Chapter 69

Organization and Information Support of Expert Reviews of I&C Systems Modernization at NPP of Ukraine

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ABSTRACT

Safety assessment of Instrumentation and Control systems (I&C systems) of NPP is performed during expert reviews of nuclear and radiation safety in the framework of the licensing process at all life cycle stages of I&C systems. Life cycle stages of NPP I&C systems, which are determined by current guides, rules, and standards of Ukraine, are considered in the chapter. A short overview of the main principles of safety regulation of nuclear facilities, licensing, and expert review of nuclear and radiation safety is presented. Specific safety assessments of NPP I&C systems at different life cycle stages are analyzed (in particular, a list of documents proving NPP I&C safety that should be submitted for expert review at each stage is given). Such assessment is a labor-intensive process that requires processing considerable amounts of a variety of information. Hence, it is reasonable to provide experts with information support for assessing the safety of NPP I&C systems. The chapter gives suggestions and examples of practical implementation of the automated system for support of expert activities and considers the knowledge base for I&C systems.

INTRODUCTION

Safety assurance is one of the most important tasks during the operation of nuclear power plants. Instrumentation and control systems play an important role and are involved in control of a majority of technological processes at NPPs.

Life cycle of the NPP I&C systems consists of several consecutive stages that cover development of systems requirements, design, testing, implementation in NPP, operation. Furthermore, assessment of the NPP I&C systems is performed at all life cycle stages in the framework of expert review nuclear and radiation safety (NRS).

Expert review of the NPP I&C systems requires effective information support because of processing of a large amount of different information. In the field of the I&C systems it is especially significant due to the following reasons:

1. Each I&C system sometimes contains tens of thousands electronic components;
2. At present a process of rapid development of electronics and computer technology both in hardware components and software is taking place, it causes a necessity for modernization of the NPP I&C systems not only because of their physical ageing but also of obsolescence (while NPP technological equipment does not undergo such changes);
3. Due to the fast development of electronics, normative base in the field of the I&C systems is also improving quickly enough.

Hence, experts have not only to analyze large amounts of information, but also constantly monitor changes of electronics and computer equipment themselves and requirements specified by national and international standards.

This fact necessitates the creation of automated system for support of expert activity for safety assessment of the NPP I&C systems.

The creation of such an information support system can be considered as one of the directions of knowledge management in expert organization. Knowledge management consists in a complex, systematic approach to identification, management and distribution of organization's knowledge and ability of employees to create new knowledge collectively and in such a way to facilitate purpose achievement of this organization. This promotes conditions for improving the work efficiency for all employees at the enterprise by simultaneous decrease of efforts.

BACKGROUND

Expert reviews of modernized I&C systems for NPP of Ukraine are performed according to requirements of national regulatory documents (NP, 2005,a, GND, 2000, NP, 2005,b, NP, 2000), and recommendation of international standards IAEA, 2002, IEC, 2011 and other.

At present the procedure of NPP I&C systems expert review is not automated in Ukraine. Earlier some scientists issued different publications (e.g. Khvastunov, 1981, Bashlykov, 1986, Tokarenko, 2000, Larichev, 2008), about using of expert assessments and designing of making-decision systems in power engineering. But these publications describe only technological processes and operative-dispatch management and were based on comparison of separate decisions of different experts. This does not take place in our case, because decisions are made by a group of experts and are not disputed.

Scientists Konorev, 2007, Kharchenko, 2004 solved the task of automation of software analysis and assessment of NPP I&C systems and development instrumentation tools for this work. But this task covers only part of expert reviews for NPP I&C systems.

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