

**REGIONAL INFORMATION SHARING SYSTEM PROPOSAL
TO COMBAT NUCLEAR TERRORISM**
A Probabilistic Risk Assessment Approach

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Abstract

The probabilistic risk assessment (PRA) methodology can be applied qualitatively as a practical tool to address the problem of illicit trafficking and nuclear terrorism. The methodology could strengthen the efforts to reduce risk in a region of concern where roots of smuggling can be traced by constructing event trees. PRA can also be used as a tool for mitigating the consequences in case of occurrence of an unwanted attack. Radioactive and nuclear materials smuggled for illegal use can always cause a threat to human health and environmental safety whether they are seized or may never be discovered. It is proposed that a regional risk information network has to be established with a purpose of strengthening national, transboundary and regional security issues by promoting regional information sharing scheme. It is argued that the inclusion women organizations in the network as one of the main stakeholders is essential.

1. INTRODUCTION

Terrorism is considered as one of major threats to all nations. In particular chemical, biological, radiological and nuclear (CBRN) terrorism is widely considered as a major if not the ultimate terrorist threat for modern societies as well as developing nations. Attacks using improvised nuclear devices or biological weapons, as well as outbreaks of a pandemic disease, pose a serious national, regional and international security risk [1-3]. Preventing the proliferation of CBRN has been the major security priority of many nations.

While the world enters a new decade in 2020, terrorism seems to be one of the major international security issues although very intensive international efforts have been spent in recent years to prevent it. It is likely that terrorism is going to be at the centre of international security policies at least within the next couple of decades.

Risk of nuclear terrorism seems to be the focus of concern of many western governments. Illicit trafficking, thefts, losses and other unauthorized activities and events involving nuclear and other radioactive material continue to occur.

The issue of nuclear terrorism risk is outlined with an emphasis on the means of preventing illicit trafficking of nuclear materials. The probabilistic risk assessment approach is discussed as a strong tool to identify priorities for risk reduction due to illicit trafficking. An establishment of regional information centre/network is proposed with a purpose of strengthening national, transboundary and regional security issues by promoting regional information sharing scheme.

2. BACKGROUND

Terrorism risk is a real fact of the today's world. It is one of the most striking and worst socio economic and political problems causing great fear for individuals, societies as well as politicians in the West and in the East. Nuclear terrorism on the other hand is a more complex international issue. It involves various complex security aspects and varies from the risk of an attack to a nuclear plant/facility to use of atomic bomb or home-made dirty bomb, illicit trafficking of radioactive materials, explosion and radioactive contamination... All of these with varying probability of occurrence and varying degree of consequences are referred in the paper as nuclear terrorism.

2.1 Root causes of nuclear terrorism

Nuclear terrorism is a very complex socio-economical phenomenon. Main reasons for emergence and continuation of the nuclear terrorism threat are outlined below:

- Cold war and post cold water period.
- Fast socio- economic changes in the world since 1960s.
- Fast socio- politic changes in the world since 1980s.
- September 11th and its political consequences.
- Gulf wars and invasion of Iraq and
- New complex driving factors in the last two decades.

Nuclear security is the response to the threat of nuclear terrorism, involving malicious acts from non-state actors to steal, have access to or organize sabotage against nuclear material in use, storage or during transport. The September 11, 2001 terrorist attacks on the United States changed the nature and scope of threats to international security. Non-state actors, asymmetric war, unconventional means and surprise attack started dominating the security agenda. Non-state actors are unlike states: They operate transnationally and without defined borders. They do not seek physical survival, but to transform the prevailing system based on Western values. To that end, they want to inflict mass casualties to spread fear and want to sustain this fear. This requires sensational attacks, which will challenge the “security-provider” status of the state, but also will raise its credibility to recruit more followers. So, they are after capabilities and material causing mass casualties and horrible scenes of attack.

The internet and social media are the most powerful means of communication and propaganda for terrorists. Thus, with the threat of surprise terrorist attacks with nuclear and/or radiological material, they will reach their political aim: To attack the political and economic system of the West, which they believe has suppressed their way of life [4].

No matter with what probability and with what degree of consequences it occurs; nuclear terrorism is a very serious health, environmental, economic, social, psychological and political risk management issue.

3. PROBABILISTIC RISK ASSESSMENT (PRA) LOGIC APPLIED TO NUCLEAR TERRORISM

The probabilistic risk assessment (PRA) methodology can be applied qualitatively as a practical tool to address the problem of nuclear terrorism. The methodology could particularly applicable in the areas or regions of concern in which illicit trafficking has occurred before and may have the probability of occurrence again [5].

PRA may help to reduce risk in the region of concern where roots of smuggling of an illicit trafficking can be traced by constructing event trees. PRA can also be used as a tool for mitigating the consequences in case of occurrence of an unwanted attack.

The problems that must be addressed in the probabilistic approaches are:

- (a) How to assess the risk of nuclear terrorism?
- (b) How to prevent terrorist actions and illicit trafficking of nuclear materials?
- (c) How to reduce the risk with regional cooperation efforts and
- (d) How to mitigate the consequences if an unwanted event occurs?

3.1. Probabilities and consequences of illicit trafficking

Probabilistic Risk Assessment (PRA) methodology can be used in order to make qualitative and when possible quantitative risk assessment of the misuse of nuclear or radioactive material for producing of nuclear arms, explosives, use in terrorist attacks. Although uncertainties may be high, the methodology will help to visualize and estimate the probabilities and consequences of an unwanted events [6].

The PRA application to the case of illicit trafficking is illustrated simply by employing risk logic diagram first to identify the problem areas, then by construction of event trees and fault trees. First step of the assessment work is the compilation of the information and data available.

The questions to be addressed, items to be identified, systems to be questioned and actions to be taken for probabilistic logic must be all considered and listed systematically. As an example of “questions and actions logic” is summarized in Table 1.

The availability and type of nuclear materials, their high end and low end in the region of concern must be estimated [7-8]. Type of nuclear materials with risk of smuggling are listed in Table 2.

TABLE 1. PROBABILISTIC RISK LOGIC STRUCTURING OF ILLICIT TRAFFICKING CONSTRUCTED ACCORDING TO THE QUESTIONS AND ACTIONS TO BE TAKEN

QUESTIONS	ACTIONS
Why Illicit trafficking or smuggling?	List all initiating events, analyse causes
What type of nuclear or other type of materials are smuggled or misused?	List kinds of nuclear and radioactive materials and toxic chemicals and their properties
Where would they go?	Construct event trees with all possible roots
How and where security and intelligence failed?	Construct fault tree and identify weak points in the hardware, equipment, human factor, regulations, lack of information
What are the probabilities involved?	Quantify probability of occurrence
What might be the risk?	Carry out health, environmental and economic risk estimates
What may be the consequences of low, medium or high consequence smuggling or attack?	Identify hazard ranking qualitatively ¹ Identify damages
What could happen if a serious nuclear attack?	Prepare an emergency plan
What are the lessons learnt?	Analyse the case (real or scenario based) Identify all weak points Produce set of recommendations
How the damage can be mitigated?	Introduce extra emergency preparedness
How can a similar event could be stopped?	Use all available data base. Share information Strengthen weaknesses
Who will be most affected hence should be more concerned?	Design and implement public participation and awareness program

TABLE 2. TYPE OF NUCLEAR MATERIALS WITH RISK OF SMUGGLING

Activity/type level	Identification of Material
Enriched	²³⁵ U (High Enriched) Pu
Fissile nuclear materials	U (Low Enriched) ²³⁵ U ²³³ U ²³⁹ Pu
Fertile nuclear materials	²³⁸ U (Depleted) ²³² Th
Radioactive sources	¹³⁷ Cs Industrial Gauge Source ²⁴¹ Am Fire Detector Foil ⁶⁰ Co Medical Source
Any other type of chemicals (non-nuclear)	All poisons, pesticides, heavy metal pollutions, etc..

¹ ranking: very low, light, moderate, intermediate, high, heavy, severe

There has been an intensive work on illicit trafficking in the past with the participation of national governments and international organizations such as IAEA, UN, EU JRC, EUROPOL, GICNT. Formal actions regulations and cooperation issues as well as collaboration means are well defined especially on the operations. Several missions are completed, and successful action plans are implemented.

The approach adopted in this paper starts from the beginning of the problem of identification of “illicit trafficking risk” in order assist the security risk researchers and academicians with logical approaches [4, 5, 6]. It differs from the wide range of risk related works in literature by including new stakeholders in the scenarios as main actors in addition to formal authorities (police, intelligence services, customs, nuclear laboratories, state authorities...) The main stakeholder is introduced as women organizations. Women in Nuclear in particular.

Radioactive and nuclear materials smuggled for illegal uses always cause a threat to human health and environmental safety whether they are seized or found abandoned or may never be discovered.

A disturbing fact is that the number of the undiscovered smuggling cases might exceed the number of the discovered ones. Undiscovered radioactive materials (or non-radioactive toxic chemicals smuggled by thinking that they are radioactive) probably may create significant environmental risk and environmental safety issue. Where they are taken? Where they are stored or where they are dumped? Are they causing serious environmental pollution of water resources, agricultural lands and products? Is there a public awareness on the probability of undiscovered spills and dumping?

In the PRA approach, risk of an event is defined as the product of the probability of occurrence of the event considered and the effects or damages it produces.

Risk = probability of occurrence X consequences

The probability of occurrence can be assessed by statistical methods or by an analysis of the feasibility of the occurrence of the event. Need to identify possibility of occurrences of events:

- Low probability low consequence.
- Low probability high consequence.
- High probability low consequence.
- High probability high consequence.

The effects or damages are determined by selecting different criteria and quantifying the effects. In the qualitative risk assessment, the criteria chosen for the effects are the size of the area affected, the health effects on people, the damage on the environment and the effects on economics.

PRA logic applied for tracking missing sources

PRA logic may be a practical tool for investigating the cases of missing radioactive material and illicit trafficking and trans-boundary movement scenarios. For example; if some kind of nuclear material or a radioactive source is reported or discovered by inspection as “missing” from a nuclear establishment of a country. Initiating event classification, construction of event tree and fault can be a practical tool to imagine /guess the possible route of the missing source. The reality of this scenario can be questioned. However, although strict security and safeguards are imposed in many countries, stealing, losing or dumping some radioactive sources, after being used for medical purposes still occurs at certain rate.

PRA logic can be applied to investigate such cases. Analysis starts with initiating event selection before constructing an event tree.

As a preliminary example, initiating event probabilities are listed, such as:

- It may be smuggled by some workers within the organization for ...purposes.
- It may be stolen by thieves from outside.
- It is not smuggled but lost.
- It is thrown away by mistake.
- It is smuggled, failed to be transported for sale and dumped as waste.

Then all routine security systems and emergency safety systems including human factors (laws, regulations, security levels, alarms, detectors, persons responsible for each action, transport routes, border check points) are listed. Event trees and fault trees are constructed. These trees indicate most probable roots for illegal transportation as well as where systems, security officials/personnel performed their actions successfully or failed.

Fault tree constructions enable the diagnosis of the weaknesses in the security systems. This methodology is very similar to probabilistic risk assessment employed in nuclear safety. Followed by recommendations for improvement.

4. RISK REDUCTION AND PREVENTION

4.1. How to prevent /reduce nuclear terrorism risk in the region?

The priority issue of prevention of nuclear terrorism in the region of interest is the strengthening national and regional nuclear security systems. This can be best achieved through:

- Enhancing national and regional nuclear detection capacities.
- Strengthening transboundary security measures concerning detection equipment and manpower.
- Improving security measures and regulations related to logistics.
- Strengthening security network of road, rail, marine and air transportation.
- Tightening the security measures of nuclear facilities and materials.
- Establishing well-designed coordinated emergency response plans.
- Reviewing emergency plans and rehearsing periodically.
- Facilitating prompt effective information exchange among countries as well as among other stakeholders.
- Analysing past smuggling events and new scenario-based events.
- Ensuring a secure global digital information and communications infrastructure.
- Improving intelligence capacity and information sharing.
- Establishing information management scheme in 3 steps: national, inter regional and regional.

4.2. Stakeholder involvement

During information management process divergent interest of stakeholders in the region must be taken into the account. Such as;

- Central governments
- Municipalities
- Local people
- NGOs
- Environmentalists
- Investors
- Private national energy companies
- Giant multinational energy companies
- International agencies, organizations
- Public at large
- Policy makers
- Media
- Women Organizations

5. INFORMATION SHARING

"*Think Globally, Act Locally*" Principle urges people to consider the health of the entire planet and to act in their own communities. It was first used in the environmental concern by volunteers. The term is increasingly applied to initiatives in several fields. This thinking in principle may be quite appropriate to the regional efforts to combat nuclear terrorism.

5.1. Information availability on nuclear terrorism in the region- The current status

In the region of concern, i.e. The Black Sea Region, only the official organizations in each country are involved in obtaining and pertaining information regarding illicit trafficking and security issues including the risk of nuclear terrorism. Therefore, very strict rules applied for confidentiality of the information. Of course, it must be emphasized that there are several international laws, regulations, conventions and agreements that have to be observed by the national authorities.

Fast and efficient information exchange and information sharing/reporting exist for example between the national atomic energy authorities of the IAEA member countries and the IAEA. Therefore, apart from the current classical system, one cannot really speak of either any transparency or any means of information sharing facility between the stakeholders listed above. As far as it is known, only formal governmental communication channels exist.

In most countries it is a classical way to keep all information very strictly within formal authorities only and usually within high officials with the incentives of keeping up the tight security measures. However, information sharing related to nuclear and bio terrorism with more stakeholders and with other nations is a new and modern issue. Moving away from very strict confidentiality to some levels of transparency is a new policy.

The level of information sharing may be satisfactory and efficient or may not at all satisfactory or may be in between. Again, probabilistic approach can be used for assessment.

Level of openness or transparency in nuclear security issues is a very sensitive subject. Like the debate on “how safe is safe enough” and “how secure is secure enough”, “how transparent is transparent enough” and “How strictly confidential” information could be transferred into “strictly useful” information to withdraw more insights into the complex probabilistic security issue of nuclear terrorism should be open to discussion.

5.2. Proposal for a Regional Risk Management Network -NURMAN

GICNT (The Global Initiative to Combat Nuclear Terrorism) Statement of Principle clearly identifies the “Information Sharing” as one of the key activities to be promoted [9-10]. Therefore collecting, analysing, and effectively sharing information and intelligence is vital to the nuclear security and to reduce the risk of nuclear terrorism.

The information collected must be analysed as well as shared by the national legal authorities, other related stakeholders and by other nations. Information sharing process whether it is scenario-based event or a real event with immediate security and emergency actions involved must consider all national legislations, law and international agreements and obligations. However, the extend of information sharing may as well depend on the attitude of managers or top legal administration officials.

A fictive regional **NU**clear **Ri**sks **MAN**agement Network (NURMAN) is proposed to strengthen efforts against nuclear terrorism among the countries in the region of interest [11]. Black Sea region is selected as a model for the case study. Fig. 1. Shows the map of the region of interest.

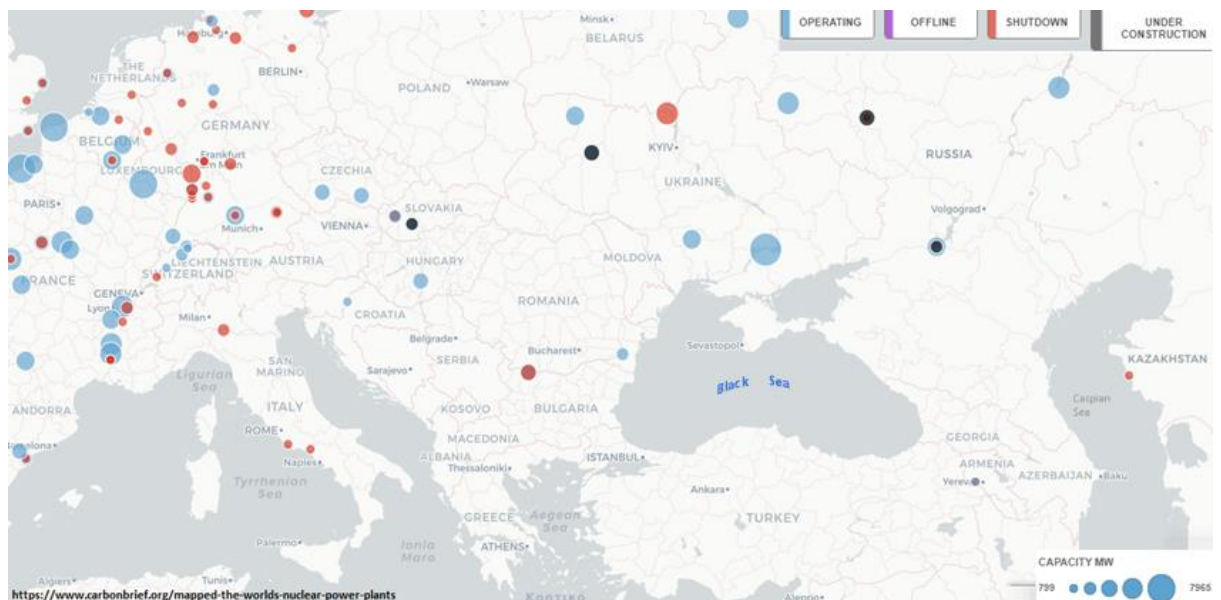


FIG. 1. Map of the Region of interest for NURMAN network showing NPPs [12].

If international support is to be provided the proposed model may be extended for the establishment of a regional strategic risk management centre for nuclear terrorism. NURMAN Centre can be designated as an independent NGO or an intergovernmental regional agency.

The aim of the regional network/centre is the establishment of stronger communication for collecting and analysing data related to nuclear terrorism and exchange the security knowledge and experience between neighbouring countries in the region.

The centre of the network could be based in Turkey, Istanbul. Turkey is a bridge between East and West with unique geopolitical issues. Turkey's role in the region occupying main transport routes in between Europe and Asia may be leading in all regional security activities.

All countries in NURMAN network/centre as focal points providing data to the centre for joint analysis and sharing the information promptly. Fig.2. illustrates the basic network of communication.

Centre's main objectives are proposed as being:

- Establish a close contact with all related international organizations.
- Start accumulating data related to past events occurred in the countries.
- Evaluate qualitatively main nuclear risk factors in the region; initiating events frequencies and consequences.
- Organize border practices jointly with network focal points and analyse the outcomes.
- Identify several of the key parameters, key persons, key sectors and weak points for illicit acting and smuggling
- Propose appropriate policy options for reducing the risk of nuclear terrorism.
- Propose new diplomatic approaches for new bilateral agreements between the neighbouring countries on the most probable routes for illicit trafficking for further securing borders, ports, airports and water resources.
- Organize annual meetings with participants from all countries in the region.
- Initiate/facilitate public awareness programmes in nuclear security issues in countries of the region as well as promoting safety and security culture.
- Integrate women organizations and women researchers into NURMAN structure as one of the main stakeholders.

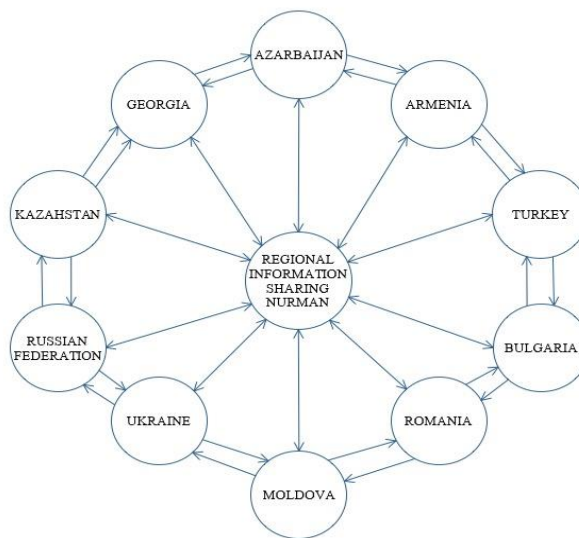


FIG. 2. Draft flow sheet of fictive regional information sharing network NURMAN.

Each focal point should promote/increase its own communication means with their domestic legal authorities, universities, private sector and NGOs. The priorities of national nuclear authorities, national rules and regulations as well as international obligations will be all taken into consideration respectfully by functioning the Centre.

6. CONCLUDING REMARKS

Nuclear terrorism risk is still one of the major international security issues although very intensive international efforts have been spent in recent years to prevent it. It looks as though it is going to be in the centre of international security policies within the next decades to come.

With the continued expansion of nuclear technology and the deployment of a global nuclear fuel cycle nuclear and radioactive materials have become increasingly prevalent. If a weapon, weapons grade material, any radioactive material is taken out of the storage or a facility it has the probability of being transported, stored unsafely, spilled, misused or dumped in anywhere, in any country. Therefore, cooperating and implementing effective national, regional and global nuclear security regulations and standards are vital for public health, environmental safety, security as well as the economic benefits of the countries involved.

Improving nuclear security is the most important factor to reduce the global risk of nuclear terrorism. It is essential to secure all nuclear facilities, all nuclear weapons, potential nuclear explosive materials and toxic chemicals against any risk of mishandling.

In detecting and preventing terrorist attacks, due to illicit trafficking of nuclear materials, Probabilistic Risk Assessment can be an effective tool to determine the accident sequences that lead to system failures, to remove weak links of the system, and to help those who regulate the shipping and port establishments.

A regional information sharing system is proposed for the strengthening the regional nuclear security efforts and information management. The Black Sea region is selected as a model to develop such a system of nuclear risk communication. A network called NURMAN is proposed to be established in the region with its centre being in Istanbul. Women organizations, Women in Nuclear particular is included in the model as one of the main stakeholders.

There are various important steps that can be taken jointly in the region of interest by starting with effective information sharing process. Through accumulating common data base of incident analysis and assessment; lessons learnt would be very useful tool for policy makers and administrators of the nuclear facilities to increase or strengthened security levels. Assessment results would also be the most useful and practical tool to prepare for emergency preparedness plans.

By employing the principle “*to think globally to act locally*” as well as regional collaboration efforts, recommendations can be produced for further steps to reduce risk as a defence against nuclear terrorism threats.

One of the most effective ways to prevent nuclear terrorism is to create/increase security culture and public awareness on the catastrophic consequences of nuclear terrorism and illicit nuclear trafficking.

Final target is to ensure regional capability that can dramatically diminish the consequences of chemical, biological, radiological and nuclear terrorism risks for the peace and security of the region and the world.

Views and opinions expressed in this paper are the author’s own responsibility. They do not necessarily reflect views of any official organization.

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