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Nuclear Terrorism Threats & Risks towards International Security

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Abstract:
Nowadays, the quantity of nuclear fissile materials as well as radiation-emission materials is rapidly increasing. Many terrorist groups have already expressed willingness in getting access to these materials or executing terrorist attacks over nuclear power plants and nuclear waste depository sites. the purpose of this paper is to examine whether or not non-state actors can make a nuclear weapons from radioactive waste materials (including low-level and high-level of nuclear waste), and what can be done on the field of preventing nuclear terrorism in future. More precisely, to examine the likelihood for a non-state actor(s) to make a nuclear bomb from the nuclear waste; the possibility of non-state actors to get nuclear-state-sponsorship and how likely is a non-state actor(s) to use nuclear bomb for their targets? In the second part, I analyze and propose pre-event and post-event policies for preventing of such as terrorists attacks from occurring in future.

Keywords: terrorism, nuclear terrorism, nuclear bomb, fissile materials, nuclear waste, terrorist groups, IAEA, radioactive emission device (RED), nuclear dispersive device (NDD), security

Introduction

In the period from 1995-1999 the Chechen Islamic paramilitary leader Shamil Basayev have threaded Russian authorities with radiological, chemical or biological weapons[1]("Bale, 2004); 9 militants associated with the Islamic extremist group al-Qaeda hijacked four airliners and carried out suicide attacks against targets in the United States ("9/11 Attacks - Facts & Summary," n.d., p. 11); terrorist groups have seized control" of nearly 40 kilograms (90 pounds) of uranium compounds at science departments at the University of Mosul with possibilities of such materials to be used in manufacturing weapons of mass destruction (Mullen, CNN, 2014.); these are just some of the many situations in which the risk of nuclear terrorism have increased. The question that arises here is: *what is nuclear terrorism*? For the first time, the term "nuclear terrorism"[2] was mention by the author Thomas Schelling in 1979, who argued that "an organization that is not a national government may acquire few nuclear weapons" (Schelling, 1982, p. 61). In addition, Shelling explains that those organizations could be in form of "political movement, a government in exile, a

[1] To support these ominous threats, he displayed containers of radioactive materials at a conference in Shali, which probably contained cobalt-60, cesium-137, or strontium-90, and told a Russian television network where to find a container of cesium-137 he claimed to have buried in Moscow's Izmailovskiy Park. For more information's http://www.nti.org/analysis/articles/chechen-resistance-radiological-terror/

[2] Till the moment of writing this paper I have not met any other author that have earlier mentioned this term.

separatist or secessionist party, a military rebellion, adventurers from the underground or the underworld, or even some group of people merely bent on showing that it can be done"(Schelling, 1982, p. 61). Hence, *nuclear terrorism* is any "act of violence and destruction performed by non- state actors where the means applied are nuclear explosive devices – or threats of such actions – with the purpose of inflicting destruction, creating a condition of fear, getting attention, blackmailing, installing instability, and to affect an audience beyond the victim(s) directly targeted" (Kazmi, 2013:13). Therefore, the purpose of this paper is to examine whether or not non-state actors can make a nuclear weapons from radioactive waste materials (including low-level and high-level of nuclear waste), and what can be done on the field of preventing nuclear terrorism in future. Hence, my main research questions are: *What is the likelihood for a non-state actor(s) to make a nuclear bomb from the nuclear waste*; *is it possible non-state actors to get nuclear-state-sponsorship* and *how likely is a non-state actor(s) to use nuclear bomb for their targets*? In the following pages, I will provide discussion on nuclear terrorism and explanation of strengths and weaknesses of pre-event and post-event policies in detail.

II. Discussion

Nowadays, one of the major threats towards international security is nuclear terrorism. Today, there are some terrorists groups which have demonstrated interest in getting nuclear fissile material for making nuclear weapons for their targets. According to the Report from the "Project on Managing the Atom" conducted by Belfer Center of Harvard University "at least two terrorist groups—Al Qaeda and the Japanese terror cult Aum Shinrikyo—have made serious efforts to get nuclear weapons, and there is suggestive evidence of Chechen terrorist interest as well"[3]("Bunn, Malin, Roth & Tobey" 2016.). Fortunately, there is not any registered case where some of the terrorist groups have gained and/or committed any attack with nuclear weapon(s). But, the recent seizure of ISIS fighters of Saddam-era degraded chemical weapons wasteland in the Al Muthanna Province and the nuclear materials from Mosul University in Iraq(Korbatov, Suzuki, & Goldblum, 2015) have raised the debate among many experts and policymakers of existing *real* threat of nuclear terrorists. Such security-destabilizing situations in the world have proven two things: firstly, terrorist groups seek to get nuclear fissile materials to make improvised nuclear or radiologic-dispersive device their targets and, secondly everyone can be a target by these terrorist groups. There is ongoing debate among many authors whether terrorists can or cannot commit terrorist attacks with nuclear weapons, based on: *the possibility of terrorists making or getting nuclear weapons*, *their access to nuclear and radioactive materials* and *the kind of leadership of the terrorist groups most likely to commit nuclear attack*.

[3] As previously mentioned above, the cases of: Chechen leader Basayev, and the ISIS's case of seizing radioactive materials at University of Mosul.

Firstly, **it is less likely that terrorist groups make or get nuclear bombs**. Undoubtedly, there are two ways to make a nuclear bomb, either with enriched uranium or plutonium. According to Nuclear Energy Information Service (NEIS) "it is clearly possible that terrorists could acquire both the isotopes and the technology needed to enrich uranium"("Nuclear Power & Nuclear Weapons", 2004.). The technology to enrich the isotopes is available for about one million dollars, and the "terrorist groups would need about 15 pounds of plutonium-239 or uranium-235 to fashion a crude nuclear device"("Nuclear Power & Nuclear Weapons", 2004.). Ivanka Barzashka[4] argues that "uranium enrichment technology has dual-use" and therefore, "any civilian enrichment facility can be used to produce nuclear weapon materials"(Barzashka, 2013). In addition, Barzashka argues that process of the enriching the uranium, through which the 5% low-enrichment U-235 used for nuclear reactor can be increased to 90% highly-enrichment U-235 for making nuclear bombs. Barzashka's assumption is that "the exactly same machines" that are being used to produce nuclear fuel "can provide weapons materials"(Barzashka, 2013). On the other hand, O'Neil argues that, even if sub-national terrorist group(s) can get any amount of spent nuclear reactor fuel they would still need to convert the fissile materials in weapon grade uranium or plutonium, a process that requires expertise in chemistry and access to necessary chemicals and equipment which is very difficult event for states(O'Neill, 1997, p. 2). Subsequently, Eaves argues that terrorist groups are *less likely* to make or get a nuclear bomb and use them for their targets because "there are so many technical, financial, military, and logistical barriers that it would be extremely unlikely that even the most dogged, nuclear-obsessed extremist group could make that happen"(Eaves, 2016). Nonetheless, the International Atomic Energy Agency (IAEA) Safeguard monitoring methods enables not only verification of the non-diversion of declared nuclear material, but also the absence of undeclared nuclear material and activities in a State("IAEA Safeguards Overview," 2014). These methods provide assurance that neither state nor non-state actor can use the nuclear fissile materials for making nuclear bombs. However, it is known that causing massive civilian casualties by such a [terrorist] groups, "would alienate the support from even those that they consider to be sympathizers among the affected public"("Managing the Atom | Belfer Center for Science and International Affairs," 2016, p. 140). Pakistani President Pervez Musharraf, in one of his speeches has stressed out that the "men in caves can't do this," by referring to the possibility of nuclear attack(s) by Al-Qaeda. Hence, from the discussion above it is apparent that

[4] Barzashka is a research associate at the Centre for Science and Security Studies, King's College, London, and an affiliate of Stanford University's Center for International Secuirty and Cooperation. Previously, she was a visiting scholar at the Center for National Security and Defense Research at the Bulgarian Academy of Sciences. A physicist, Barzashka was formerly a researcher with the Strategic Security Program at the Federation of American Scientists.

terrorist groups are incapable of constructing any type of nuclear device.[5]

Secondly, **it is more likely terrorist groups to get access to certain radioactive materials and make an improvised radiation-emission-device (RED) or so-called as a "dirty bomb."** Brill and Luongo argue that "terrorists do not need to steal a nuclear weapon," because there is possibility "to make an improvised device from highly enriched uranium or plutonium used for civilian purposes"(Brill & Luongo, 2012). There is twofold debate whether or not plutonium from nuclear power plants can be used for making nuclear devices. On the one hand, Leslie Corrice[6] in her article "*Nuclear Waste: Is It?*" argues that there are [at least] two reasons why plutonium from the power plant reactors *cannot be correctly termed as a "weapon's grade"* and cannot be used for making nuclear bomb(s). I will paraphrase:[7] firstly, in the 5% nuclear "waste" atoms from the 1% - 3% U-235 fuel cell there can be almost 1% Plutonium, because from 1% U-235 only 20% can come from the U-235 fissioning and the rest of the waste atoms come from plutonium fissioning. Thus, spent fuel coming out from the spent fuel is not "weapon grade." Secondly, two plutonium isotopes are being formed in the reactors that are not allowing explosion: Pu-239 and Pu-240 isotopes. In the fuel that was made in nuclear reactors, about one third (or 32%) consists of Pu-240 isotopes which do not fission and cannot explode, i.e. they absorb sufficient number of neutrons which absorption is not allowing chain reaction that leads to explosion. Hence, Corrice's assumption is that plutonium fuel from nuclear reactors cannot be used for making any nuclear bombs. On the other hand, Robert Reardon argues that the plutonium from power plants can be used to fuel nuclear weapons. Additionally, Reardon explains that the plutonium which is produced by irradiating natural uranium fuel rods in a reactor can be used either to fuel commercial reactors or to fuel nuclear weapons.[8] The isotopic composition of reactor-grade plutonium (RGPu) from light-water reactors (LWR), by using certain operating parameters under specific conditions can be used for making nuclear weapons.[9] Hence, Reardon's assumption is that plutonium nuclear-power-plants fuel can be used to make a nuclear bomb. If it is highly unlikely for terrorist group to get nuclear fissile materials from the nuclear power plants[10] and make a nuclear explosive

[5] Whether improvised or sophisticated nuclear device or nuclear bomb capable for launching on rockets.

[6] Leslie Corrice is member of the American Nuclear Society, Scientists for Accurate Radiation Information, and the National Education Association, with 21 years as (in order) a **nuclear power plant** operator, environmental monitoring technician, health physics design engineer, public relations spokesperson, public education coordinator and emergency planner.

[7] Corrice. L, "Nuclear Waste: Is It", http://www.hiroshimasyndrome.com/nuclear-waste-is-it.html

[8] Reardon. R (2012), "Containing Iran: Strategies for addressing the Iranian Nuclear Challenge", RAND Corporation, pp.29

[9] Reardon.R & Mattingly.J (n.d), "What Is the Strategic Utility of Reactor-Grade Plutonium?"; North Carolina State University.

[10] From national aspect due to national high security and control of the facilities and the restricted access of people,

device, it is more likely that terrorist groups would be able to make a RED and use it for their targets. Besides this, Reardon and Mattingly argue that non-state actor would prefer RGPu instead of WGPu, but "the high rate of spontaneous fission would obviate the need of neutron initiator, which could be beyond the capacity of the group to obtain or produce."[11] In terms of accessibility of the materials necessary to build nuclear or radiological disperse device, O'Neil argues that these materials "have widespread commercial application in industry, medicine and research, and the quantity of radioactive materials needed for radiological dispersal device is substantially less than the amount of plutonium needed to build an nuclear explosive device"(O'Neil, 1997 : 2). Consequently, the radiological disperse device, i.e. "dirty bomb" makes very small civilian casualties and infrastructure damages; but have almost the same effect of a nuclear bomb in spreading fear and panic among the civilian population. Hence, it is *more likely* for terrorist groups to make an improvised "dirty bomb," which in further could be used for their targets (Ibid).

Thirdly, **terrorist group are more likely to target attack on civilian nuclear facilities of the states**. It is harder to execute successful act of nuclear sabotage, but substantially easier than an attack involving a nuclear weapon(Nuclear Threat Initiative, n.d.). Brill and Luongo argue that "some of these groups operate in or near states with histories of questionable nuclear practices"(Brill & Luongo, 2012) which raises the possibility that the terrorist groups could target-on sabotaging some nuclear facilities, or aim to steal such a radioactive materials. For example, the NDI Nuclear Security Index [for Theft and Sabotage] identifies 24 countries with risk environment as a potential targets for sabotage (NTI, 2016, p. 21). However, some states are facing with additional threat of rocket attacks, such as those already in Hezbollah's possession, which could be effective weapons of terror(Freilich, 2010). This organization might be capable of undertaking terrorist attack(s) on certain nuclear facilities. Also, it raises the awareness for the extent of physical security of the civilian nuclear facilities needed to prevent [possible] terrorist attacks. The 9/11 attacks raised serious concerns that terrorists might use airplanes for suicidal attack on nuclear facilities (Nuclear Threat Initiative, n.d.). According to Dr. Pape, "suicide terrorist attack is tactically more lethal than an ordinary terrorist attack"(Street, NW, Washington, & Inquiries, 2005). In addition, Dr. Pape explains that "the purpose of a suicide attack is not to die, but to kill a large number of people in the target society," a type of terrorism that is frequently chosen by terrorist groups because generate the most coercive leverage to compel a democratic state to fulfill terrorist requirements(Street et al., 2005). The consequences from the eventual suicidal terrorist attack "are much lower than nuclear

and from international aspect the safeguard monitoring system of early detection suspicious activities

[11] Reardon.R & Mattingly.J (n.d), "What Is the Strategic Utility of Reactor-Grade Plutonium?"; North Carolina State University.

terrorism because there would not be nuclear explosions but instead dispersal of radioactive materials that emit ionizing radiation"(FAS, n.d.).

Nevertheless, the message that would be sent means that "if one individual or one group of individuals are willing to die to carry out an attack, there might be more"(Street et al., 2005). Also, successful sabotage might not cause the same massive and instantaneous damage like detonating nuclear bomb, but successful sabotage might cause a massive and long-term radiation release, i.e. will cause a "security Chernobyl"(Bunn, 2009). There is no doubt that all nuclear facilities need higher protection not only from ground, but also from air.

Last but not least, **the motivation, ideology and organizational behavior of terrorist groups play a crucial role in determining the goals and types of weapons for attack(s)**. From the one hand, motivation categories describe terrorist's goals and objectives and "include separatism, ethnocentrisms, nationalism, and revolution"[12]. These motivation categories refer to traditional[13] terrorist groups which are highly unpredictable in their behavior. For example, according to Military Guide for Terrorism *separatist groups* motivation is "independence, political autonomy or religious freedom or domination" and are highly resistant to conquest or occupation by a foreign power, with predominant ethnic and national characteristics in support for its rationale, whereas the *ethnocentric groups* motivation is segregation of the society groups revolted from the superior position of one social groups "because of its ethnic or racial characteristic" towards other social groups. Further still, the *nationalistic terrorist groups* demonstrate high loyalty to its nation and they are motivated to place its nation's culture and interests above those of other nations or groups; and *revolutionary groups* are motivated and "dedicated to the overthrow of an established order and replacing governance" with new political and social regime.[14] On the other hand, ideological categories describe the terrorist's specific "political, religious and social purpose."[15]

Hence, terrorist organizations which are more likely to use radiological weapons for their attacks are the *non-traditional religious extremist terrorists*.[16] Tactics used by

[12] A Military Guide to Terrorism in the Twenty-First Century (2007), Chapter 2 " Terrorist Motivations and Behavior" pp.5-10

[13] The goals of the "old" (traditional) terrorism, by contrast, are thought to have been negotiable and limited. The past aims of terrorism were understandable and tangible, typically related to issues of territorial autonomy. Deals could be struck. The state could bargain with them. Conflicts could be resolved. Cited from Palestine-Israel Journal (PIJ). For more information's visit http://www.pij.org/details.php?id=80

[14] A Military Guide to Terrorism in the Twenty-First Century (2007), Chapter 2 " Terrorist Motivations and Behavior", pp.5

[15] Ibid, pp.5-7

[16] The "new" (non-traditional) terrorism is presumed to be unlimited and non-negotiable. Such terrorists are said to have no "red lines." In this view, their goals are derived exclusively from religious doctrines that emphasize transformational and apocalyptic beliefs, usually associated with Islam, although present in all monotheistic religions. The "new" terrorists are presumed to hate Western, and

terrorist groups for executing terrorist attacks differ from suicide and car bombing to hijackings and paramilitary operations against civilian and military targets(ADL, n.d). Ferguson and Smith argue that terrorists could use a radiation emission device (RED) to instill fear in the target societies, by exposing higher number of people to ionizing radiation throughout external exposure, inhalation, ingestion and immersion(Ferguson & Smith, 2009 : 23). The question that here arise is *whether or not terrorist groups who possess nuclear weapon(s) would announce their intentions in advance?* The answer is they might not. The reason for that is because executing terrorist attack by surprise would obviously increase the amount of destruction, chaos and widespread panic that terrorists tends to achieve, as well as would enable terrorists to claim that more detonations would come(Carter, May, & Perry, 2007). The history reveals that such as attacks were demonstrated by Aum Shinrikyo in the past (1995), when this terrorist organization without any warning has carried out a terrorist attack by exposing huge number of people to nerve-agent sarin by killing twelve and wounding around six thousand people ("Aum Shinrikyo," n.d.). This case has proven that "apocalyptic millennial cults can be expected to proliferate and experience a heightened sense of urgency, which may lead other groups to pursue the path of weapons of mass destruction aggression to precipitate the final struggle"(Post. J, 2002 : 197). For an illustration, Asahara's fascination with high technology led him to recruit nuclear physicists, nuclear engineers, chemists, and microbiologists, simultaneously exploring nuclear, biological, and chemical weapons(Post, 2002 : 11). In this regard, in 1993 the Aum Shinrikyo cult have sent members of its organization to Zaire to study and collect Ebola virus samples and which further would be used for its targets("Aum Shinrikyo," n.d.).

In terms of *organizational behavior*, every single member of such as terrorist groups have its obligations and tasks which is expected from him/her to fulfill its obligations on the best possible way, in precisely planned time. In this regard, worth mentioning is that existence of the terrorist group becomes more important than the life of its members; thus in cases of conspiracy towards its organization their goals, objectives, structure and operations may change over periods. If terrorist organizations are experiencing any difficulties, such as frustration, low morality of its members, disloyalty, conspiracy, arrest, infiltrating secret agent or identifying doubles inside the organization may lead to increased level of violence.[17] In order to overcome such a situation they may tend to increase the attacks and casualties ratios. Furthermore, such actions of conspiracy

especially American, values, culture, civilization and existence. Their violence is expressive, not strategic or instrumental. Destruction is an end in itself, rather than the means to an end. Cited from Palestine-Israel Journal (PIJ).For more information's visit http://www.pij.org/details.php?id=80

[17] A Military Guide to Terrorism in the Twenty-First Century, 2007, pp.15

could drastically harm organization's reputation among rest of its members and civilian population which supports them. Thus, member's commitment to its terrorist group must be kept in secrecy and loyalty because the "slightest suspicion of disloyalty can result in torture and murder of the suspect."[18] Hence, the main characteristic of these terrorist groups is its highly organized structure, where the cleric is the leader and whatever he declares is moral, just and compulsory for his followers. These non-traditional terrorist organizations are motivated to cause mass casualties, because on that way public would fear to respond on state-related-attacks towards them(Post, 2002:192). Therefore, the conclusion that could be drawn is that non-traditional terrorist groups are more likely to commit radiological or nuclear attack due to their highly conspiracy behavior, central command, strong motivation and high ideological influence over its members, commitment in executing the planned attacks. Additionally, it is necessary for states to have well-defined guidelines to reduce the probability of the abovementioned events from happening, as well as guidelines to mitigate the consequences if such as events.

III. Pre-event Policies of Nuclear Terrorism

1.Strengthening cooperation among states in law enforcement, border security, export controls, intelligence, interdiction of WMD, the terrorist related shipments and financial flows (Freilich, 2010) – the assumption that can be drawn from the above provided discussion is that terrorist groups are more likely to "obtain fissile materials from governments, and relatively few governments have made such materials thus far"; and the best way that terrorists can be contained is "by locking up nuclear material, destroying excess stock, and blocking new production"(Carter & Carter, 2004). The existing security factors indicate the danger of nuclear terrorism which "is likely to increase in the absence of substantial changes in the international policies and practices as part of the comprehensive non-proliferation efforts"(Razmi, 2013:18). The cornerstone of preventing further nuclear proliferation is the Non-Proliferation Treaty (NPT), but "its effectiveness is substantially undermined by the refusal of the existing nuclear weapons states to fulfill their obligations under article VI to move to the complete elimination of their nuclear weapons"(Helfand, Forrow, & Tiwari, 2002). Thus, it requires imposing higher extent of enforcement and monitoring [of UNSCR 1540] for prohibiting financing proliferation of WMD and stricter export/import control in order to combat all cross-border illicit activities in smuggling nuclear weapons. Worth mentioning is that nuclear technologies, material, and personnel are internationally available; thus the primary sources of this availability are commercial power reactors and research reactors which create a legitimate international market for elements of a nuclear program(Hynes, Peters, & Kvitky, 2006:154). The enforcement of

[18] Ibid, pp.15

abovementioned export/import controls would drastically lower the chances of terrorist groups to get access to nuclear technology, nuclear fissile materials or nuclear weapons through the international illegal nuclear market, i.e. it lowers the chances of occurring nuclear terrorism. In this regard, it is expected United States to have a leading position "in assisting all governments to meet those standards through a dramatic expansion of the Nunn-Lugar programs of the Departments of Defense, State, and Energy" (Carter & Carter, 2004). In terms of preventing financing proliferation of WMD, these certain actions consequently includes the "recruitment and movement of personnel; the acquisition of knowledge, expertise, specialized equipment and use of suitable facilities" which notably "require the dedication and movement of financial resources that can be tracked"(Hynes et al., 2006, p. 08). Thus, to combat black illicit market and prohibit financing proliferation of WMD, it requires **higher cooperation among states instead of higher deterrence for nonproliferation of WMD.** For example, states that have nuclear weapons and nuclear fissile materials, like North Korea is, should not be deterred because if these states fear deterrence or retaliation is more likely that they will use the "back-door" approach of transferring weapons to terrorists"(Lieber&Press, 2013). Beside this, the collective action in combating terrorism is possible only through successful cooperation among state and non-state actors. For example, if [hypothetically] certain terrorist attack occurs in Paris or London, it is more likely that that will happen in Beijing, Moscow, New York, Rome etc. Thus, states should implement stricter penalties in their legal systems for participating in theft or smuggling of nuclear material or any type of assistance to nuclear terrorists; countries must expand police and intelligence cooperation with other countries focused on identifying and countering criminal or terrorist groups with nuclear smuggling aspirations; and countries should establish national police or intelligence units specialized to deal with nuclear smuggling cases(Bunn et al., 2016, p. 130). The U.N Convention on Nuclear Terrorism[19] from 2005 defines nuclear terrorism as an act against humanity, "as the use or threat to use nuclear material, nuclear fuel, radioactive products or waste, or any other radioactive substances with toxic, explosive, or other dangerous properties; the use or threat to use any nuclear installations, nuclear explosive, or radiation devices in order to kill or injure persons, damage property, or the environment, or to compel persons, States, or international organizations to do or to refrain from doing any act"("Convention on Nuclear Terrorism | Treaties & Regimes | NTI,2005," n.d.). This convention have 99 parties, from which 16 signatories have not ratified the convention, yet("Convention on Nuclear Terrorism | Treaties & Regimes | NTI,2005," n.d.). In this regard, it requires **adoption and implementation of this convention to be mandatory for all**

[19] Have adopted on 13th of April, 2005; opened for signatures 14th September,2005 and have entered in force 07th July 2007. 16 signatories have not ratified yet.

member states of UN. Furthermore, it requires higher enforcement of the Global Initiative to Combat Nuclear Terrorism(GICNT) Statement of Principles (SoP) in order to deter, prevent, detect and develop an appropriate response and "develop partnership capacity to combat nuclear terrorism, consistent with national legal authorities and obligations" as well as "relevant international legal frameworks such as the Convention for the Suppression of Acts of Nuclear Terrorism, the Convention on the Physical Protection of Nuclear Material, and United Nations Security Council Resolutions 1373 and 1540"("Global Initiative to Combat Nuclear Terrorism (GICNT)," n.d.). Hence, higher cooperation among states and higher enforcement of international norms are crucial in combating nuclear weapons proliferation and nuclear terrorism.

2.Strengthening the security of all nuclear facilities– Unfortunately, there are some gaps in the standards for physical security. The IAEA standards for safety and security expressed in **Governmental, Legal and Regulatory Framework for Safety (2016)** is consisted of 36 requirements which shall be implemented for nation-state governments into its national legislation for safety and security of nuclear facilities. This framework is solely based on requirements for harmonization of national legislations which implementations are subject to monitoring by IAEA; but does not provide unified safety and security standards for nuclear facilitates for all signatory parties nor steps or standards for prevention from terrorism and sabotage of nuclear facilities("IAEA General Safety Standards," n.d.). Nevertheless, there are a lot of gaps in the safety and security legal frameworks of nuclear facilities in particular states. For example, in United States neither Department of Energy (DoE) nor Nuclear Regulatory Commission (NRC) address some important problems such as penetration by high-speed land or aerial vehicle (Dixon, 1987, p. 195). The U.S NRC claims that "nuclear power plants can withstand aircraft attack crashing into them", but "it seems likely these plants are highly vulnerable"(Helfand et al., 2002). Unfortunately, there is evidence that nuclear sabotage have occurred. For example, insider succeed to get access to Belgium's Doel-4 nuclear power plant reactor who opened the locked valve that have caused the whole lubricant from the turbine to drain out, which consequently lead to overheating and destroying the turbine by itself(Bunn et al., 2016, p. 29). To date, there is no existing "comprehensive global database assessing the effectiveness of the security measures for each nuclear site and transport route handling nuclear weapons or weapons-usable materials"(Bunn, 2009). Thus, one of the best ways for countries to prevent nuclear terrorism or sabotage is to establish a "design basis threat (DBT) including a substantial array of potential adversary capabilities and tactics that operators must protect against"(Bunn et al., 2016, p. 32). In addition, I would elaborate more which aspects and why should be considered the most under the DBT's national guides for preventing nuclear terrorism or sabotage besides IAEA's requirements. In terms of

external security of nuclear facilities, if is built on ground, it is highly recommended to be outside of populated areas and strategically located where any appearance of people or vehicles can be noticed on proper distant. In this regard, it is required installing external detectors, radars and alarms (Dixon, 1987). External detectors should capture any motion around the nuclear facilities which will enable security officers to act on time. In addition, this requires establishing three "rings" (perimeters) of external security where each ring of security is consisted of civilian and/or military well-equipped personnel strategically deployed which will prevent penetration of any kind of threat towards nuclear facilities. By default, it is necessary to have 24/7 surveillance of the area, by human sources and high-quality cameras, including drones from air. In this regard, having high quality radars will enable detection of any unidentified flying object towards or near to area with nuclear facilities. Worth mentioning, it is very useful for security personal to have the list of commercial flights over or near the area with nuclear facilities, because it decreases the risks of possible terrorist attack from air and preparedness of the security personnel to react appropriately if its radar identifies unidentified flying object coming to protected nuclear area. Finally, high and heavy-structured fences combined with high voltage electrical power running through it, would enable protection of direct penetration from ground if the technology and human personnel have failed to detect. In terms of internal security nuclear facilities should be protected by identification and detailed checking's of all people and vehicles going in and coming out from the facilities, including and nuclear facility staff, security personnel, management and subcontractors. Also, should include security clearance of staff, security personnel, management and subcontractors on annual basis. In support to this argument is the Belgian case of sabotage, which illustrates that their powers plant "had a budding jihadi terrorist in its vital areas" (Bunn et al., 2016), even though the sabotage was committed by another employee. Once the guest have passed the security checking's on the entrance gates, each guest must be accompanied with at least two members of the personnel during the entire presence inside the facility; thus, one member from the department which guest intends to visit and one member of the security personnel. This reduces the risk of taking as hostage(s) staff members and requiring certain demands, or killing the key people of the nuclear program. Like in the case of external security, and the internal security requires 24/7 surveillance, seismic and infrared detectors and alarms of all nuclear facilities and empty spaces including the parking lots. Besides that, it requires mobile patrols on ground with dogs which allows detection of unauthorized presence of people. Most importantly, must be installed proper protection software system which will prevent cyber-terrorism and disclosure of official documents related with the process of getting weapons grade enrichment uranium, and tracing the source of penetration. Most authors and nuclear

experts argue that the cyber-terrorism from outside is least likely to occur because the computer systems that operate the nuclear reactors and the nuclear equipment are isolated from the Internet[20] and can travel only in one direction "outgoing from the plant."[21] However, in 2017 a cyber-attack has occurred in at least one U.S nuclear power plant(Sheth, 2017). According Greg Martin, especially vulnerable are business sides documents and email that contains "communications involving design plans, information about security assessments, emails or documents that contain passwords" etc (Sheth, 2017). On the other side, what is more likely to occur is cyber-sabotage by insiders by stealing crucial information's from "thumb drives and laptops that are used to interface with plant equipment"(Gross, 2017) For example, in 1974 the Pakistani scientist Abdul Qadeer Khan stole the information's of the URANCOO's G2 centrifuge[22] who not only helped the Pakistani government to build the bomb, but also has become the "largest and most sophisticated exporter in the nuclear black market"(Broad, Sanger, & Bonner, 2004). This sort of information's would value whole treasure on both international legal and illegal market. Finally, all nuclear facilities must have evacuation plans and action plan for giving first aid to wounded employees, if sabotage or error in operation occurs. In terms of that, is needed on probe distance to have certain medical building with sufficient quantities of equipment and medical materials, as well as number of employees, which will be able to provide adequate first-medical-aid assistance to wounded employees exposed on ionization and radiation.

3.Maintaining safety and security of nuclear arsenal and radioactive materials – Another conclusion that can be drawn from the discussion above is that nuclear terrorism might not occur by "state's attack-by proxy strategy, but rather from the problem of "loose nukes" - poorly secured nuclear weapons or materials falling into the wrong hands through illicit means"(Lieber.K & Press.D, 2013 : 96). Therefore, highest level of security is needed for nuclear arsenal in order to avoid losing nuclear weapons or being detonated by "third party". According the estimates of the Stockholm International Peace Research Institute (SIPRI), till 2014 nine countries have in total approximately 16,300 nuclear war heads, from which approximately 3,970 warheads are placed on missiles or located on bases with operational forces by four countries(SIPRI, 2014.) Countries which need higher scrutiny over its nuclear arsenal arguably are Russia, India, Pakistan, Israel and North Korea, as a reason that many terrorist groups operate within or around their territory. Nonetheless, all nation-state governments should make significant efforts

[20] Nuclear Energy Institute. For more information's please visit https://www.nei.org/Issues-Policy/Safety-and-Security/Plant-Security

[21] Bill Gross, NEI's Director of incident preparedness. For more information please refer to https://www.nei.org/News-Media/News/News-Archives/2017/4-Things-to-Know-About-Nuclear-Plants-and-Cyber-Se

[22] The most advanced uranium enriched technology in that time.

for safely maintaining and gradually reducing its nuclear arsenal following the U.S-Russia nuclear disarmament example, instead of increasing the size of its nuclear arsenal like in the cases of China, Pakistan, India, and North Korea(Kristensen & McKinzie, 2015). For example, according the NTI Nuclear Security Index the progress on securing and eliminating materials has slowed(NTI, 2016, p. 32). To date, except the IAEA Safeguards monitoring requirements, the safety and security of nuclear arsenal heavily it depends on each country's national security policy drafted on their own experience or in cooperation with other states in that field. Nowadays, very little information is known about the mechanisms for nuclear safety. Understanding nuclear safety issues is hard even for political and military leaders, which regardless of its nationality they are not trained in nuclear physics, mechanical engineering, and chemistry; thus must rely on guarantees provided by the technical experts and laboratory heads(Krepon, 2015). Indeed, the leaders should not be strictly from the abovementioned fields, but should engage experts from such as field who are capable to provide the desired nuclear expertise for maintaining the security of its nuclear weapons and fissile materials. Hence, it is required strengthening of national standards for safety and security of nuclear weapons and fissile materials in compliance with IAEA safeguard recommendations, but also participating in IAEA discussions on developing new modules for enhancing the security of the nuclear arsenal and the fissile materials. In this regard, these standards should include electronic barriers of external electronic devices; armed military and civilian guards; surveillance cameras of whole nuclear complex; motion sensors, detectors, alarms and lasers[23] and background checking's of personnel. The less likely scenario is terrorist to steal a nuclear bomb, but they might seek to penetrate either in their software system to detonate nuclear bomb(s) or infiltrate people to steal top secret documents related with how to build, weaponize and deploy nuclear bomb. In terms of that, one of the main advantages of securing nuclear arsenal from cyber-terrorism is the sophisticated electronic system used by United States called a **permissive action link (PAL)** that lies on "two man rule"; in order to arm the nuclear weapon two correct codes must be inserted which makes it "nearly impossible for a person to detonate a weapon by himself"(Fuller, 2008). Therefore, in order to minimize the chances of "losing nuclear bombs" it is recommended installing **long-range detectors of the lowest possible radioactivity** all over the territory of nation states, as well as **GPS tracing of nuclear bombs,** which will enable early detection of possible criminal/illicit or terrorist activity. Imposing strict and regular [day-to-day] accounting of nuclear stockpiles and weapons-use nuclear materials would enable early detection of missing nuclear arsenal and weapons-use nuclear materials, and hence, would decrease the chances of theft

[23] For more information's check this website https://www.nap.edu/read/12849/chapter/4#24

of weapon-usable nuclear material. In this regards, it requires higher enforcement of IAEAs General Safety Requirements and General Safety Guides[24] for monitoring and accounting weapon-usable nuclear material. States should establish a tip line and reward system to encourage people to blow the whistle on nuclear thieves or smugglers.

4.Disarmament and dismantlement of nuclear weapons – President Barack Obama in his speech in Prague in 2009 has stated: "The United States will take concrete steps towards a world without nuclear weapons", on a way that United State will "reduce the role of nuclear weapons in our national security strategy, and urge others to do the same"; in order "to reduce our warheads and stockpiles, we will negotiate a new Strategic Arms Reduction Treaty with the Russians"("Obama Prague Speech On Nuclear Weapons | The Huffington Post," n.d.). But, this call of Obama have not result with success because his administration suffered "lack of enthusiasm for eliminating nuclear weapons, seeking to cut annual spending for weapons dismantlement in fiscal 2015 by 45 percent"(Alvarez, 2014). Worth mentioning is the success of START I Treaty which lead to disarmament of "*4,900 warheads for ICBMs* (land-based intercontinental ballistic missiles) and SLBMs (submarine-launched ballistic missiles), *154 heavy ICBMs* (defined as having a launch weight greater than 106t or a throw-weight greater than 4,350kg), *1,540 warheads for these heavy ICBMs*,[25] and *1,100 warheads for mobile ICBMs*[26](Strategic Arms Reduction Treaty, 2011). However, as I have mentioned above it is necessary to establish Strategic Arms Reduction Treaty not only between U.S and Russia, but **Global Strategic Arms Reduction Treaty** (GLOB-START) which will include all nuclear and non-nuclear weapons states. Readdressing the existing real threat of nuclear terrorism by reaffirming the main goal of the United Nations for "safe world without nuclear weapons" is more likely to lead all "nuclear states" to disarm and dismantle its weapons. The GLOB-START should mean "no deployed weapons, no stock-piled weapons, no assembled weapons, no nuclear weapons in the hands of the military; no national nuclear weapons"(Lodgaard, 2009, p. 142); thus, no to nuclear terrorism. Also, should include systematic disarmament of not only nuclear weapons, but all chemical, biological, radiological and other weapons of mass destruction. Disarmament and dismantlement of the weapons of mass destruction should be undertaken by states transparently and successively. Besides that, it is required reaffirming and reinforcing the provisions of Nuclear Non-Proliferation Treaty (NPT), as well as to pursue negotiation with other nuclear weapons states which are not part of NPT to join NPT or to stop the nuclear race by investing "systematic and progressive efforts to reduce

[24] For more information's check IAEA's website here http://www-ns.iaea.org/standards/documents/general.asp

[25] Only the Soviet Union possessed this type of missiles.

[26] de facto applied only to the Soviet Union and Russia because the United States, shortly after the signing of START I, decided to forego deployment of such missiles

nuclear weapons globally"("Nuclear Disarmament Resource Collection | Analysis | NTI," n.d.). Therefore, the dismantlement of nuclear weapons "should be high on the global public health agenda"(Helfand et al., 2002). Dismantlement of nuclear weapons is very complex process that requires "separation and storage or disposal of the component parts of the weapons involving the handling of high explosives and large amounts of fissile materials" which is "highly dependent on precise documentation of how the weapons are constructed"(Alvarez, 2014). In order to prevent further nuclear arms race and manufacturing of new nuclear weapons,is needed ratification and implementation of Fissile Material (cutoff) Treaty – (FMcT). This treaty would enable decreasing of nuclear fissile material stockpiles. Hence, the assumption would be disarmament and dismantlement of nuclear weapons are very important segments for destroying nuclear weapons, but in same time they possesses high risks that some terrorist groups would get access to some components of the dismantled nuclear weapons would come into hands.

5.Establishing special organizations with nuclear expertise - the international nuclear forensics organization. Establishment of such as organization is extremely important for conducting immediate and successful investigations if nuclear or radiological terrorism [ever] happen and should be part of the UN organization. Firstly, this organization must establish significant database of nuclear isotopic fingerprints (NIFD) from all nuclear power plant and research reactors in the world. It is possible to establish nuclear isotopic fingerprints database because from one side "the ratio of uranium isotopes varies according to where raw uranium was mined and it was processed", on the other side " the composition of weapons-grade plutonium reveals clues about particular reactor used to produce it and how long the material spent in reactor"(Lieber & Press, 2013 : 85). This type of database is crucial for further investigations of possible nuclear and radiological terrorism. By using the isotopic fingerprints after the detonation of certain nuclear device and comparing these isotopic fingerprints with those in their database, the international investigators from such as organization would be able to trace the fissile material device to its source. Secondly, all nuclear weapons states as well as all states that run nuclear programs for civilian purposes must be members of this organization. Besides that it is needed to allow access of international investigators from the abovementioned organization to pick up samples of nuclear isotopes from its nuclear power plants and research reactors. Thirdly, by its existence will play as a deterrent factor for all state and non-state actors; thus, it will decrease the possibility of nuclear terrorism either by terrorist groups or attack-by-proxy strategy from certain states. Finally, it will allow fast and effective retaliation towards the supporters, orderers and executors of such an attack. [eventually] occur.

IV Post-event policies of nuclear terrorism

In event of occurrence of nuclear or radiological terrorist attack "timely,managed, controlled, coordinated, and effective response measures" must be undertake in order "to mitigate their consequences, so as to minimize risks to health, life, and environment"(Bhardwaj, 2010, p. 157).If radiological or nuclear terrorist attack occur the necessary actions in such as events fall into two categories: *actions to recover from the first detonation* and *actions to prevent a second*(Carter et al., 2007, p. 20). In the first category would fall the emergency response, evacuation and sheltering, resettlement of people from "hot" zones and investigation of the immediate radiation effects; while in the second category would fall investigation and detection of other explosive devices, i.e. nuclear forensics of the bomb for identifying its country of origin, preserving continuity of the government; identifying the attackers/organization responsible for attacks and retaliation to the threat of follow-on attacks(Carter et al., 2007).

IV-1. First category of response

Emergency response, evacuation and sheltering, resettlement of people from "hot" zones and investigation of the immediate radiation effects – Effective mitigation of the consequences from nuclear or radiological terrorism needs "contingency planning, capacity development in terms of provision of basic infrastructure, trained human resources, equipment, and evolvement of coordination and implementation mechanisms"(Bhardwaj, 2010). At the very beginning, in the event of occurrence nuclear or radiological terrorist attack must be established "an exercised incident command structure specific to a nuclear terrorism scenario coordinated with state and local responders and authorities"(Carter et al., 2007, p. 23), which should involve the most experienced workers from all levels of government, including "emergency medical systems, firefighters, law enforcement, radiation experts, hazardous material (HazMat) teams, public health officials, and health care providers"(Barnett, Parker, Blodgett, Wierzba, & Links, 2006, p. 1657). After this is done, the command structure must declare "emergency situation of highest level," which requires active engagement of all levels of government. The first team that should arrive at the place of attack is the team of radiation experts and HazMat personnel with aim to determine the nature of attack and whether or not the extent of radiation is above or below the expected levels(Barnett et al., 2006, p. 1657). Also, the radiological expertise from the "hot spot" it is very crucial for determining the most effective steps for rescuing people; it is especially crucial for medical health responders in order to provide a more appropriate care for the victims. If the level of radiation is above the normal or expected levels, which is more likely for attack with nuclear weapon(s), the public health responders and health care providers must immediately start with facilitating "evacuation, sheltering, decontamination" and providing "mass medical and mental health care"(Redlener, Garrett, Levin, & Mener, 2010, p. 17). Depending on the intensity of explosion and level of radiations

"victims may experience radiation effects ranging from rapid death to only delayed, minor sickness" where those "victims who become ill could survive with proper medical care"(Redlener et al., 2010, p. 12). If hypothetically nuclear terrorist attack happen, it is very important recruiting as much medical personnel as possible from other cities and regions, because it is more likely that such an attack will damage "health care facilities, the infrastructure and impede the delivery of health and first responder services and reduce the number of available healthcare providers" (Redlener et al., 2010, p. 18) which additionally complicates the healthcare delivery. However, all involved actors must be aware of the consequences and ready to accept the exposure that will be necessary for them to carry out their life-saving tasks(Carter et al., 2007, p. 26). After rescuing and sheltering is done, external and internal decontamination must be done with the both injured and non-injured people. The external contamination means removing the clothes of all people exposed to radiation and appropriately securing them in double bags for future analysis, washing their heads and hands, full showering etc; and internal decontamination uses "dilution, purging, diuretics, and laxatives to facilitate excretion and reduce incorporation of radionuclide's"(Barnett et al., 2006, p. 1658). One of the major challenges is deciding which victims should get immediate and which delayed care. The extent of exposure on radiation "varies drastically between high and low doses" (Carter et al., 2007, p. 26). In such as situation, patients should be classified based on their ability to independently walk, breathe and follow commands(Cone & Koenig, 2005 p.298). Finally, after nuclear or radiological terrorist attacks have occurred, it is very importantly nation-state governments to strengthen its cooperation with mainstream media's, in terms of providing balanced and ethical informing for people. Most of the national and international media's have at least one journalist who covers terrorism and international security issues and in an emergency situation "*how* information is communicated to the public is as important as *what* information is communicated"(Barnett et al., 2006, p. 1659). There is always possibility some media's to spread foreign propaganda and to transmit pessimistic predictions for future which would additionally spread fear and panic among people. Therefore, the risk communication must be "built on well-established relationships with key stakeholders and the media"(Siaw Khiun Then & Martin Loosemore, 2006, p. 165) in order to keep the general public up-to-date at all phases of the terrorism event, as well as if is needed to demand all disinformation's which might appear in public. In sum, in order to provide the most effective emergency health care prior to occurring any radiological or nuclear terrorist attack, it is important for all nation-state governments to strengthen the education of its emergency medical relief personnel; to optimize its emergency medical institutions and organizations; modernization and serialization of its equipment for emergency medical

responses; conducting researches on the prevention of psychological problems caused by terrorist attack on its territory and establishing mental health counseling systems for emergency relief(Wang, Liu, & Jiang, 2014).

IV.2 – Second category of response.

Preserving continuity of the government and prevention of follow-on attacks – terrorist attack causes "acute difficulty and urgency which threaten the viability of an organization, its business units or key products and even the lives of people"(Siaw Khiun Then & Martin Loosemore, 2006, p. 164). In dealing with such a crisis it is very important to preserve continuity of the government which requires adequate crises management to mitigate the consequences over people, resources, and national security in general. Firstly, nation-state governments have to "act swiftly to avoid "decapitation"—that is, a break in civilian leadership"(Mann, 2004). Prevention of decapitation involves securing the top political and military officials and maintaining secure communications lines with all members of government. Beside this, it requires legal authorization for nomination of presidential succession if the President is killed, have died or is incapacitated to serve the nation in that situation. Secondly, requires closing all nation-state borders for certain period of time, checking's and identification of people not only from the affected area and its neighboring regions but across the whole territory; coordination of all available law-enforcement personnel and activating of the reserve squad in order to protect fleeing out the perpetrators and its supporters and preventing possible follow-on attack. In this regard, if terrorists were able to get or make one nuclear bomb it is more likely to have few more, which raises the likelihood if one nuclear weapon is detonated more are to follow(Carter et al., 2007, p. 27). Searching for others nuclear weapons and terrorists who committed the first nuclear/radiological attack is very difficult without cooperation and coordination between the national and foreign intelligence services and law-enforcement agencies and special unit with expertise in nuclear forensics. Nuclear weapons built from uranium or plutonium are very difficult for detection, because uranium "emit little radiation" and nuclear weapon built from plutonium is "easily shielded by a container of lead"(Carter et al., 2007, p. 28). Thirdly, nation state authorities must work on decreasing the consequences among its population from the post-traumatic syndrome of the terrorist attack, i.e. nuclear terror.

IV-3. Nuclear forensics of the bomb and identifying the attackers and organization responsible for the attacks – In situations when nuclear terrorist attack happens, nation-state governments must "trigger an unprecedented search employing every diplomatic, intelligence, and military tool available" to trace back the perpetrators(Lieber & Press, 2013). At the very beginning, most importantly is determining the composition of a sample's key components (Stanley, Stalcup, & Spitz, 2013, p. 1387). Hence, the role of nuclear forensics is to examine the "nuclear or other radioactive materials or evidence

contaminated with radionuclide's"(Keegan, Kristo, Toole, Kips, & Young, 2016) in terms of identifying the nature of the materials and how-when and-where the materials were made. Each nuclear weapon have unique signature that vary "from uranium ore to uranium fuel pellets used in power reactors, natural uranium to weapons-usable, highly enriched material, and spent nuclear fuel to separated plutonium"(Mayer, 2013). Also, technological methods used for fabrication and reprocessing of the nuclear fuel processes, as well as the origin of uranium, differ geographically and geologically. Nuclear forensic investigations should start from the moment when material(s) from the affected area has been seized and categorized as "nuclear material", which includes comparing the ''nuclear fingerprints'' of the seized material with existing samples(Mayer, Wallenius, & Ray, 2005). However, to date there is no centralized international nuclear-forensic database. The only existing database is the IAEA's information system on incidents of "illicit trafficking and other unauthorized activities and events involving nuclear and other radioactive material outside of regulatory control"("Incident and Trafficking Database (ITDB)," n.d.). Therefore, performing a comprehensive nuclear forensic analysis may require collaboration and cooperation with other nuclear weapons countries and international organization for sharing actual nuclear samples, as well as sharing intelligence reports among countries of registered illicit trafficking with nuclear materials(Keegan et al., 2016). In this regard, in order to perform more effective nuclear forensics analysis and investigation is very important establishing of **international nuclear forensics database** under the patronage of IAEA. Just like the "human fingerprints and DNA evidence in criminal cases," creation of international nuclear forensics database would be the most helpful tool "in attributing responsibility for an attack when it can be compared against databases containing reference signatures and data from worldwide sources of nuclear material"(Phillips, 2007). Once the components of the seized sample have been identified and the source of production or leakage is identified, the nuclear forensic investigation proceeds to the second phase for identifying the perpetrators and its organization. The history of terrorism reveals evidence that in most of the cases when terrorist attack have occurred, those organizations who stands behind the attack would claim its responsibility. But, there were situations where multiple terrorist groups have claimed responsibility for certain terrorist attack(Gilbert, 2016). Also, it is possible "that no evidence of a particular state's involvement will be found" because it is least likely some states to confirm its involvement [even if they were involved] because of the fear of nuclear retaliation towards them(Corr, 2004, p. 07). In such as situations, it is very important to identify whether solely terrorist attack is or attack-by-proxy strategy.

IV-4. Retaliation on nuclear terrorism – Nowadays, the threat of a nuclear response to nuclear terrorism must be as much as like the threat of nuclear retaliation during the

Cold War (Corr, 2004). The history of terrorism reveals that "seventy-three percent of past high-casualty terrorist attacks have been traced back to the perpetrators"(Lieber & Press, 2013). The decision for retaliation on nuclear or radiological terrorism includes several aspects. Firstly, all states must be aware that "the loss of fissile material that is then used against another city, when that fissile material is not stored according to global standards" they will be held accountable for that (Corr, 2004). This means that "any transfer to terrorists of nuclear weapons or the materials to make them," or intentionally or unintentionally "losing nukes" and radioactive materials "would provoke a swift and sure response"(Bunn, 2009). Secondly, the threat of retaliation with either nuclear or conventional weapons must play as plausible option only in situations when attacked state has sure evidence that proves who the perpetrators and sponsor(s) are. For example, if [hypothetically] Hezbollah bombed Israel, and Israel is suspecting Iran of contributing the weapons; the question that arises is what is the likelihood that Israel's government would refrain to retaliate on Tehran if such as situation occurs? Thirdly, all states must clearly state that they "reserves the right to retaliate against governments that knowingly transfer nuclear weapons or fissile materials to nongovernmental entities"(Carter et al., 2007, p. 30) even before any terrorist attack have happened. For example, in one of his statements for media in 2006, the former French President Jacques Chirac made clear that "countries which support terrorism or desire weapons of mass destruction are at risk of a nuclear attack"(Germany, 2006). Last but not least, states must "avoid overstating its capabilities" for attribution and retaliation(Levi, 2008, p. 28). There are some countries that might not be capable to recover from such as attack nor to retaliate. Hence, retaliation on nuclear terrorism requires collective action. If nuclear or radiological terrorist attack happens in any country in the world, there is strong likelihood that UN Security Council will authorize retaliation towards state-sponsors and terrorist groups who have committed the attack(s). This respond must be solely based on using conventional weapons instead of nuclear weapons. Thus, deepening the nuclear war should not be a valuable option because is counter-productive and against the humanity.

V – Conclusion

From the discussion above the conclusion that can be drawn is that the non-traditional terrorist organizations which are motivated for making or getting nuclear bomb are not capable of either making nuclear bomb nor are capable of getting nuclear bomb from state sponsor. On the other hand, the traditional terrorist organizations are neither capable nor motivated in making, getting nor using nuclear or radiological weapons for its targets. But, terrorist organizations might be capable of making "dirty bombs". The evidence presented above has proven that not all nuclear fissile materials and radioactive materials are safely guarded. Therefore, much have to be done on field of maintaining safety and security of all

nuclear fissile and radioactive materials. Furthermore, states must be aware that any intentionally or unintentionally transfer of nuclear materials, or nuclear technology, or nuclear weapons, or radioactive materials will be held accountable for that. In such as situation, retaliation should be the last instance for respond, unless states are not 100% sure who the perpetrators and sponsors of terrorist attack are. Hence, establishing international nuclear forensics organization and the international nuclear forensics database would be play as deterrence for nuclear or radiological terrorism from occurring, as well as preventing nuclear state sponsorship from occurring. Finally, combating global terrorism requires global action in strengthening the international cooperation among states in law-enforcement, border security, export controls, intelligence, interdiction of WMD, and terrorist related shipments and financial flows(Freilich, 2010); maintaining the safety and security of its nuclear arsenal, nuclear facilities and dismantling nation state nuclear weapons. Terrorism cannot be eradicated, but can be prevented from occurring with appropriate cooperation among all state and non-state actors.

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