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الله أكبر

Design an Effective Physical Security System to Prevent Breaches in the Security of Radioactive Material at Al-Tuwaitha Nuclear Site

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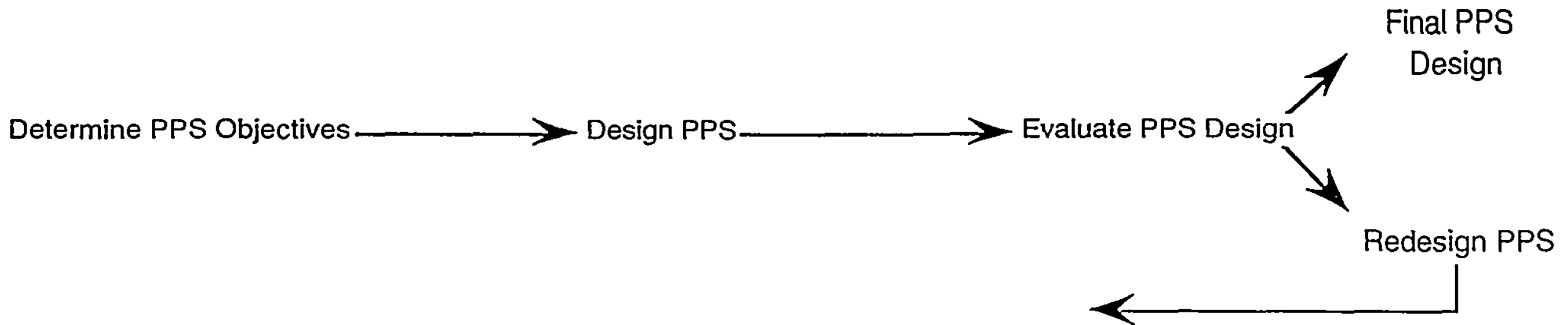
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INTRODUCTION

The first step in the development of the Physical Protection System (PPS) design is to determine the objectives of the PPS. To formulate these objectives, the designer must:

- 1) Characterize the facility operations and conditions,
- 2) Define the threat,
- 3) Identify the targets.



PPS design and analysis cycle

OBJECTIVE AND METHODOLOGY

The present study aims to design an effective physical protection system (PPS) able to prevent breaches in the security of radioactive material at Al-Tuwaitha nuclear site, instead of the initial (former) PPS, through the following methodology:

1. Assessing the potential internal and external threats against the site,
2. Redesigning and upgrading the initial PPS design of the site by installing number of modern physical protection equipment at selected sensitive strategic locations of the site,
3. Testing the ultimate PPS design of the site after redesigning and upgrading to prove its worth and effectiveness by conducting some of hypothetical scenarios.

AL-TUWAITHA SITE OVERVIEW

- There are significant numbers of nuclear facilities and sites in Iraq, but the most complex is Al-Tuwaitha Nuclear Research Center, which is famous as "Al-Tuwaitha site".
- Al-Tuwaitha site located approximately 1 km east of the Tigris River, 18 km southeast of Baghdad and covers an area about 1.7 square meter.
- Al-Tuwaitha site includes the remains of two research reactors (Osiraq and IRT-5000), a fuel fabrication facility, plutonium separation facilities, and other support facilities.



Aerial oblique photograph of Al-Tuwaitha site

EVALUATE THE INITIAL PPS DESIGN

Analysis and evaluation of the initial PPS design of Al-Tuwaitha site was conducted, and below the most important vulnerabilities:

- The site's security and protection system has been designed since its establishment (in the 1960s) then upgraded in the 1980s, so it is considered outdated, and it is not completely reliable to detect, prevent and respond to potential threats against the site.
- Physical damage to the site because of the two aerial bombings in 1981 and 1991 as well as the looting in 2003.
- The site contains 18 destroyed nuclear facilities subjected to the Iraqi Decommissioning Programme (IDP), which has been planned to continue for 18 years (2008-2025). The decommissioning activities are ongoing till now, some of these facilities were completed and others under study of decommissioning.

CONT'D

The site also contains the following sensitive facilities:

- Central Radioactive Sources Storage Facility “**Bunker-B**” for storing disused sealed radioactive sources that generated over Iraq.
- Radioactive Wastes Complex, which consists of a set of facilities and locations, allocated for storing and treatment of radioactive wastes resulting from the decommissioning activities.
- Radiological and nuclear laboratories dedicated to peaceful applications.

As a result of these vulnerabilities mentioned, the initial PPS of the site has been redesigned and upgraded to obtain an effective PPS able to prevent potential breaches in the security of radioactive material at the site, by the following stages:

- Equipping the site's strategic areas with the necessary physical protection equipment.
- Maintenance of what can be repaired from the site's outdated physical protection equipment (perimeter fences, monitoring towers, surveillance cameras, gates, lighting systems, communication systems, etc.).



Tammuz-2 Reactor



IRT-5000 Reactor

Photomontage as an example of destroyed nuclear facilities at Al-Tuwaitha site



Photomontage of Bunker-B at Al-Tuwaitha site



1- Radioactive Waste Treatment Station RWTS,
3- Temporary Storage Bunker

2- Monolith
4- Russian Silo for Radioactive Waste

Photomontage of Radioactive Waste Complex (RWC) at Al-Tuwaitha site

Redesign the Physical Protection System (PPS)

Through the regulatory inspection by the staff of Al-Tuwaitha site's Nuclear Security Division to redesign and upgrade the initial PPS of the site, the vulnerabilities and gaps in the initial security system were identified to correct them. Also, both potential internal and external threats against the site were discussed.

As a result, the focus was on both pedestrian and vehicle Access Control System (ACS) in the protected area (PA), for the purpose of obtaining an effective PPS meets the protection objectives and able to prevent breaches in the security of radioactive material.

PA PEDESTRIAN ACP

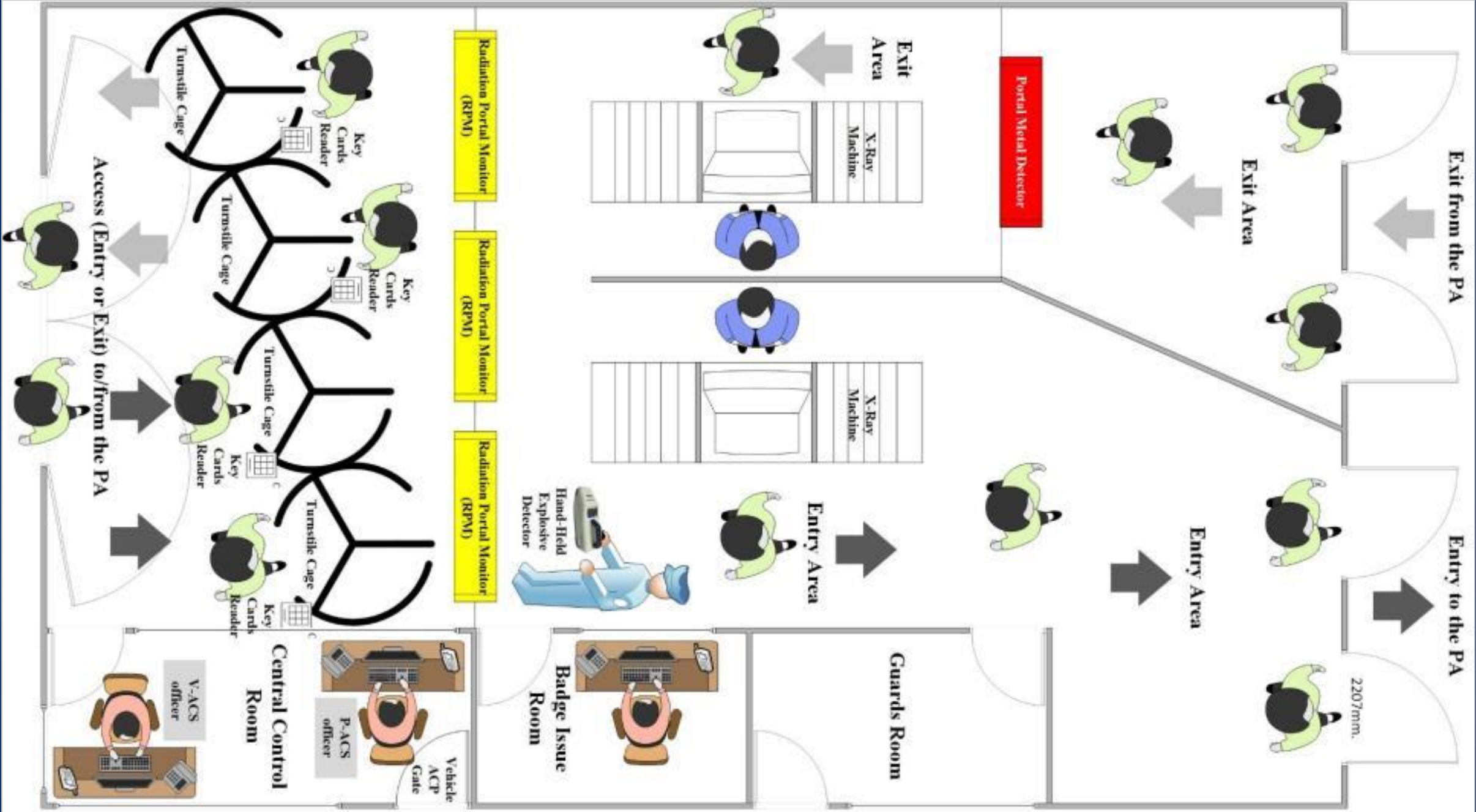
The security screening process for personnel access (entry or exit) to/from the PA perimeter is conducted according to the following mechanisms:

➤ **Pedestrian Entry:**

- Hand-Held Explosive Detector that sense the presence of chemical residue that could be explosive material.
- X-Ray Machine to check their packages, purses, briefcases, lunch boxes, etc., and to detect both prohibited and suspicious material.

➤ **Pedestrian Exit:**

- Radiation Portal Monitor (RPM) to ensure that the personnel are not contaminated and do not have unauthorized radioactive material.
- Walk-Through Portal Metal Detector which alarm for any metal objects may be shields for radioactive material.
- X-Ray Machine to check their packages, purses, briefcases, lunch boxes, etc., and to detect any stolen material.



Pedestrian access control system design located in the access control building at Al-Tuwaitha site's protected area

PA VEHICLE ACP

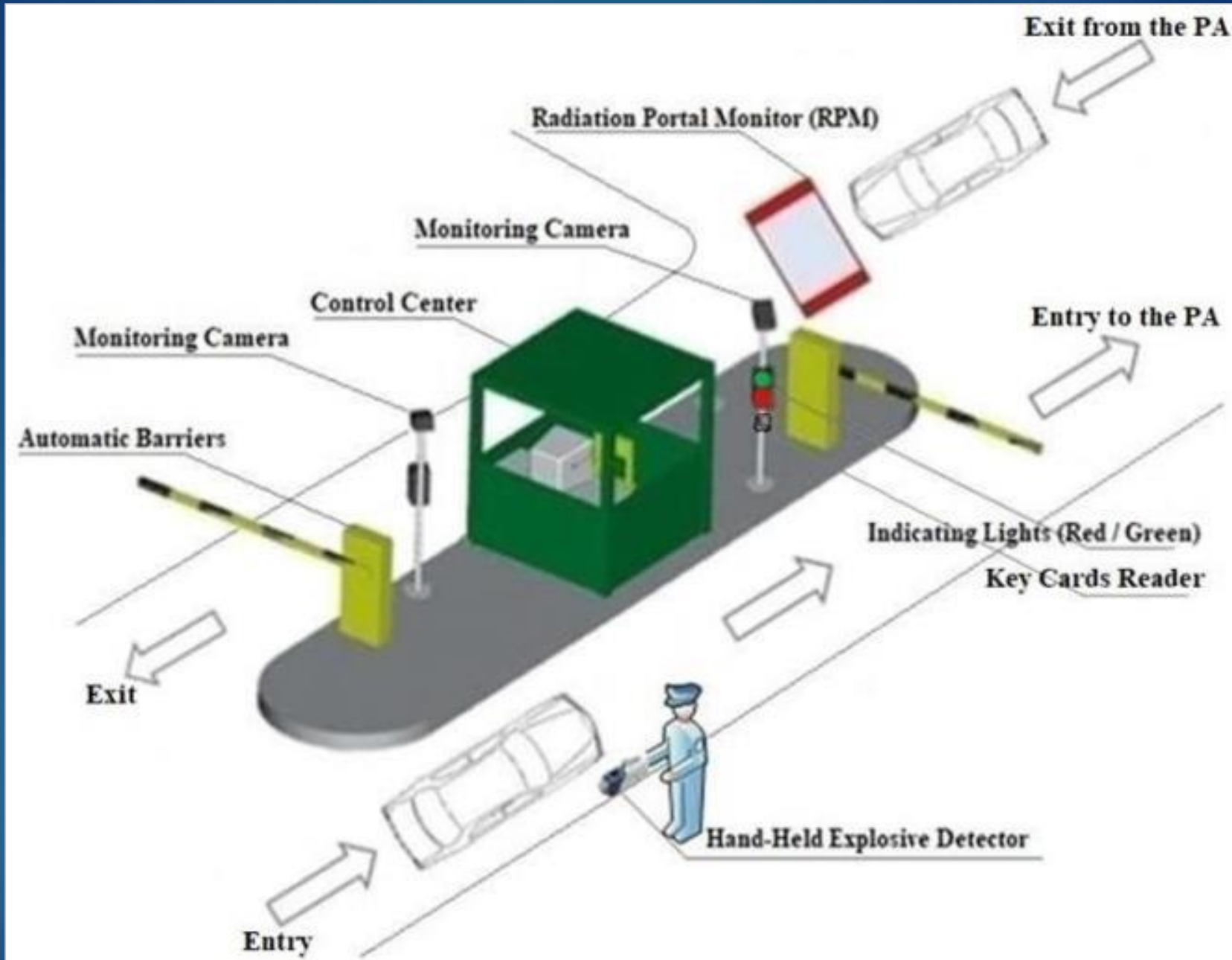
The security screening process for vehicle access (entry or exit) to/from the PA perimeter is conducted according to the following mechanisms:

➤ **Vehicle Entry:**

- Hand-Held Explosive Detector that sense the presence of chemical residue that could be explosive material.

➤ **Pedestrian Exit:**

- Radiation Portal Monitor (RPM) to ensure that the vehicle is not contaminated and does not carry unauthorized radioactive material..



Vehicle access control system design located to the right side of the access control building at Al-Tuwaitha site's protected area

ADDITIONAL ON-SITE NUCLEAR SECURITY MEASURES

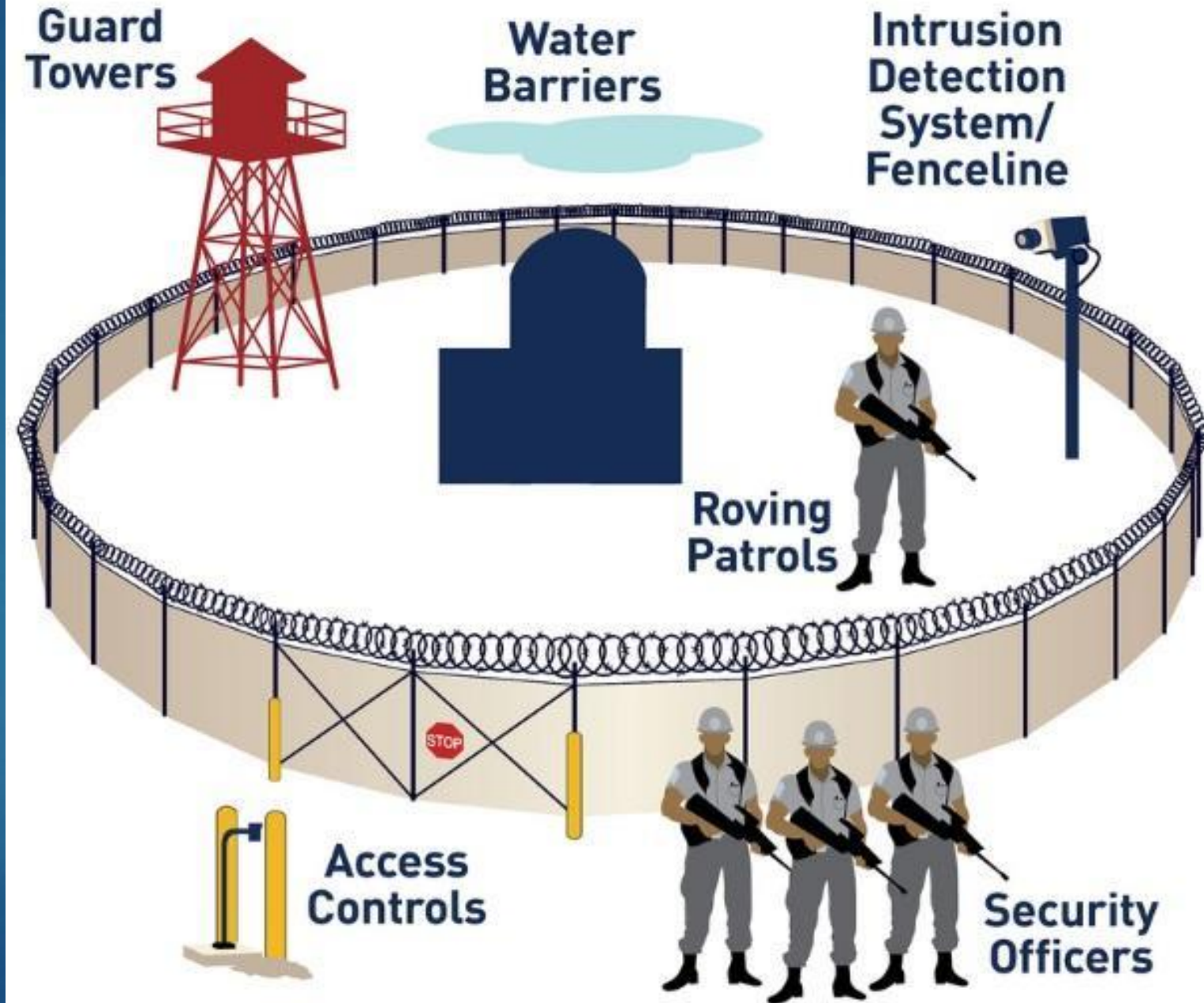
- Fencing the site's nuclear facilities and those subjected to decommissioning activities using a concrete wall to prevent unauthorized access.
- Surrounding the site with monitoring guard towers.
- Installing the RPMs at the ACPs to scan both pedestrians and vehicles and to ensure that they are free from the effects of radioactive material.
- Installing a set of the CCTV cameras, CCTV monitors and Digital Video Recorder (DVR) devices and a set of lights in strategic areas of the site to detect the suspicious acts.
- Application of Material Control and Accounting (MC&A) System in both Bunker-B and radioactive waste storage facilities.
- Development of Human Resources (HR) by spreading the nuclear security culture, training courses, workshops, exercises and scenarios to raise and develop the skills and experiences of the site's guards and staff on prevention, detection and response measures.

CONCLUSION

- This paper proposed the concept of designing an effective PPS to reduce the risk associated with potential threats to radioactive materials at Al-Tuwaitha nuclear site.
- Therefore, the initial PPS of the site was tested by conducting a number of hypothetical nuclear security scenarios for unauthorized removal and sabotage acts of radioactive material.
- Then studying the deterrence, delay and response measures, on the basis of which was determined the required security level and the upgrading degree for the system, in order to achieve an effective and typical PPS capable of preventing of breaches in the security of radioactive material at Al-Tuwaitha nuclear site.
- Analysis and evaluation of the initial PPS of the site showed a number of vulnerabilities and gaps.
- The same scenarios above were applied to the ultimate PPS of the site to verify its strength and resistance to any potential attacks or threats, and has already proved its efficiency and worth.
- The study is considered as the basic guidelines to apply the PPS for radioactive facilities, where it can be used scientifically and practically to redesign or upgrade the security systems of these facilities.

THANK YOU
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Security Components



Protecting nuclear facilities requires all of the security features to come together and work as one.