Interface Between Nuclear Safety and Security in Radioisotope Production Facility

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ABSTRACT

Radioisotope production facility is commissioned in 2013 to produce some radioisotopes for medical and industrial applications. Nuclear safety and security is standardized and have common purposes for protection of people, society and the environment. In both cases, such protection is achieved by preventing a large release of radioactive material as well as nuclear material protection .The purpose of this manuscript is to provide a better implementation and understanding of the interfaces between safety and security procedures in radioisotope production facility. It discusses the means to achieve both objectives interchangeably in an optimal procedure. It also adopts the required actions with the goal of maximizing the protection of the public, property, society, and the environment through an improved and strengthened interfaces between safety and security.

1. INTODUCTION

The fundamental purpose of each safety and security is the same. Both safety and security typically follow the strategy of defense in depth. Priority is given to prevention of risk, detection any abnormal situations early and applies measures promptly to avoid consequent damage. Extensive emergency plan should be available in area in the event in case of prevention, protection and mitigation systems failure. There are many elements that are common to safety and security as well as challenges related to differences in approach and culture between the two disciplines. Some actions that are taken for security reasons may serve to inhibit safety or emergency response. Safety and security considerations exist in RPF in all stages, such as the transport of nuclear material, the usage of nuclear material and radioactive waste disposal. This manuscript studies radioisotope production facility security and safety measures and interfaces between them.

2. RESPONSIBILITY OF RPF OPERATORS

The operators have the prime responsibility for the safety and security of the RPF. This allocation of responsibility reflects the reality that operating staff are in the best position to identify the risks arising at the facility and to ensure compliance with regulatory requirements. In this context, the operators must verify the skills and appropriate training of personnel. Inform the RPF manager of any event likely affects the safety or security of the facility and, as appropriate, request support. Maintain coordination with State organizations that are involved in safety or security; and Implement a quality assurance system in both the safety and security fields.

Nonetheless, there are some elements that are unique to each culture. For example, one difference between the two cultures relates to the way of information handling. In the security field, the sharing of information should typically be restricted to a special group of individuals in order to prevent sensitive information related to protective measures or facility weaknesses from falling into the hands of adversaries.

The risks from safety are from unintended events as the followings: Natural occurrences (earthquakes), Hardware failures (Mechanical breakdowns, I&C defects), internal events (Radioactive material falling, fire), Human mistakes (incorrect alignment, wrong diagnostic, negligence, etc.). The risks from Security (insider threat) are arising from malicious acts with the intent to spill radioactive material to cause damage for contamination.

3. INTERFACE SAFETY – SECURITY ELEMENTS

3.1 SYNERGIES: Elements or actions in one area enhances also the other area, and the interaction or cooperation of two or more, factors to produce a combined effect greater than the sum of their separate effects as follows:

Containment structure: RPF building is purposed for safety which serves to prevent a significant release of radioactive material to the environment in the event of an accident while it serves also for security to provide a robust structure that protects the Radioisotope production facility (RPF) from a terrorist assault.

Doors or barriers: It can serve both safety and security. Doors as barriers have a safety purpose by serving as a radiation barrier. Also it can serve a security purpose by delaying or preventing unauthorized access.

RADIOLOGICAL SAFETY BARRIER: These types of barriers are dedicated by ventilation system. It is supported by access control system and monitored by alarm system. The access control is a security system but it enhances and keeps depression in radioactive areas to confine contaminations inside each area based on its radiological classifications. Loss of depression in each area is triggered by alarm system in case of deviation to notify operators that access door of this area are opened by someone. So security system is included by default as demonstration example of interface between security and safety.

3.1.1 MONITORING AND CAMERA SYSTEM: Several cameras are installed for two purposes: Security, to register and detect any usual and unusual events during operation and day off as well as safety, to monitor and register the process or manipulation of any material and tasks inside the facility.

3.1.2 PROVIDE CLEAR BORDER DEFINITION OF CONTROLLED SPACE: Spaces are defined well in RPF to preserve operating rights. Boundaries are identified physically and symbolically. The arrangements of floors' color definition are means of identifying interior spaces and powerful environmental cues that affect the behavior and predispositions of normal users, and abnormal users (visitors and inspectors) alike.

3.1.3 INTRUSION DETECTION SYSTEM: Perimeter protection is the first barrier in the defense to detect intruders. The most common points equipped with sensing devices for premise perimeter protection in RPF are windows and doors. Since over 80% of all break-ins occur through these openings, most alarm systems provide this type of protection. The major advantage of perimeter protection is its simple design. The breaking of such opening leads to interruption of depression in burglarized area and the alarm system is triggered by safety and security dedicated systems.

3.1.4 PASSIVE SYSTEM: The use of passive system is mainly to avoid and deter human errors intentionally or without and may make it more difficult for potential aggressors to tamper with systems; such controls may be of particular importance in safety and security context. Air samplers in RPF are a crucial tool that used to monitor the more significant hazard within the breathing zone of an individual worker and provides a total measurement of radioactivity that is trapped on a filter to detect contamination in special points and operators can diagnosis its cause and can predict how it happens.

4. DEFENSE IN DEPTH ELEMENTS (DIDE) IN RPF

Radioisotope as part of second Egyptian testing and research reactor complex is designed by applying the defense in depth principle for both safety and security. Certain design criteria considered for safety purposes may also serve to reinforce and support security

DIDE	Safety Regime	Security Regime
Prevention	Robust Design, Construction	Deterrence steps to discourage the aggressor, access control
Detection	Concise I&C systems	Security systems (alarm system)
Mitigation	Radiological I&C, Ventilation system	Recovery actions
Emergency Plan	For Unintended events	For malicious acts, DBT

5. ACTIVITIES OF SPECIAL SIGNIFICANCE

There are activities undertaken during life cycle of Radioisotope Production Facility that deserve special security and safety consideration and its interests.

5.1 MAINTENANCE, SURVEILLANCE AND INSPECTIONS

The availability of safety and security systems must be permanently guaranteed. Compensatory measures should be put in place whenever a safety or security capabilities are rendered unavailable. For example, the cut off electric power in area to conduct maintenance should be undertaken with full awareness of the possible compromising of surveillance systems that serve security purposes and the need to introduce compensatory security measures. It is common at RPF to undertake many maintenance and surveillance activities during emergency stops. This inevitably tasks lead to more demands from supplementary workers and resources from spare parts and tools, which are in general provided by breaking some rules and regulations. This leads to the need for additional access and control measures to ensure security and safety. The following activities need these significance interests:

a- Repairing of Tele-manipulators of hot cells during operation;

b- Repairing of Container of Transportation and Transfer of Active Material (CTTA);

c- Loss of ventilation system in active areas;

These activities lead to break some rules as shown above and leads to the need for additional access and control measures to ensure security and safety.

5.2 ACCESS AND CONTROL MEASURES

Access and control measures are relevant for both safety and security. For safety, such controls physical barriers (ventilation system) and prevent unexpected radiation exposure or ensure that access to critical systems is limited to appropriate personnel. Moreover, access control records is also used and automatically registered to confirm that all workers have been safely evacuated from a facility in the event of an emergency. Access controls can create conflicts between safety and security. This is typically the case with access and egress of personnel during emergencies in RPF. Rapid access is necessary for safety purposes to respond to events in a timely manner and rapid egress may be necessary to protect the health of workers. But it may create a vulnerability that could be exploited by a terrorist adversary.

6. SECURITY AND SAFETY DURING MATERIAL PACKAGING

Packaging is assembly of products to confine the radioactive contents completely. It consists of one or more receptacles, absorbent materials, spacing structures, radiation shielding, absorbing mechanical shocks (foam), handling and tie-down; and service devices integral to the package. The packaging may also be a freight container (wood box).. Measurements are taken in contact and 1 meter distance from package to define the transportation index. Precautions are deemed to enhance the security safety interfaces are:

a) Workers receive appropriate training commensurate with their responsibilities concerning radiation protection to avoid and restrict their occupational exposure and the exposure of other persons who might be affected by their actions.

b) Individuals who classify, pack, mark and label radioactive material prepare transport documents for radioactive material; offer, accept, carry, handle load or unload radioactive material for transport are acknowledge by competent authority; and receive the following training:

a) General awareness/familiarization training

b) Function specific training

Each person receives detailed training concerning specific radioactive material transport requirements which are applicable to the function that person performs;

CONCLUSION

Interaction of safety and security finds senses and has feedback to diverging goals. Interaction of safety and security starts already during the making of regulations, guidelines and other documents in different facility stages, so comprehensive approach in the interaction of safety and security at the management, administration and workers are essential.

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