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ENHANCING PLANT PERFORMANCE IN NEWER CANDU PLANTS UTILIZING PLIM METHODOLOGIES

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Over the past 5 years, Atomic Energy of Canada Ltd. (AECL) has been working with CANDU utilities on comprehensive and integrated CANDU PLiM programs for successful and reliable operation through design life and beyond. Considerable progress has been made in the development of CANDU PLiM methodologies and implementation of the outcomes at the plants. The basis of CANDU PLiM programs is to understand the aging degradation mechanisms, prevent/minimize the effects of these phenomena in the Critical Structures, Systems and Components (CSSCs), and maintain the CSSC condition as close as possible in the best operating condition.

Effective plant practices in surveillance, maintenance, and operations are the primary means of managing aging. From the experience to date, the CANDU PLiM program will modify and enhance, but not likely replace, existing plant programs that address aging. However, a successful PLiM program will provide assurance that these existing plant programs are both effective and can be shown to be effective, in managing aging. This requires a structured and managed approach to both the assessment and implementation processes.

Many of the critical components assessed in the CANDU 6 PLiM program have had a very good service record with little or no significant active degradation to date. However, this excellent operating record also has provided a unique challenge for the CANDU PLiM program, given the subsequent lack of evidence of aging effects. In performing the systematic and detailed assessments, a key activity is diagnosis of the operational history for aging indicators, as well as a thorough understanding of applicable degradation behaviour. With little plant-specific degradation data, a heavy reliance is placed on the thorough understanding of the applicable degradation mechanisms and the associated "stressors". This understanding derives from research and development programs, integrated with knowledge from relevant field data of other plants. Then, appropriate diagnostic and assessment methods for each physical asset under investigation are used, as well as health prognosis approaches, particularly suited to components with active degradation experienced to date.

The detailed understanding of these aging mechanisms enables an in-depth component-specific assessment to be made of the aging risk during plant operation. This then enables component inspection, monitoring and maintenance scope and techniques to be focused on the specific significant degradation mechanisms of potential concern and proactive measures to be taken to slow the aging process. Subsequently, new plant data related to aging is regularly fed back to the updating of the reports to improve reliability of the remaining lifetime assessments. This comprehensive and proactive CANDU PLiM approach is being used to enhance the surveillance, inspection, maintenance, and operations

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programs for aging effects, and hence to achieve the plant's targets for safety, reliability and production capacity during its full design life and to preserve the option for extended plant operation.
Thus far, the objective of AECL's PLIM program has been to apply the PLIM results to mature CANDU plants that have already seen duties of over 60%-70% of their design life. The intervention has been timely in that these results have been used as pivotal information in life extension decisions of plants such as Point Lepreau and Gentilly 2. This paper illustrates, using several examples, the application of PLIM methodologies to newer CANDU plants that can also derive significant benefits. In particular, use of the knowledge of CANDU degradation mechanisms and "stressors" is important in designing inspection, monitoring and maintenance programs and strategies that are capable of preventing similar degradation from occurring. Also, since not all aging effects can be prevented, a further objective is to "optimize" plant programs to detect any significant degradation at the earliest possible time, should it occur.

In order to assure high capacity factors during the operating life of the plant and beyond, there is also a major association of system maintenance optimization with the CANDU PLiM program. This system maintenance optimization program, utilizing Reliability Centred Maintenance (RCM) analysis of critical systems, is now moving into the implementation phase. In order for the plant to take full advantage of these studies, ensure the appropriate transfer of system related knowledge over time, and to provide a means for controlled and continued optimization of the plant maintenance program, these studies need to be incorporated into a System based Adaptive Maintenance Program (SAMP).

SAMP provides a means to ensure system-based health decisions are systematically translated into effective changes to the component-based maintenance and inspection programs, in an auditable and well-understood process. If the maintenance program is adapted through the SAMP process, plant operators have assurance that the equipment will be effectively managed, and the maintenance/monitoring program will be continually and effectively optimized to provide for maximum availability and reliability, while optimizing O&M costs. This particular offshoot of PLiM methodologies supported by corresponding inspection and test programs serve as reliable predictors of future plant performance provided the recommended aging management practices are followed. This paper will go on to show calculable benefits of implementing an RCM program that not only improves capacity factors through avoidance of unplanned shutdowns but can be a major force in optimizing and reducing plant OM&A costs when applied properly and early in the life of a piant.

This paper additionally outlines the CANDU 6 PLiM program methodologies being proactively applied by certain newer CANDU plants at an early stage in the plant's operating life and, hence, enhancing plant performance and reducing operating costs.