

## **Enhancing Regulatory Inspection Practices and Safety Culture of Regulatory Body' Personnel for Improving Safety of Nuclear Fuel Cycle Installations**

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### **Abstract**

The nuclear fuel cycle installations (NFCIs) are characterized by different physical and chemical processes applied on fissile and radioactive materials in different physical forms, as well as many human interventions required for the control of these operation and maintenance of NFCIs equipments. Therefore, personnel radiation protection requirement is more demanding in these installations. Accordingly, it is necessary to apply a wide range of specific safety measures or actions in addition to inherent design features in the form of administrative safety actions during normal operation of these processes in NFCIs. In this paper, emphasis is focusing on operational administrative safety control measures in NFCIs as a major factor for preventing abnormal conditions and accidents in the NFCIs and hence protection of personnel against release of radiation. The paper presents a systematic and improved Operational Safety Management Approach focusing on administrative safety measures and enhancement of safety culture of NFCIs operators and a Regulatory Inspection Methodology (OSMARIM). This approach can help for enhancing regulatory inspection practices of regulatory body inspectors and ensuring operational safety management in NFCIs.

### **1. Introduction**

In view of many human interventions, wide distribution and mobility of fissile materials required during the operation and maintenance of nuclear fuel cycle installations (NFCIs), certain abnormal conditions could potentially result in criticality accidents and release of radioactive material from its designated location, with the consequent risk of radiation exposure to personnel. Radiation protection requirements for staff personnel in these facilities are especially more demanding [1,2]. For this reason, it is necessary to provide correspondingly a wide range of specific safety measures as inherent parts of these activities. In NFCIs the emphasis is on the control of operations using administrative and operator controls to ensure safety, as opposed to engineered safety features used in reactors. The safety of NFCIs is an issue of global importance and great concern relevant to success of nuclear programmes and public acceptance of nuclear energy. This paper is focusing on operational safety in NFCIs as a master key for preventing abnormal conditions and accidents in the NFCIs, and hence protection of personnel against release of radiation. The paper presents an improved Operational Safety Management Approach and a Regulatory Inspection (RI) Methodology for ensuring operational safety management in NFCIs.

### **2. Technical Safety Functions Requirements in NFCIs**

To protect NFCIs staff personnel, society and the environment from radiological hazards, establishing and maintaining effective defense against radiological hazards in nuclear installations are required. This general nuclear safety objective is supported by two complementary safety objectives dealing with engineering or technical aspects and administrative aspects [3].

Fig.(1) demonstrates the fundamental Safety Objectives (FSO) or radiation protection objective requirements in NFCIs. As shown from Fig.1, prevention of facility accidents or events is the first priority

in the scheme of operational safety achievement in NFCIs. On the other hand, to prevent accidents, preventing the degradation of facility safety status and performance will provide an effective protection to the workers and the environment as well as the protection of the installations. Table. 1, depicts briefly the basic technical safety requirements in a NFCI. These technical safety requirements in combination with the basic safety concepts, will achieve the fundamental or basic safety functions and hence a good operational safety condition in the NFCI. The fundamental or basic safety functions required for achievement of a good operational safety condition are: a- confinement of radioactive materials and shielding sources of radiation, b- maintaining system sub-criticality, and c- control of process heat from chemical processes.

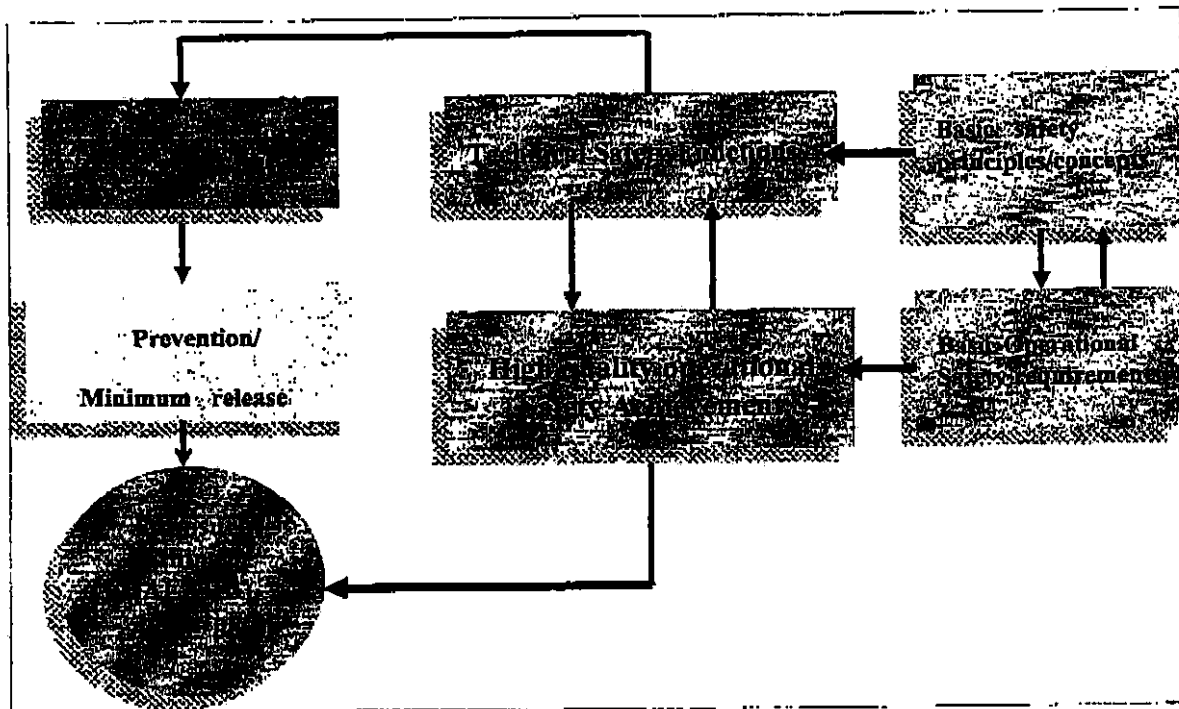


Fig. 1: Fundamental safety objective requirements in NFCIs

### 3. Basic Safety Principles and Safety Management Approach in NFCIs

To ensure that the fundamental safety functions are adequately fulfilled, an effective defense-in-depth (DID) strategy should be implemented, combined with an increased use of inherent safety characteristics and passive. The technical or engineering safety measures implies that; during all phases of the NFCI; siting selection and evaluation, bid evaluation, design, construction and operation should be in compliance with nuclear safety regulations and safety standards. so as to keep all sources of radiation exposure under strict technical and administrative control. DID concept, is an overall safety management strategy for operational safety systems in NFCIs designs [3,4]. of nuclear facilities. The facility inherent safety features or technical aspects in conjunction with administrative and procedural measures ensure defense against hazards due to exposure to ionizing radiations.

Table 1. Technical Safety Functions requirements in NFCIs

<u>-Technical safety measures (TSM):</u>	<u>-Administrative safety measures (ASM):</u>	<u>-operational safety requirements</u>
<u>Safety of:</u> - Site selection - Bid Evaluation - Design - Construction - Commissioning - Operation - Decommissioning	<u>Personnel adherence to:</u> - NCF SAR - NCF Quality Manual - Operational manual - OLC - Check lists - R.P. procedures - Maintenance Program - Code of practice - Training Programs	-Well- trained Operation staff  -High quality operational safety Methodology  -Reliability of Facility System Equipments

In contrast to nuclear reactors, due to many human interventions requirements in NFCIs for the operation and maintenance, (manual operations cannot be completely avoided here), much emphasis are focusing on administrative safety measures or procedures during operation of these facilities. These safety measures should include a clear definition of responsibilities and appropriate training of facility staff in the operation and maintenance tasks to enhance personnel safety culture. In this case, operational safety will be achieved in NFCIs, if the knowledge and experience gained has to be translated into enhanced safety culture and practices [5].

Accordingly, prevention or mitigation of the radiological consequences of accidents is enhanced and facility staff exposures to radiation are kept below prescribed limits as low as reasonably and practicable, (ALARA principle). However, the radiation protection objective does not preclude limited exposure of people or the release of legally authorized quantities of radioactive materials to the environment from installations in operational states. Such exposures and releases, however, must be strictly controlled and must be in compliance with specified operational limits and radiation protection standards. Fig.2 illustrates an improved approach for operational safety management application in NFCIs.

## Conclusion

The paper is focusing on operational safety in NFCIs as a controlling parameter for preventing or mitigation abnormal conditions and accidents in the NFCIs and hence controlling or protection of personnel against release of radiation. The paper presents an improved proposal for Operational Safety Management Approach in NFCIs. This approach emphasize the role of administrative safety features and safety-culture for ensuring high quality operational safety management and hence good personnel radiological protection in NFCIs .

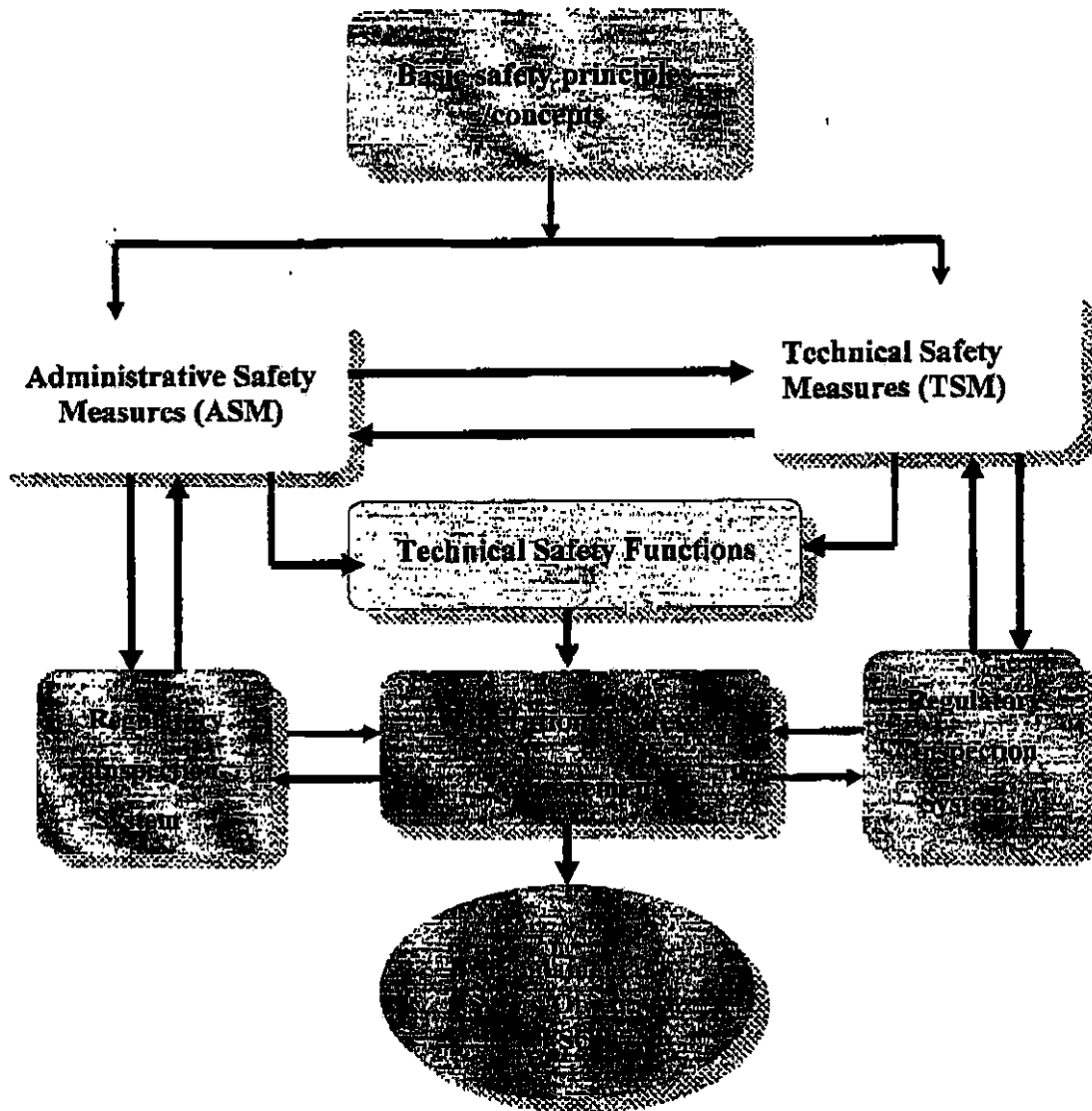


Fig.(2): Operational safety management approach in NCFs.

**References**

- (1) A.A.Gad Alla et al, "Nuclear Fuel Cycles: Description, Demand and Supply Estimates", Report: AREAEE/Int. Rep.283, (1985).
- (2) IAEA, OECD/NEA, Environmental Remediation of Uranium Production Facilities, OECD, Paris, France, (2002).
- (3) IAEA, "Safety of Nuclear Fuel Cycle Facilities", IAEA Draft Document.. (2005)
- (4) IAEA, " Safety of Conversion and Enrichment Facilities", IAEA DS 344. , (2006)
- (5) A.A. Gad Alla, "Safety Aspects of radioactive Waste Management in Different Nuclear Fuel Cycle Policies, A Comparative Study", Report: AREAEA- 479 (2007).