Review of Safety Criteria for Nuclear Steam Supply System in Pressurized Water Reactor

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1. INTRODUCTION

Nuclear Steam Supply System (NSSS) possesses a vital share of the importance in nuclear power plant safety. Modern safety features are the sequential development of safety criteria which was started by those early pioneers who had discovered and inaugurated the concept of nuclear plant system. The contemporary aspects of safety criteria for Pressurized Water Reactor (PWR) have been studied by American Nuclear Society in their report ANSI/ANS-51.1-1983 (1) which depicts various safety parameters of NSSS used in a stationary PWR. In addition, the 10 CFR of the US NRC, European Utility Requirement and joint study by the USA and Japan has provoked multidisciplinary functions of NSSS safety in depth (2). Moreover, the International Atomic Energy Agency (IAEA) has its continuous research effort, review findings and recommendation (3-6) for the safety of PWR. However, to enhance adequate safety (whether general aspect or design basis) for PWR any other alternative options which are reasonably acceptable can be evolved from the safety review of standards and guides available in global nuclear safety knowledge. Specifically for the new entrant to nuclear power plant program a great variety of safety criterion are needed to be customized and have to be set up considering the collective dose, estimated release of contaminants, socioeconomics aspect, public safety and environment etc. The aim of this study is figure out number of suitable safety parameters of NSSS specially to be applied in a new built 2000MW PWR of a developing the country's first nuclear power plant.

2. MATERIAL and METHOD

This study is an ongoing research work, for which a number of safety standards has been selected and more others are to be incorporated to have an effective goal of the study. An acceptable level of safety review is expected in this research work.

2.1 Safety Criteria and Standards:

Standards from the Western type (1, 7 and 8), successfully experienced safety criteria from Korean and Japanese (2) nuclear power plants system and the IAEA technical documents, safety standard series (3-6) for nuclear power plant safety etc. have been chosen to perform the esteemed safety review for the NSSS. The fundamental safety parameters are to be reviewed and there is no way to compromise with them. However, in regard to the social and economical aspect, the level of risk against a highly populated site, some parameters are selected based on the existing reality, regulatory control, affordability in cost management, others standards relating to their social and economical situation, national and international compliance etc. Whatever the safety parameters are in consideration all of these are under justification based of the four major subjects mentioned in the Table-1.

Table 1: Classified Aspect and their goal

Subject	Safety Goal in the Review Process
Public safety	Achieving safety criteria to control release of radioactive material in dangerous quantities from a nuclear facility to the general public.
Occupational workers	To minimize accidents involving plant employees. The frequencies of such events have to control towards the lowest possible level, certainly lower than that of any other comparable industries.
Economics	In severe accident scenario that might unexpectedly occurs and results severe damage to the nuclear facility should be kept to the least possible level and must be justified enough.
Operational problem	Mechanical failure, and system malfunctions, or deviations from normal behavior should be reduced to a minimum level. Assurance redundancy by two or more similar component.

2.2 The Review Process:

The practical number of nuclear safety parameters is huge in numbers, which always go up in their volume through a continuous development in nuclear safety worldwide. Using general safety criteria in 10 CFR of US-NRC, safety criteria in the European Utility Requirement (EUR) and the IAEA safety criteria for

nuclear power plants, specific compartment relating to the NSSS are being reviewed. Overall safety review processes is to be performed under guideline of IAEA safety standard no. SSG-2 and no. SSG-16 (3, 4). Simple block diagram of the procedure is shown in Figure 1.

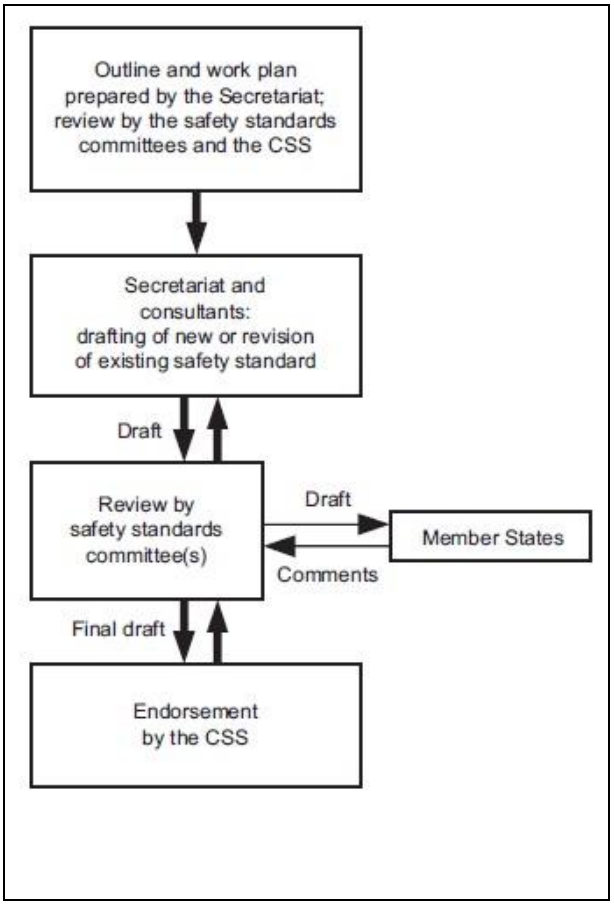

Figure1: The process for developing a new safety standard or revising an existing standard.

3. DISCUSSION

Throughout the study, safety issues relating to NSSS are the primary interest and using reference materials, the ANSI/ANS-51.1-1983, American Nuclear Society, and the IAEA Safety Standard Series No. SSG-2 and No. SSG-16, elements of safety criteria that have been taken under review consideration are- plant condition (PC), best estimated frequency of occurrence (F), defense-in-depth (D3), single failure, diversity, redundancy, reliability, reactor vessel internal (RVI), design basis, code and standard, regulation, operating conditions, pressure, temperature and neutron exposure, primary coolant chemistry specifications, ageing mechanisms, fatigue and corrosion, reactor coolant system and its connectives and associative, ultimate heat sink, general classification of design, safety classification etc.

According to the procedure mentioned in Figure 1, the important safety criteria are to be reviewed to achieve an intensive list of safety parameters which are potentially require to set up a new built PWR.

All the selected safety features are expected to particularly useable in a developing country, with mass population body and the associative risk factor.

4. REFERENCES

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