those concerning human performance, safety and security.

¹⁵ IAEA. IAEA Safety Guide GS-G-3.5, *The Management System for Nuclear Installations*. 2009.

¹⁶ IAEA Technical Meeting on Regulatory Oversight of Human and Organizational Factors, IAEA Headquarters, Vienna, Austria, December 14–18, 2015.

¹⁷ Canadian Standards Association. N286-12, *Management system requirements for nuclear facilities*. June 2012.

A human performance program is a documented part of the organization's management system. The management system is employed to achieve, among other things, objectives concerning human performance in terms of planning, carrying out processes, assessing the program's effectiveness and making continual improvements. The human performance program initiates and maintains the focus on human performance, and enables the overview of human factors considerations to be understood, so that the organization can use this information to achieve its goals. The workers and the work that they perform are essential in achieving an organization's objectives and should be managed coherently using the management system. In this way, the organization can consider human performance as a fundamental component within the management system.

A human performance program can be a formal program within the management system governance, which provides a formal and comprehensive umbrella-type overview, including the documented interfaces between the process elements.

Alternatively, a human performance program may be a documented but less formal "road map" to demonstrate how the organization's activities and processes interface to ensure effective human performance management.

8. Graded Approach

Both the CNSC and its licensees use a graded approach. This means that the application of requirements and guidance is commensurate with the risks and particular characteristics of the facility or activity.

The CNSC seeks to set the right level of requirements and guidance to enable flexibility without compromising safety. The graded approach means that the scope, content and application of human performance programs reflect the diversity of nuclear licensees and regulated activities. A human performance program for a small reactor facility or other licensee would differ than that of a nuclear power plant; each licensee would tailor its human performance program to reflect the risks and characteristics of the specific facility or activity.

The requirement to implement a human performance program is currently a licence condition in the operating licences of nuclear power plants and other specified nuclear facilities. However, the CNSC considers that a systemic human performance program, with a broad, integrated view of human factors, would be of value to safety for all licensees, whether it is a formal program within the management system or documented but less formal "road map".

A human performance program can be a formal program within the management system, which considers an overview of human performance, and the interfaces and influences between the elements to identify and manage activities to achieve the program's aims.

Alternatively, a human performance program may be a defined, collectively managed set of interfaced activities and initiatives, which consider the elements of human performance and the aims of the program, but without being a formal program within the management system.

Q 6. Do you think that the requirement to have a human performance program should be applied using a graded approach to all CNSC-licensed facilities and activities? If so, what might this graded approach look like?

Q 7. Which type of human performance program (a formal program or otherwise) is most appropriate for the types of nuclear facilities most relevant to your comments, and why?

9. CNSC Expectations of a Human Performance Program

The CNSC expects licensees that are required to have a human performance program to have a clearly defined program scope, including the identification of interfacing policy statements, programs and procedures. Interfaces between the range of human performance program elements applicable to the organization's functions and activities are expected to be identified and implemented (see section 5 of this document for a suggested list of elements to be considered).

Licensees' human performance programs are expected to address all applicable stages of the lifecycle, as well as all applicable activities that may impact safety, including maintenance, testing, monitoring, operation, modification and fuel management. This is to ensure that workers are fully supported in carrying out their work safely.

Roles and responsibilities for staff involved in developing, monitoring and implementing the human performance program, are expected to be documented, and to include oversight roles to monitor and manage the human performance at the site.

The CNSC expects licensees to demonstrate support for human performance across all levels of the organization. This includes senior management, who is accountable for and committed to improving human performance, and line managers who demonstrate support for improving human performance. The CNSC expects individual workers at all organizational levels to take responsibility for their behaviours and to be committed to improving themselves, as well as the task and work environment.

Where licensees have implemented a defined set of human performance tools, they are expected to promote and train workers on their appropriate use, and ensure that expectations for the use of human performance tools are clearly communicated.

The CNSC expects licensees to periodically assess and review their human performance programs to ensure that opportunities for continual improvement are identified, planned for, and implemented. In addition, licensees are expected to identify problems that affect human performance using various methods. These could include structured observations of work being performed, reporting of problems to management, or external assessments by industry associations or the regulator. Finally, licensees are to have mechanisms for identifying and addressing human performance trends, which are used for continual improvement.

The same objectives and practices (see bulleted lists in section 4) underpinning the human performance program apply to all licensee organizations, large or small. How an organization addresses the objectives and practices will depend on the types of tasks carried out by workers and the types of hazards to be prevented in the course of the work. The size and complexity of the organization and its processes will also determine how best to achieve the objectives.

Most organizations, regardless of size, already consider the elements of a human performance program (see bulleted list in section 5). For example, management and supervision, personnel training, and procedures are specific areas that are managed by the organization. The human performance program will ensure the explicit consideration of the overview of these elements and how they may interact to influence human performance.

For example, a new employee is initially assigned to perform a number of system tests, according to the relevant procedures, but is not yet familiar with the facility nor fully trained on the various types of procedures. While an experienced and fully trained worker could complete the task appropriately on their own, the new employee does not have sufficient skills, knowledge and training to do so. Although the

procedure indicates that a single worker can complete the system tests, after considering the range of human factors, the supervisor decides that the new employee should be accompanied by a more experienced worker to peer-check the work.

The management system for a larger organization may ensure that no worker carries out tasks alone unless certain training has been completed and competency has been demonstrated. A smaller organization may need to consider the specific human factors in day-to-day decisions to ensure that the worker and the facility remain safe.

To return to the previous example, if the new employee had carried out the system tests alone and the system had been improperly reinstated afterwards, the systemic and human-focused approach promoted by the human performance program would have been brought to bear in analyzing the failure. This approach considers the various factors that influence human performance as an integrated overview. Instead of identifying the failure as a “human error” and stopping there, the range of human factors would be considered, from the perspective of what made sense to the new employee when they carried out the work activities. For example, the elements of management and supervision, personnel training, and procedures would be considered together to identify what contributed to the failure, and to determine how the identified weaknesses can be corrected. While it could seem that the failure was mainly associated with training, the overview of the elements indicates that changes in organizational processes, job design, safety culture and procedures may have also provided defence against inexperienced workers carrying out safety-critical tasks without supervision.

Q 8. Do you propose any additional or alternative expectations of a human performance program?

10. A Note on Human Performance Tools

“Human performance tools” are specific behaviours and approaches that workers are trained to consciously select and use, with the intention of reducing human errors when they carry out work activities. They are also called “event-free tools” or “error-free tools”. Examples include: self-check of task steps or actions; stopping the task when unsure; and three-way verbal communication, where the key message is repeated back to ensure that accurate understanding has been achieved.

The CNSC considers human performance tools to have value when they are viewed as a final defence in preventing an error, although there is more to a human performance program than just human performance tools. To draw an analogy, using a human performance tool to prevent an error is like a goaltender stopping a goal from being scored. To extend this analogy, the broader consideration of human performance is analogous to the whole team, which is supported and coached to work as a strong, coordinated organization with a common purpose. This well-supported team works to reduce the shots on goal and in doing so, reduces the likelihood that the team’s goaltender has to make a save in the first place. Therefore, the whole human performance program works with the organization’s management system to identify and strengthen defences against events, with the various elements of the program working together to contribute to defence in depth.

11. A Note on Human Error

Human error is a by-product of being human; we are all predisposed to see what we expect, to forget complex information, or to do things automatically out of habit. The outcomes of these human failings are often trivial, but they can have serious implications in the context of nuclear systems and equipment. Human errors may only be seen as such when there are undesirable outcomes, although there may be

regular deviations from a procedure or a preferred action. Sometimes, human performance programs mistakenly focus solely on human error and undesirable outcomes.

Common perceptions of human error are strongly associated with notions of blame and individual responsibility for failure. Undue focus on human error can be counterproductive¹⁸ and result in a culture where the last person to touch a system generally receives the blame for an undesirable outcome. The CNSC considers that while an understanding of human error is important, the main focus of a human performance program is to support people's work activities **to go right**, and helping to manage the risks related to human factors. Examples of supporting people to do the right thing include designing easy-to-use equipment, combined with systematically developed and implemented training, and providing accessible, usable, accurate procedures. Equipment can also be designed to be sufficiently robust to perform safely when human errors do occur; for example, using designs that avoid single-point failures and enable error recovery.

12. Conclusions

Licensees are responsible for ensuring that they operate in a manner that protects the health, safety and security of persons and the environment. The CNSC needs to ensure that licensees provide workers with the necessary support to carry out their work safely and effectively. To support human performance in the nuclear industry, the CNSC is considering providing further clarification of its expectations in this area.

The CNSC intends to use the feedback received on this discussion paper to inform its approach to regulating human performance. Before incorporating any new requirements or guidance on human performance into its regulatory framework, the CNSC will provide stakeholders with further opportunities to provide feedback on any specific measures that might be proposed.

The CNSC encourages all stakeholders and the public to voice their views on this topic. Furthermore, the CNSC is committed to meaningful early engagement with stakeholders on this issue and will consider all feedback received at this preliminary stage of its review of human performance.

13. How To Participate

The discussion paper seeks early feedback on the opportunities presented to improve the CNSC's regulatory framework for human performance.

The CNSC seeks comments from all stakeholders, and is interested their views on the impacts of the proposals described in this paper. Questions about potential impacts have been included throughout the paper, and additional comments are welcome.

If the CNSC proceeds with any regulatory amendments or changes to regulatory documents, additional opportunities for consultation on specific proposals will be available to stakeholders. By consulting early, the CNSC is seeking to validate the need for improvements in various areas of the framework and to understand stakeholder views on preliminary proposals.

Please submit your comments or feedback to:

¹⁸ Dekker, S. *The Field Guide to Understanding Human Error*. Ashgate, 2006.

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