Radioactive Source Security Plan for Central Radioactive Waste Processing and Storage Facility (CWPSF), AERE, Savar, Dhaka

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Abstract - *Security of radioactive sources has been an issue since the earliest days of safety regulation of such materials. Since the events of September 11, 2001, some governments and regulatory bodies have been much more focused on these issues and have introduced extensive and enhanced security arrangements. In response to a resolution by the IAEA General Conference in September 2002, the IAEA has adopted an integrated approach to protection against nuclear terrorism. This approach coordinates IAEA activities concerned with the physical protection of nuclear material and nuclear installations, nuclear material accountancy, detection and response to trafficking in nuclear and other radioactive material, the security of radioactive sources, and the promotion of adherence by States to relevant international instruments. CWPSF, HPRWMU and the GTRI have worked together to design a security system to enhance the physical protection of radiological materials located at CWPSF, in support of Russian regulations for the security of radioactive sources. The security upgrades have been designed to accommodate the site-specific conditions to maximize security and minimize operational impacts.*

Key words*: DSRS, Categorization, 'D' Values, CWPSF, HPRWMU, GTRI, PPS.*

1 INTRODUCTION

The safety refers to operate a facility in a manner that protects the workers, general public and the environment from harmful effects of radiation, whereas the security aspect refers to protect the facility from potential adversaries who intend to steal nuclear and other radioactive material for malicious purposes or damage the facility and consequently harm the people. Thus, there is synergy between nuclear safety and nuclear security as both are working to assure the peace of mind and quality of life of the individual, the society, country and the globe.

Bangladesh Atomic Energy Regulatory Authority (BAERA) is regulating all the nuclear and radiation facilities in Bangladesh.

It upholds the responsibility of protecting the population of Bangladesh against harmful effects of radioactivity and other ionizing radiations in accordance with the Bangladesh Atomic Energy Regulatory (BAER) Act-2012 (Act No. 19 of 2012) and Nuclear Safety and Radiation Control (NSRC) Rules-1997 promulgated by the Government of Bangladesh (GOB). BAERA is committed to ensure that safety and security of nuclear and radiation facilities in the country are maintained incessantly. Physical protection of nuclear material and nuclear facilities is one of the important aspects of over all nuclear security arrangement. The genesis of physical protection of nuclear material and nuclear facilities and security of radioactive sources goes back to decades when safety and security was being managed the basis for inspection and enforcement.

2 DESCRIPTION OF THE FACILITY

Operators, as the authorized entities, should have the primary responsibility for implementing and maintaining security measures for radioactive sources in accordance with national requirements. The Central Radioactive Waste Processing and Storage Facility (CWPSF) is the unique facility of Bangladesh which is responsible for the collection, transportation, sorting, treatment, conditioning and storage of radioactive wastes to ensure the protection of human and environment, at present

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and future, from the hazardous effects of ionizing radiation arising from radioactive wastes (RWs).

There are both sealed and unsealed radioactive wastes

Sealed Sources (Disused/Spent Radioactive Sources (DSRS)):
The radionuclides involved are: Co-60, Cs-134, Cs-137, Sr-90, Ir-192, Tc-99m, I-131,I-125, C-14, H-3, Ra-226, Am-Be neutron sources, Cm-224, Am-241, Mn-54, Zn-65, P-32, Sc-46 etc.

Unsealed Sources: Spent ion-exchange resins, graphite, lead and polythene plugs, contaminated vials, hand gloves, plastic syringes, tissue papers, shoe covers, protective clothes, plastic and metallic wares, activated carbon, etc.

The building layout and the design of the facility were based on the IAEA generic reference design, The facility building is single storey building with an area of about 1163m^{2}and officially came into operation in 2005 for safe processing and storage of LILW. It is supposed that it will serve the purpose of interim storage of RWs arising in Bangladesh for the next 50 years before establishing a permanent near surface disposal facility.

3 PHYSICAL PROTECTION SYSTEMS (PPS)

A physical protection system is the integration of people, procedures, and equipment for the protection of assets or facilities against theft, sabotage, or other malicious acts. The objective of PPS is to prevent theft and sabotage. To deter the adversary PPS have to implement so that all adversaries perceive as too difficult to defeat but the problem is deterrence is impossible to measure. The PPS (Physical Protection System) being used for protecting the nuclear facilities and materials in Bangladesh has three basic elements:

1. Detection
2. Delay
3. Response

. Detection has intrusion sensing, alarm communication, alarm assessment and entry control. Delay included physical barriers and guards. Response means interrupt the adversary:- communication to response force and deployment of response force – defeat the adversary. Actions of response force prevent adversary from accomplishing his goal

3.1 Detection Systems at the Central Radioactive Waste Processing and Storage Facility (CWPSF)

Detection is discovery of an attempted or actual intrusion. It is accomplished by intrusion sensing, alarm assessment, alarm communication and display. In the detection system sensor has activated then alarm signal sent. Received alarm accessed and communicated to response.

PIR Motion Sensor

Remote Control and Panic Switch

Alarm Control Panel

Figure 3.1a: Fingerprint Reader and alarm system

Fig 3.1b: Lighting system around the CWPSF and watch tower

Fig 3.1c: 4 Surveillance cameras

3.2 Delay Systems at the Central Radioactive Waste Processing and Storage Facility (CWPSF)

Delay impedes adversary's progress toward task completion to allow time for response. However its provide obstacles to increase adversary task time by physical barriers and guards.

Fig 3.2.a: 2 meter high nuisance fence along the site boundary parallel to the CWPSF and SSDL

3.3 Response Systems at the Central Radioactive Waste Processing and Storage Facility (CWPSF)

Response encompasses the actions undertaken following detection to prevent adversaries from succeeding in completion of their task. Response systems include communication to response force then deploy it. Response force interrupts the adversary and tries to defeat.

CWPSF is guarded round the clock by security guards who are the permanent employees of BAEC.

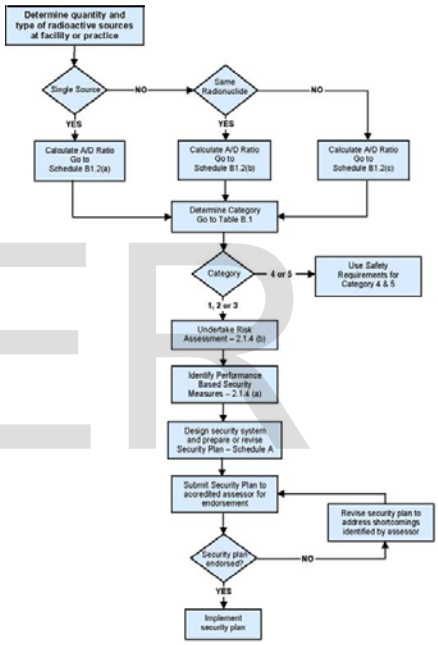
Additional security guards patrol around the security fencing of the CWPSF during the off hours.

4 SECURITY OF RADIOACTIVE SOURCES-CODE OF PRACTICE

The security requirements to be applied to a radioactive source depend on the category of the radioactive source and the threat level for a radiological attack set by IAEA. The Code of Practice categorizes radioactive sources into five categories and allocates security outcomes commensurate with the risk posed by sources in each category. This categorization was informed by risk analyses that considered the major applications of radioactive material in Bangladesh.

Category 1 sources are considered to pose the highest risk and are therefore subject to the most stringent security outcomes. In practice, the Code only requires additional security measures, other than reporting of security breaches, for Category 1, 2 and 3 sources because the security measures in place for safety purposes are considered adequate to ensure the physical security of Category 4 and 5 sources. Each Category 1, 2 and 3 source will be subject to a security plan that must be endorsed by an assessor accredited by the regulatory authority. The threat levels grade from 'negligible' to 'extreme'. The Code links expected procedural security outcomes to the threat level. A change in the threat level would change the procedural security outcomes a person dealing with a Category 1, 2 or 3 radioactive sources would be required to achieve.

4.1 Logic flow chart for source security:



The Code of Practice sets clear objectives for improving the security of radioactive sources. But its effective implementation depends on the development and maintenance of an effective security culture. Such a culture consists of characteristics and attitudes in organizations and of individuals that ensure security issues receive the attention warranted by their significance. It is vital that this culture followed as early as possible.

4.2 Source categorization and threat level assessment according to IAEA Guidelines

Category	Activity Ratio (A/D)	Threat Level
1	A/D ≥1000	Extreme
2	1000>A/D≥10	High
3	10>A/D≥1	Medium
4	1>A/D≥0.01	Low
5	0.01>A/D>Exempt /D	Very low or negligible

Where:

• A is the total activity of a specific radioactive source, or aggregation of radioactive sources, containing a particular radioactive isotope, in units of gigabecquerel (GBq); and

• The *D* value is the radionuclide specific activity of a source which, if not under control, could cause severe deterministic effects for a range of scenarios that include both external exposure from an unshielded source and internal exposure following dispersal of the source material. The D-value for the specific radionuclide corresponds to the activity level at which the radioactive source is considered to be a Dangerous Source.

The ratio of the activity in the radioactive source to the corresponding D-value for the radionuclide in the source (A/D), determines the category of the source.

4.3 System for the Notification of a security breach

In the event of a security breach, the Responsible Person dealing with a radioactive source must:

(a) In the event that the security breach is detectable theft, unexplained loss, unauthorized damage, unauthorized access or unauthorized transfer notify the local police service and immediately thereafter the regulatory authority that a security breach has occurred and provide, as a minimum, the following information:

- circumstances of the security breach;
- steps taken or proposed to be taken to rectify the breach;
- if a radioactive source is lost or stolen, any information that may assist in the recovery of the source; or

(b) In the event of any other security breach notify the regulatory authority and immediately thereafter the local police service that a security breach has occurred and provide, as a minimum, the following information circumstances of the security breach steps taken or proposed to be taken to rectify the breach.

Persons that deal with the radioactive source should be alert to suspicious behavior in relation to not only the radioactive source and the asset in which it is housed but also the immediate environs. Such suspicious behavior must be reported to the local police service and the regulatory authority.

5 CONCLUSIONS

According to the NSRC Rule of 1997 [Section-17.2 (a)] it is mandatory for installations using Sources to implement appropriate level of PPS. As such BAEC is took measures to strengthen the PPS of its installations where Sources are being used in the country. BAEC welcomes help and cooperation of its strategic partners in this regard.

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