# Challenges of maintaining the security

# of radioactive sources of categories

# 1,2 and 3 in case of abnormal conditions

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**Abstract**

### The security of radioactive sources, nuclear materials and the facilities they contain is related to the provision of factors related to the human role, while others are related to the technical aspect in a way that provides the following security elements: deterrence, detection, delay, response and security management.

### The human role represents the administrative procedures which consist of monitoring, guards, alarms evaluation and conversion to declaration of detection status followed by disability and delay to provide the necessary time to respond and security management.

### An important part of the deterrence concerns the human role. The presence of security elements in the specific location can provide sufficient deterrence. The assessment of alarms is carried out through a human element, up to the announcement of a detection situation. The work of disability and response is carried out by the human role to a large extent. This task cannot be accomplished without the human role.

### In the same context, the technical factors require activation to be provided to the main and alternative sources of energy, as the means of deterrence and detection (cameras, sensors of movement, padlock, etc.) all require continuous supply of electrical energy and the loss of energy sources eliminates the full existence of the technical role. The integration of the work of technical and human role is required to be carried out within the framework of a comprehensive security system or community stability in general. The occurrence of abnormal events such as loss of state control and the collapse of the system, the occurrence of severe environmental disaster or the occurrence of wide range military operations that would lead to the loss of the human role or leads to loss of technical role as well. Which is happening in the city of Mosul where the selection of ISIS gangs calling for the medical complex as an area of ​​operations led to the medical complex to the consequences and severe damage to buildings, electrical power supply and infrastructure , which led to the loss of the human and technical role, thus the loss of all elements of security elements (deterrence, detection, delay and impediment, response and security management), Unauthorized access to the therapeutic source (the cobalt-60 unit) had happened and fortunately the unauthorized arrivals were thieves who were looking for any simple material theft so they stealing electrical connections and some operation components of the device, so can be imagine the sabotage scenario if the adversary are terrorists and they have the capability and intention, with presence of attractiveness, and ease to access to the radioactive source, by making a simple threat assessment, according to practical information regarding to the security situation and terrorist capabilities, the conclude is threat assessment rating is very high.

### In order to prepare for such situations, the role of the technical factor should be greater and work independently of the human role, such as providing teletherapy treatment rooms or any rooms containing high-level radioactive sources from first or second categories with automatic doors operated by an independent power supply and closed in special cases such as earthquakes, explosions, war operations, hurricanes and floods, or if they are activated by the security official when they feel that a certain danger is imminent. The opening of these doors should be difficult without special codes that are equipped exclusively for those authorized person.

## INTRODUCTION

Nuclear security focuses on the prevention of, detection of, and response to, criminal or intentional unauthorized acts involving or directed at nuclear material, other radioactive material, associated facilities, or associated activities. Possible scenarios for a terrorist attack are the dispersion of radioactive material, by an explosive device or other means, or the use of radioactive sealed sources to expose people to large doses. The dispersion of radioactive material poses the risks of external exposure to persons, if the material emits penetrating radiation such as gamma rays, and internal exposure if the material is inhaled, ingested, or absorbed through the skin. The dispersion of radioactive material may cause fear and even panic in some people and is likely to complicate the efforts to respond to and recover from a terrorist incident. The dispersion of radioactive material may cause significant economic loss, from the cost to decontaminate buildings or other areas, or from the cost of abandonment, if decontamination is not feasible.

Therefore, every reasonable effort should be devoted to preventing terrorists from obtaining suitable radioactive material.

## TYPES OF SPECIFIC SECURITY MEASURES

The security performance objectives for the security groups will be met by the use of a combination of administrative and technical measures. These security measures should be seen as an integrated concept of safety and security involving industrial safety arrangements, radiation protection measures and appropriate design to achieve the necessary level of protection against unauthorized acquisition of radioactive sources.

### Administrative measures

Administrative measures are the use of policies, procedures, and practices that direct personnel to securely and safely manage sources. Administrative measures are used to support or supplement the technical ones. Administrative measures include:

* access control procedures;
* alarmed access points (e.g. with radiation detectors);
* key control procedures;
* video cameras or personal surveillance
* records related to management of sources;
* inventories;
* regulations and guidance;
* reliability and trustworthiness of personnel;
* information security;
* establishment of a safety culture and a security culture.

Even if surveillance measures involve intrusion detectors as opposed to human observation, they are considered administrative measures in that they do not provide a physical barrier. The efficient achievement of the administrative measures primarily depend on human role monitoring and responding.

### Technical measures

Technical measures pose a physical barrier to the radioactive source, device or facility in order to separate it from unauthorized personnel and to deter, or to prevent, inadvertent or unauthorized access to, or removal of, a radioactive source.

Technical measures are generally hardware or security devices and include:

* fences;
* walls;
* cages;
* transport packagings;
* locks and interlocks for doors;
* intrusion-resistent source-holding devices.

Their design and level of quality assurance should be appropriate to the threat and the potential consequences of the defined malevolent act. Generally, this means high quality materials and components [1].

### Physical protection system

A physical protection system is the integration of persons, procedures and equipment to protect valuables or installations from theft, vandalism, or other hostile human attack, consists of:

* + Deterrence
  + Detection
  + Delay
  + Response

### Purpose of a design base threat

A DBT is a tool that provides a common basis for planning for physical protection by the operator and approval of its physical protection plan by the competent authority for nuclear security. A physical protection system is designed to prevent adversaries from successfully committing a malicious act. To ensure that this objective is met, the designer for physical protection should understand the conditions under which the protection system must perform. Intelligence and other sources of information related to threats would provide sufficient information for the specification of requirements for the design and for the performance of a physical protection system to help ensure that this objective is met. However, intelligence is often limited, and threats are inherently dynamic. A physical protection system designed only for the current threat may not be effective against tomorrow’s threat.[2]

## Practical situation

To examine the effectiveness of the technical role and human role in two security systems, the first one with Gamma Knife in Al-Mosul University and the second one the security system for the teletherapy unit Co-60 at Al-Jumhury hospital also in AL-Mosul Provence at north of Iraq. The administrative measures and technical measures were adopted and working properly along years and satisfied an acceptable securely performance, also they were subject to regular inspections to check the effectiveness and permanence of the measures and there expected responses to design base threats dependent on general national security and social situation. The general view of the high activity authorized two radioactive sources until the mid of Jun 2014 as follow:

* The Co-60, (total number 193) sources of the fixed multi-beam teletherapy Gamma Knife unit, total activity 5750 Ci@2014, which will use for the treatment of brain tumors at the educational hospital at Mosul University, the authorization was still in process when the war was begun and the city occupied by ISIS gangs, the security totally depend on safety measures.
* The teletherapy cobalt unit (11350 Ci@1980) in Al-jumhory hospital at the medical complex in AL-Mosul province too, it was in use until the day before the war was begun.

The two medical devices and related security systems subjected to the same war conditions and military operation. The safety and security measures to prevent unauthorized intrusion to the treatment hall of the Gamma Knife at the educational hospital in Mosul University are primarily depends on the machinery movement of the mechanical heavy door, it closed by electric motor, the opening is very difficult without electric power, it can be opened manually by authorized or qualified person, there must be a special knowing to reach out to the way of manual opening, the war was begun before enhancing the security measures. While the safety and security of the theletherapy cobalt unit at Al-jumhory hospital are depend on human role, the security achieved by access control and monitoring by set of cameras with control security room by guards, the security depends on administrative measures.

### 3.1 Lose of security measures

When the war operation of liberation of AL-Mosul province was begun, it take lot of time at the medical complex and AL-Mosul University, with the ending of the military operation, there's was no presence of real special guarding force to protect the security of radioactive sources, it's so clear that the human role for security of radioactive sources has absent, the technical measures of Gamma Knife are efficient, although there was no electric power, the heavy closing door still totally closed and save the radioactive source.

regarding the teletherpy cobalt unit at Al-jumhory hospital, at the ending of military operation, the security measures wear become out of order, all the administrative measures wear broken (doors, fences, cameras ,access control,....), duo to their wear no additional technical security measures, the target (cobalt unit) was become non secure. and easy to intrusion. for theft or sabotage actions.

### 3.2 Situation threat assessment

The neighbors of the hospital are old residential areas and poor population, there wear many terrorists still in this area with ability and intention to perpetration a sabotage action, the military forces control on medical complex in general, without any special concern to this hospital (radioactive source). The damaging of doors, fences made attractiveness and the poverty made a motivation to small thieves to reach out the internal different rooms in hospitals to steal a valuable things like electric components and parts of furniture, the group of thieves success in reaching out the room of MRI unit (at the same hospital) and burning the device to steal the copper pipes and plates, also steal few electric components and cables from the teletherapy cobalt-60 unit, it's so clear that the intention and capability of the group of thieves to perpetration sabotage action is real with the aim of theft not for terrorist purposes By making a simple threat assessment as shown in TAB.(1), according to practical information regarding to the security situation and terrorist capabilities, intentions and general security situation the conclude is threat assessment rating is ranged between high and very high.

### 3.3 our fast response

When IRSRA informed that MRI unit was deliberately burned, the IRSRA emergency response team arrived to Al-Mosul province at the second day to check the security situation of the cobalt unit, we found some doors damaged and opened due to explosive and military war operation, some doors opened by the thieves to steal valuable things.

Our assessment to the general security situation and security of the cobalt unit, the threat is very high so must be conduct fast measures to save cobalt unit, with taking into account the lack of resource, first think was asking the support from the governor of AL-Mosul province to provide us by a welder and quantity of structural steel sections to close two doors totally by welding to minimize the access to the main hall of cobalt unit, which supported by steel cage and two secure locks, also another steel cage at the mid way to the main hall supported by lock, the main entrance locked too.

our work provide a temporary security technical measures to secure the cobalt unit until the time of dismantling and transporting to secure storage location in Baghdad.

TABLE (1) THREAT ASSESSMENT RATING

|  |  |  |
| --- | --- | --- |
| Treat assessment rating | cabapiltes | intention |
| very high | adverseies have an established capability to attack the target | adversareis have a current intention to attack the target |
|  |  |  |
| high | adversaries have the capability to attach the target | attacke of the target is consistent with the intentions of the group |
|  |  |  |
| medium | adversereis have some capabality to attack the target | attack is not consistent with their intention, depending on current corcumstances |
| low | adversereis currently have little capability | adversareis have little intention to attack the target |
|  |  |  |
| very low | adversereis currently have no capability | adversaries currently have no intention to attack target |

## conclusion

### In order to prepare for such situations, the role of the technical factor should be greater and work independently of the human role, such as providing teletherapy treatment rooms or any rooms containing high-level radioactive sources from first or second categories with automatic doors operated by an independent power supply and closed in special cases such as earthquakes, explosions, war operations, hurricanes and floods, or if they are activated by the security official when they feel that a certain danger is imminent. The opening of these doors should be difficult without special codes that are equipped exclusively for those authorized person.

References:

1- Security of radioactive sources,IAEA-TECDOC-1355

2- IAEA Nuclear Security Series No. 10 , Development, Use and Maintenance of the Design Basis Threat. INTERNATIONAL ATOMIC ENERGY AGENCY VIENNA, 2009.

3- IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on physical Protection and Nuclear facilities. INTERNATIONAL ATOMIC ENERGY AGENCY VIENNA, 2011.