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Mr. M. Dallaire
Director General, Regulatory Policy Directorate
Canadian Nuclear Safety Commission
P.O. Box 1046
280 Slater Street
Ottawa, Ontario
K1P 5S9

Dear Mr. Dallaire:

Bruce Power
Comments on REGDOC 2.2.1 "Managing Worker Fatigue and Hours of Work"

The purpose of this letter is to provide the CNSC with Bruce Power's comments on the proposed REGDOC 2.2.1.

Bruce Power fully accepts responsibility for nuclear safety in plant operations and acknowledges that fitness for duty including fatigue management is an important aspect of safety. Our review of this document coincided with an expert review of Bruce Power's fatigue management program which allowed a more in-depth look at this Regulatory Document than the allotted time normally affords. In our view because of significant weaknesses with the structure and basis for REGDOC 2.2.1 safety will not be improved but regulatory burden will be increased. Because of the fundamental nature of our concerns we have forgone our normal approach of a clause by clause comment but have included our major concerns below.

It is our strong recommendation that REGDOC 2.2.1 be rethought and repositioned as a component of an overall fitness for duty document rather than as a separate requirement.

Effective management of Safety is complex as it requires the successful interaction of many components. There is no doubt that hours of work is one of the components, however, it is not the only component; it may be far from the most important in a given circumstance; and alternate coping strategies are available. The Human Factors North report, as well as other studies listed as references by CNSC staff, stresses the importance of a broad approach to fatigue management as opposed to such a heavy reliance on limits to hours of work. Basic hours of work limits are a valid initial step in managing fatigue but such limits are only so effective and only a small step in managing fatigue. Risk mitigation/management ultimately depends on the sleep of workers. The approach in REGDOC 2.2.1 assumes that if an employee works less, they will be less fatigued. Studies agree that while there is some value in basic limits to work hours, additional or more stringent limits have a diminishing return in terms of risk mitigation/management and safety. Bruce Power does not schedule or plan shifts longer than 12 hours but despite detailed planning, managers can be faced with unexpected situations and circumstances that require an appropriate and safe

Bruce Power Frank Saunders Vice President - Nuclear Oversight and Regulatory Affairs
P.O. Box 1540 B10 4th floor W Tiverton ON N0G 2T0
Telephone 519 361-5025 Facsimile 519 361-4559
frank.saunders@brucepower.com

response. Hours of work should not unilaterally limit the capability to respond but rather ensure consideration of fatigue is included in developing a safe response. Despite the contrary indication of many studies, REGDOC 2.2.1, as it is currently drafted, elevates hours of work to the primary indicator of fatigue rather than a factor to be considered and when necessary mitigated by appropriate techniques. The REGDOC also suggests that other regulatory requirements such as minimum compliment requirements that are in place for emergency response capability are somehow less important.

Elevating the importance of the hours of work limits results in limits that are more detailed than appropriate and appear to be designed to restrict current shift schedules rather than to provide basic principles to be adhered to when constructing shift schedules. As a result there is misalignment between the hours of work limits and the risks they are designed to manage. Certain shift arrangements that present significant fatigue risk would be acceptable under the proposed limits while other arrangements that present limited fatigue risk would not. For example, a worker could work a day shift on Day 1, a day shift on Day 2 and then work a night shift beginning on the evening of Day 3 without violating any limits. The worker is unlikely to be able to shift their sleep schedule from night to day in one 24-hour period causing them to potentially show up for the night shift on Day 3 with minimal sleep in the last 12 hours. Conversely, working six 12-hour day shifts in a row, where sleep patterns are likely consistent and sufficient, is a violation of the limits. The hours of work limits should be described in terms of the basic principles that will be incorporated into the fatigue management programs that ultimately determine shift schedules and the controls on extended work hours. Such limits cannot be successfully described in the detailed fashion of this REGDOC without creating unnecessary limits in some cases and missing requirements in others. The detailed and in some cases redundant limits also result in a complex and overly burdensome record keeping and reporting requirements that have little or no safety value.

The proposed CNSC regulatory document is broad in scope and prescriptive in its requirements while not fully considering the unique aspects of nuclear operations, such as the extensive and station-specific training requirements for nuclear operators. Staffing and operating a nuclear power plant is a highly complex exercise. Worker roles and activities are very specialized with technical and human factors interacting constantly. The scale and technological evolution of operations on a large site amplifies these considerations. For example:

- The role of the Authorized Nuclear Operator (ANO) reflects the complexities of nuclear operations. It is also one of the most important roles covered by the scope of this regulatory document. The number of ANOs required on the operating station panels in a four unit station is 4, however, the minimum staff level within the station at any time is 6 allowing opportunity to manage fatigue. Becoming a fully certified ANO requires multiple years of experience in other nuclear operator roles, completion of a challenging classroom and simulator-based training program, and on the job experience. The training and on the job experience components of the certification program are specific to each nuclear station. Once trained for one nuclear station, an ANO cannot transition to a different nuclear station without repeating their training and on the job experience. This means staffing requirements need to be projected far into the future, and ANO recruiting and training started today to meet those projected requirements. The complexities of the certification program makes it difficult to

retain a certification when an individual is not actively in role thus maintaining an abundance of additional certified staff is also not practical. Given this complexity it is possible that ANO staffing at a given point in time while meeting minimum requirements may be less than desired for a short-term. Since additional staff cannot simply be assigned but must complete the training program there is a period of time where the possibility for some extended shifts to occur is higher than normal. While hours of work limits are useful for shift planning they are not sufficient to deal with unexpected occurrences. Consider the scenario where an ANO calls in sick on short-notice. The best response based on the proposed limits would be to fill their spot with an off-duty ANO. Where such an ANO is available, they may be called into work with little notice. There is a risk that they will not be prepared for duty (e.g. may not have slept sufficiently in the last 12 hours or may have engaged in non-work strenuous/fatiguing activities in the last 12 hours). This would not be reportable under the proposed limits. Where such an ANO is not available, an ANO currently on-duty may be asked to extend their shift for some period. This response results in a violation of the limits to hours of work and will be reportable but if properly managed through fatigue management actions such as scheduled rest breaks and appropriate assignment of tasks may in fact be the safe option. Our studies indicate that extended shifts present no more risk than the primary shift if properly managed. A more important factor in these circumstances is determining the actual condition of the employee prior to the shift and after the shift ensuring an appropriate rest and recovery period is provided after the shift and prior to subsequent shift assignments.

This example illustrates that safety is better served by determining an appropriate response through valid fatigue management assessment tools rather than to simply elevate a single fixed control point such as hours of work.

The proposed CNSC regulatory document lists nine references including publicly available journal articles; reports published by the International Atomic Energy Agency (IAEA), and independently commissioned studies. The reference most directly linked to the limits on hours of work in the proposed CNSC regulatory document is the report titled "Review of Criteria for Assessing Shift Schedules in the Nuclear Industry" drafted by Human Factors North, an independent consultancy, in March 2013. CNSC engaged Human Factors North to review the previous limits on hours of work released by the CNSC in 2005 and recommend improvements based on benchmarking and a literature review. The study draws on a wide range of literature as well as limits to hours of work in other industries and geographies to support its recommendations. Industries considered included nuclear, petrochemical, aviation, air traffic control, and road transport. However, the study did not involve any data collection or observation specific to the licensed nuclear facilities or their workers that will be subject to the proposed CNSC regulatory document. In reviewing the Human Factors North report the following observations were made:

- The report explored the question of whether there is any "basis for granting exceptions to the hours of work limits or rest periods for short durations at times of peak demand" and concluded that there was no scientific basis for allowing such exceptions. However the phrasing of this question led the study to focus on extended hours of work during high stress/high activity periods only. The study did not consider the merit of exceptions to hours of work limits for other reasons

such as filling minimum complement requirements when a late notice sick call creates a vacancy that would not involve periods of high stress or high activity. The study also did not consider the effect of risk management programs in these situations such as the rest breaks or minimized activity that are in place at Bruce Power.

- The report made reference to very few of the impracticalities that exist in implementing the recommended limits to hours of work. For the impracticalities that are mentioned in the report such as the difficulties involved with having workers split an extended shift to adhere to limits to hours of work, no potential solutions are provided.
- The report fails to explicitly take into account the unique aspects of nuclear operations that present additional challenges with respect to fatigue risk but also provide opportunities to implement procedures and practices to address fatigue risk without relying exclusively on limits to hours of work. An example of the unique aspects of nuclear operations that present additional challenges is the long lead time required to develop workers for certain roles and the non-transferability of these skill sets. An example of the unique aspects of nuclear operations that offer opportunities to implement fatigue management procedures and practices is the varying risk of activities performed by workers. Applying "quiet mode" or rotating fatigued workers into spare or non-active positions significantly decreases risk associated with fatigue in these roles.
- The report recommendations represent a conservative consensus of the literature and benchmarks reviewed but did not adequately consider the specific needs of the nuclear industry nor actively seek information from industry sources. The recommendations in our view do not describe the most appropriate approach to limits for nuclear operators in Canada.
- There is no evidence presented of safety events caused by fatigue within the nuclear operators in Canada or that current fatigue management is inadequate such that additional limits should be proposed.

It is our view that these shortcomings significantly undermine the basis for this Regulatory Document.

Other regulatory requirements already in place are not appropriately considered by this document. Contractor hours of work are controlled under provincial legislation. Further, operating licence conditions already require that work by contractors be undertaken only with proper licensee oversight to ensure safe performance of the work and that quality requirements are met. These requirements ensure that safety related equipment returned to service is fully inspected and tested to ensure its operability meets all requirements. Additional hours of work constraints on third parties such as contractors will not improve safety but will significantly increase administrative overheads.

In conclusion it is our view that:

- The heavy reliance on limits to hours of work in this document diminishes the importance of a broad approach to fatigue management and fitness for duty in general. While the number of hours worked must of course be controlled, hours of work limits are a small step in managing fatigue and should not be elevated to an inappropriate level of importance.

- The scope of this REGDOC is broader than necessary and does not account for other regulatory controls already in place such as those for contractors. There is no evidence presented that other controls are ineffective such that additional controls on contractors and the subsequent burdens are necessary.
- The study carried out focused on extended hours of work during high stress/high activity periods rather than the actual conditions normal to plant operations.
- The study was largely an academic exercise rather than a study of the actual conditions, programs and controls in place at nuclear facilities and did not engage licensees directly. This is a serious shortcoming that can lead to impractical and ineffective recommendations.
- There is no evidence of an actual safety need to further restrict hours of work as proposed in this document.
- Treating fatigue management and hours of work as a separate issue from overall fitness for duty will detract from the synergistic approach necessary to ensure safety.

It is Bruce Power's sincere recommendation that the time be taken to thoroughly study the specific work environment within the nuclear power industry so as to allow a thoughtful examination of the current application of fatigue management science within the industry. Based on this review, REGDOC 2.2.1 should be rethought and repositioned as a component of an overall fitness for duty document such that effective, practical requirements are established. Issue of the current document will not further improve safety but will certainly increase regulatory burden. Bruce Power is fully prepared to participate in a collaborative review with CNSC, industry and subject matter experts.

If you require further information or have any questions regarding this submission, please contact Mr. Maury Burton, Department Manager, Regulatory Affairs, at 519-361-5291.

Yours truly,

Frank Saunders
Vice President Nuclear Oversight and Regulatory Affairs
Bruce Power

cc: CNSC Bruce Site Office (Letter only)
R. Lojk CNSC Ottawa
C. Moses CNSC Ottawa