ELFORSK
THE SWEDISH ELECTRICAL UTILITIES' R&D COMPANY - ELFORSK AB

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Program area Nuclear
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Strategy plan

ENSRIC

- Elforsk nuclear safety related I&C program

Period: 2014-01-01 to 2015-12-31

Summary

ENSRIC is a research program focused on safety related I&C systems, processes and methods in the nuclear industry. The three focus areas of the program are emerging systems, life time extension and I&C overall. Information from the program will assist the nuclear industry and the Radiation Safety Authority when analysing how to replace systems and methods - choosing a new technology or finding a way to stay with the present solution - with maintained safety and promoting a low life cycle cost. Participation of a mix of junior and senior participants in the program is encouraged to facilitate knowledge transfer.

1 Vision

The vision of the nuclear I&C research within Elforsk is that the activities should contribute to safe and robust I&C systems that promotes low Life Cycle Cost.

The results will be used in the decision making process when choosing the technology pathway forward and also to make the implementation and maintenance process of safety I&C more efficient.

The information obtained can be used in the decision making whether to renovate the existing technology in a component/system or to convert to a new technology.

The program should also constitute an arena for discussion on nuclear I&C issues for plant owners, authorities, vendors and researchers.

2 Background

The Nordic nuclear fleet of today consists of a mix of technologies for safety I&C. A large portion of the equipment is still of conventional type but there are also new digital equipments, systems and platforms installed.

In the coming years a considerable amount of systems and equipment must be replaced or upgraded because of different aspects of aging. This is a challenge and the experience from recent years is unfortunately mixed.

In many cases the use of new digital equipment has introduced complexities in the functions, but also in documentation and in licensing issues. On the other hand; the operating experience, availability etc., are in most cases excellent after the digital systems have been commissioned.

Regarding cost; new digital equipment has a reasonable price tag as long as only the products themselves are considered. However, when adding on the engineering hours required to implement the system in the nuclear power plant with verified safety the cost has in many projects escalated far beyond budget.

Hence, there is a need for research around these issues to achieve both safety and reasonable life cycle cost.

3 Focus areas

The main focus of the program is on safety classed I&C systems, both digital and conventional analogue and relay based systems. Activities carried out can be on maintaining present systems and on replacing present systems with new equipment. Competence building activities are also included in the program. Many of those who work with I&C issues in the nuclear industry are to be retired within a few years, so there is a need for skills transfer. Because of this the research program will promote, on all levels, a mix of senior and more junior participants.

The activities are financed by Swedish and Finnish nuclear power plant owners and the Swedish Radiation Safety Authority. A steering group consisting of representatives from the financiers has been appointed, and they are responsible for the individual project decisions and follow up. Additional expert groups, for example reference groups, can be appointed when needed.

Activities and projects initiated can result in:

- Reports
- Guides
- Seminars
- Knowledge databases
- Mapping of ongoing research

depending on the need.

The steering group has identified the following three focus areas for the program:

3.1 Emerging systems and technologies

3.1.1 Introduction

The lessons learned from recent use of digital and programmable safety systems have pointed out the fact that these in many cases are complex solutions to simple problems.

They require vast quantities of validation and verification work that have made the projects in-proportionally expensive. Further more, the future costs to maintain these systems will most probably also become high.

Some vendors have recently started to develop alternatives to overcome these problems. These technologies are less complex but consists of modern, and on the market readily available, components.

3.1.2 Objective

Obtain an overview and understanding of new systems, technologies and market players. The results can be used when assessing whether new technologies are a realistic alternative in future investment programs within the next 5-10 years.

3.1.3 Activities

a. Screening new systems; what is on the market and on the drawing board (more focus on platforms than on equipment)

b. Investigate the potential to fulfil safety requirements

c. Map the potential use in Nordic nuclear power stations

d. Look into the potential to obtain a cost effective lifecycle

3.2 Life time extension of present systems

3.2.1 Introduction

Aging of equipment and systems is not just isolated to the hardware and supply of spare parts. It is just as much a question of knowledge and documentation, both at the plant and from the supplier's side.

The issue is obvious for equipment installed decades ago, but it is of course also important for new equipment where there are choices to be made that influence the future safety and cost.

A renovation and/or upgrade program can be an alternative to replacement. Internationally this is a trend and several operators and suppliers have initiated strategic programs for this.

3.2.2 Objective

Obtain understanding of how effects of aging can be handled to promote a long cost effective lifetime with maintained safety. The results can be used when assessing if a system can be renovated using existing technologies in a safe and cost effective way.

3.2.3 Activities

e. Screening available methods for prolonging the lifetime of existing systems

f. Investigate the potential to fulfil safety requirements

g. Map the potential use in Nordic nuclear power stations

h. Look into the potential to obtain a cost effective lifecycle

3.2.4 Limitation

The aging of I&C related polymers (cables etc.) is not included in this research program, since there are a number of activities ongoing in this area in other forums.

3.3 I&C overall

3.3.1 Introduction

There are a number of more general issues within the area of safety I&C that are suitable to address within this research program.

These issues span from implementation experience to new requirements, and could also include such issues as reviewing and learning from other safety critical industries.

3.3.2 Objectives

To widen the knowledge base of safety I&C and the implementation of it and make sure that the findings obtained through completed investment programs is utilized, within the nuclear sector and other safety critical sectors.

3.3.3 Activities

i. Conclude experiences from recent Nordic I&C projects. For example when implementing major programmable I&C systems, the experience is that the continuous updating of the systems are costly and time consuming. This should be kept in mind when specifying a system to get a more cost effective system during the life time of the system.

j. Market outlook; what are the trends, will conventional I&C still be available on the market?

k. Screening ongoing research within this area

l. How are other safety critical industries addressing I&C issues, what can we learn and benefit from these?

m. Verification of components – methods to verify sealed components in safety classed applications to assure that no non certified components are used.

n. Develop generic methods for writing safety cases and SAR for I&C systems.

o. Expanding the safety demonstration plan guide.

p. Develop generic method for writing Long Term Operation strategies for I&C systems including programmable platforms.

4 Steering group

Anders Johansson, Vattenfall (chairman)

Bo Liwång, SSM

Fredrik Bengtsson, Ringhals

Hans Edvinsson, Vattenfall

Harri Perhonen, Fortum

Inge Pierre, Svensk Energi

Karl-Erik Eriksson, OKG

Monika Adsten, Elforsk (adj.)

Roger Granath, Forsmark