

Overview of Plant Life Management for Long Term Operation in Nuclear Power Plant

Ki Sig KANG(K.S.Kang@iaea.org)

IAEA (International Atomic Energy Agency)

Abstract

Nuclear power plants provide secure and sustainable energy supplies, however safety should always be the prime consideration. Plant operators and regulators need to take the necessary steps to ensure that plant safety margins are maintained and, where possible, even enhanced throughout the plant's operating life. At the end of April 2019, there were 451 nuclear power reactors in operation worldwide, with a total capacity of 398.2 GW(e). There were four new grid connections while four reactors were officially declared permanently shut down.

In the region, 117 units are operating in North America, 115 units in Pacific Asia and 112 units in Western Europe, 28 units in middle east and south Asia and 7 units in Latin America and 2 units in Africa. Many Member States have given high priority to licensing their nuclear power plants to operate for terms longer than the time frame originally anticipated (e.g. 30 or 40 years. Approximately 80 % had been in service 25 years and more. The task of managing plant ageing is assigned in most Member States to an engineering specialty called Plant Life Management (PLiM) applying a systematic analysis methodology to System Structure Components (SSCs) ageing. Specifically plant life management can be defined in one sentence as the integration of ageing and economic planning for the purpose of maintaining a high level of safety and optimize plant performance by successfully dealing with extended life ageing issues, maintenance prioritization, periodic safety reviews, education and training.

PLiM techniques that can be defined as the integration of ageing and economic planning, have been used in operating nuclear power plants to maintain a high level of safety, optimize performance and justify LTO beyond the plant design life. In addition, as a follow up to the Fukushima accident, operators have become even more attentive to beyond design basis measures in the preparation of their plants for operation beyond their design life.

In many countries, the safety performance of NPPs is periodically assessed and characterized via the periodic safety review (PSR) process. Regulatory review and acceptance of PSRs constitutes for these countries the licensing requirement for continued operation of the plant to the following PSR cycle (usually 10 years). In the USA and in other countries operating US designed plants, instead of a PSR process, a license renewal application (LRA) process is followed, which requires certain pre-requisites such as ageing management programmes, particularly for passive irreplaceable SSCs. Active components are normally addressed via the maintenance rule (MR) requirements and other established regulatory processes. A third group of Member States have adopted a combined approach that incorporates elements of both the PSR process and selected LRA specific requirements, such as time limited ageing analysis.

Taking into account this variety of approaches, the IAEA initiated work to collect and share information among Member States on good practices in plant life management for long term operation in nuclear power plants, by comparing the various approaches to the PSR reference and by drawing lessons learned from relevant applications and experiences.

Keywords: *Nuclear Power, Long term operation*