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The Need for Securing Nuclear Materials

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Abstract

Nuclear materials in a broad term includes Uranium, plutonium, Thorium and all other radioactive substances. These materials find applications in different walks of life; hospitals, industries, scientific research institutes, power generation etc. Nuclear materials also have the potential to be made into weapons such as the improvise Nuclear Devise (IND), Radiological Exposure Device (RED), Radiation and Dispersal Devices (RDD) and so on. Moreover, some radioactive sources have a very high dispersibility enabling them to have the capacity to cause harm to lives or even communities. Over the years, terrorist have shown interest in acquiring these materials to aid their malicious intentions and few cases of individuals or even communities that got harmed using radioactive materials have been recorded. This paper alludes the beneficial and maleficial uses of nuclear material, and accentuate the need for securing them.

1.0 Introduction

Until recently, Nuclear Materials were often referred to as fissile materials; Fissile materials are directly weapon-usable, and therefore considered the most dangerous. But in broad term Nuclear Materials include Uranium, Plutonium, Thorium and other radioactive substances, fissile and non-fissile. Examples of Other radioactive substances: Americium 241, Californium 252, Cobalt 60, Iodine 131, Iridium 13, and Hydrogen 3 (Tritium) etc. Nuclear materials can be found in many countries around the globe, even though their exact quantities remain unknown (NAS, 2013). These materials are used in Nuclear Power Reactors, hospitals, industries, and scientific research institute for purposes like power generation, diagnosing and treating illness, sterilizing equipment, and inspecting wields. On the contrary some Nuclear Materials have the potential to be made into weapons such as the Improvised Nuclear Devise (IND), Radiological Exposure Device (RED), Radiation and Dispersal Devices (RDD) and the likes. Over the years, terrorists have shown interest in acquiring these materials to aid their malicious intentions. Individuals and even some localities have been harmed due to cases of theft and unauthorized acquisition of some nuclear materials. Great steps and measures must be taken in order to secure these materials and prevent them from landing into the hand of terrorist groups or individuals with malicious intent.

2.0 Nuclear Materials and their Uses.

Nuclear materials refer to Uranium in Various forms (Powder, pellet, fuel rods, solid Metal, alloys), Plutonium, Thorium as well as other Radioactive Materials. (WINS, 2016).

2.1 Beneficial Uses of Nuclear Materials

Basically, Nuclear materials can be categorized into fissile and non-fissile materials. Fissile materials are materials that are capable of sustaining a nuclear fission chain reaction, they serve as fuel for nuclear reactors. the energy from the fissioning atoms of these material heats the water or any other heat-transfer medium, usually a fluid. This hot fluid then transfers the heat to ultimately produce electricity. In a water-cooled reactor, for example, the hot water will be used to produce steam, and the steam then spins turbines in order to produce electricity (Karam, 2017). Nuclear reactors can be used to produce radio-isotopes for medical diagnosis. They are also used for carrying out scientific analysis like the Neutron Activation Analysis (NAA). Uranium, Plutonium and Thorium are fissile materials.

Other radioactive Materials are the non-fissile ones, they find applications in Hospitals, industries, research institutes and many other civil settings. In Hospitals and other medical centers, Radioactive materials are used to treat cancer patients and irradiate blood. Teletherapy uses Cobalt-60, Blood Irradiators uses Ceasium-137 and Brachytherapy uses iridium-192, Ceasium-137, iodine-125 and some other radioactive materials. In the industry, radioactive materials have numerous applications which includes: industrial radiography carried out using Iridium-192 and cobalt-60, measurement of the contents of sealed tanks using a radioactive source to suitable detector (level gauging), density and moisture gauges devices contain gamma and neutron sources, industrial irradiation using cobalt-60 and X-ray tubes, self-shielded irradiation using cobalt-60 and ceasium-137 as well as oil and gas well logging using neutron and gamma sources, mostly americium-beryllium and cesium-137 respectively (WINS, 2016). Other uses of radioactive materials include; tracing the flow of water (Tritium), identifying molecules in scientific studies, Checking the integrity of pipeline welds, boilers and aircraft parts (Iridium 131), preserving poultry, fruits and spices (Cobalt 60), detection of explosives in luggage at airports (Californium 252), determining drilling locations for oil wells (Americium-241), testing weld sand castings (Cobalt60) etc.

2.2 Maleficial Uses of Nuclear Materials

In contrast to their beneficial uses, nuclear materials can also be used for harmful activities. There are mainly four forms of devices in which nuclear materials can be used to harm human, they can be seen below:

Nuclear Weapon: The energy released in a nuclear explosion resulting from a nuclear bomb is derived from the splitting of radioactive materials (fissile materials) e.g., Uranium-235 and Plutonium-239. The massive amount of energy released in the event of such nuclear explosion comprises of blast forces, prompt radiation, light and heat (thermal energy), and delayed or residual radiation (REMM, 2016). It is unlikely any terrorists organization, group or individual with malicious intent could acquire or build fully functional nuclear weapon (Cangemi, 2002). Examples of Nuclear Bomb are the ‘Little Boy’ and the ‘Fat Man’ dropped on Hiroshima and Nagasaki, Japan at the end of World War II.

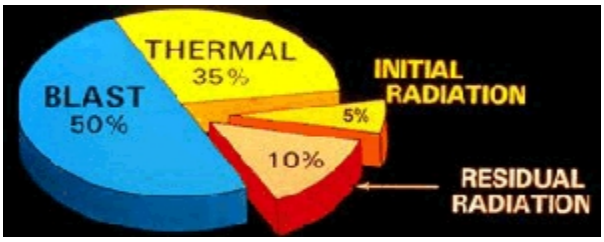

Fig.1: Nuclear Bomb Explosion Effect

Source: Radiation Emergency Medical Management of the United States (2016).

Improvised Nuclear Device (IND): An IND can be defined as an illicit nuclear weapon bought, stolen, or otherwise originating from a nuclear state, or a weapon constructed by a terrorist group from illegally obtained fissile Nuclear Materials capable of producing a nuclear explosion (REMM, 2016). IND may be constructed from the components of a stolen weapon or from scratch using fissile nuclear material.

Radiological Explosive Devise (RED): According to the World Institute of Nuclear Security, RED is created by hiding a strong gamma emitter in a public place or domain of a targeted personality to cause harm using radiation. The effects resulting from such devices could be catastrophic, depending on the properties of the source, proximity of the source and exposure time. The use of RED was recorded in China in 2003, where an individual was targeted for murder using Iridium-192.

Radiological Dispersal Devices (RDD): RDDs are also known as dirty bombs, they are not categorized as weapon of mass destruction as they have much less radiation effects compared to IND and RED. They are created using explosives to disperse radioactive materials. RDDs are poor weapons which may kill either no, or very few people outside the immediate explosion (IAEA, 2003). In 1995 some group of rebels planted Cesium packed with dynamite in a park in Moscow, Russia.

Radiological Incendiary Device (RID): RID refers to a device that couples fire with radioactive materials. Emergency responders would have to contend not only with public panic in regard to the fire, but also with the rapidly spreading radioactivity in the area (Gade, 2019). Terrorists and other groups with malicious intent may want to use RID to complicate 'firefighters' efforts in rescuing people and protecting properties.

3.0 Securing Nuclear Materials

The wide and extensive civil applications of Nuclear Materials have softened their accessibility to terrorist groups and individuals with malevolent intent. According to the International Atomic Energy Agency (IAEA)'s Illicit Trafficking Database (ITDB), there is a total of 2,734 confirmed incidents of either unauthorized possession of nuclear materials or related criminal activities, which includes theft of sensitive Nuclear Materials across the world between 1993 and 2016.

The interest of terrorist groups in obtaining Nuclear Materials can be traced at least to the mid-1990s, when the Aum Shinrikyo cult in Japan explored the possibility of acquiring uranium for possible use in terrorist attacks. More recently, documents with primitive sketches of nuclear

weapons obtained from Al-Qaeda camps and statements by Al-Qaeda leaders suggest that this terrorist network has also considered the possibilities of laying their hand on nuclear materials for the purpose of terrorism (NRS, 2006). After the 9/11incident, it was apparent that terrorist could do anything to actualize their ulterior motives. According to Community Emergency Response Team (CERT) of the United States, experts believe that nuclear weapon falls among the categories of weapons that could possibly be utilized by terrorists to unleash their malicious intent. Even before 9/11 incident, it was obvious that there are a significant orphan source issue arising from poor security of radioactive materials around the world.

With the above and many more in records, it became far beyond necessity for Nuclear Materials to be secured, chances must not be taken for such materials to find their ways into the possession of terrorists or any person with malicious intent. The security of these materials should be a collective responsibility and shouldn't be taken in any way for granted. Legal operators of facilities involving Nuclear Materials (Licensees), various states and their Nuclear regulatory bodies, and other multinational agencies should collectively do the needful to maximize the security of nuclear materials at their respective levels and capacities.

Strong security measures should be domesticated by respective states to prevent access to Nuclear Materials through verification of the legitimacy of applicants for licenses, strengthening the security of Nuclear Materials while in transit, in storage or in use. It is also important to control their accessibility to prevent diversion by an insider, employ tracking devices so as to ensure that no Nuclear Material has been lost or stolen, maintain proper disposal of nuclear waste and put in place a standard emergency response team in case of terrorists event (IAEA, 2003). It can be argued that a lot of states have these elements in place, but there are also many other countries especially those in the third world that have failed to put these elements or their replica in place. Meanwhile several forms of Nuclear Materials are in different civil applications in those countries.

Ensuring the security of Nuclear Materials is not the responsibility of individual states alone, it is also a shared global responsibility for the fact that Nuclear Materials stolen from other states could be used to cause havoc in another state. Some developed states and multinational agencies have already developed initiatives and elements to help states meet their responsibilities towards securing nuclear materials. Developed states and multinational agencies should put more efforts towards making countries in the third world realize their obligations and commitments in securing Nuclear Materials

4.0 Conclusion

Nuclear materials are unarguably beneficial to mankind, with their effects being felt in many aspects of the human activities. Opposing to the use, these same materials have the potential to be utilized in other to harm humans. Looking at the two sides of nuclear materials one cannot overrule their benefits because of their potentiality of being utilized as weapons against humans. The only way out is to ensure their security to prevent them from finding their ways into the hands or terrorist groups of individuals with malicious intents. Licensees, states and multinational agencies should do all it takes to secure these materials, especially since the interest of terrorists in acquiring Nuclear Materials keeps growing. while the state remains the key player in securing Nuclear Materials, licensees also should try as much as possible to comply with their respective states. Multinational agencies in their own jurisdiction should put more

effort in devising initiatives and elements that will help States, especially those in the third world meet their responsibilities of securing Nuclear Materials.

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