LALN
Latin American and Caribbean Leadership Network
for Nuclear Disarmament and Nonproliferation

Terror Unleashed

An assessment of global and national impacts of a nuclear terrorist attack

A call for awareness and action

2016

About the Latin American and Caribbean Leadership Network (LALN)

The LALN is a network of more than 20 highly respected political, military, diplomatic leaders, and experts from nine countries across Latin America and the Caribbean, who work to reduce global and regional security risks.

Under the motto: “No security vulnerability in our countries must lead, either by act or by omission, to increase nuclear risks anywhere in the world,” the LALN members work to raise awareness, shape public opinion and positively influence quality policymaking. The main focus is nuclear disarmament, non-proliferation and nuclear security issues.

The LALN is led by Irma Argüello, Founder and Chair of the NPSGlobal Foundation. The head office is located in Buenos Aires.

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An assessment of global and national impacts of a nuclear terrorist attack

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* Any opinions, findings, conclusions, or recommendations expressed in this document are those emerging from the work of the LALN/ NPSGlobal Expert Group and do not necessarily reflect the views of any of its members in particular, nor those of any of the institutions or individuals who participated or supported activities related to this research.

Foreword

By Irma Argüello

How would our lives be affected, if terrorists managed to detonate a nuclear bomb in a capital city anywhere in the world? To what extent, and in which way, such act would change our present and our future, that of our country and of others?

This document, developed by a high-level multidisciplinary Expert Group convened by the NPSGlobal Foundation for its project, the Latin American and Caribbean Leadership Network (LALN), aims at demonstrating through systematic analysis that if such an attack were to take place, multiple negative impacts would spread promptly around the globe.

Intuitive thinking shows that such act would undoubtedly draw a line in the history of humankind. In fact, it would trigger deep changes in all the meaningful dimensions of human activity, and in the way that countries and individuals relate to one another. Such global disruption would affect not only the balance of global and regional power, and the levels of confidence between states, but also the legal framework that regulates international relations. Implications would reach military affairs, the global economy and finance, the international trade, and consequence of panic and chaos, the behavior of individuals and societies. It is evident that one single act can unleash terror as never seen before.

Beyond the primary destruction and losses derived from the attack, this report tries to bring light on the less obvious impacts, that bear a large influence on the strategic aspects of human activity, globally and that of groups of countries with similar profiles.

The document specifically aims to resonate with policymakers, by offering them perspectives on the many concrete ways that nuclear terrorism threatens national interests, in all countries.

The concepts and recommendations given here stem from the conviction that further international efforts are essential to prevent that an attack like the one described here never happens.

The detonation of a nuclear device, by states or non-state actors, though hard to accept, is today a very plausible scenario. We live in a world of growing insecurity where explicit and tacit agreements between the most relevant powers - which upheld global stability during the post-Cold War – are giving way to increasing mistrust and hostility.

**No country in possession either of nuclear weapons or of weapons-usable materials can guarantee their full protection against nuclear terrorism or nuclear smuggling.
Nor is it realistic to conceive of a full compensation to others in the international community, if a catastrophic event happens, because of any country's acts or omissions**

While the current nuclear weapons arsenals, with about 15,350 warheads, involve risks of intentional or unintentional use, the threat of nuclear terrorism is there and increasing. Since more than a decade ago, Al Qaeda, Aum Shinrikio and other terrorist groups have expressed their will to acquire fissile material to build and detonate an improvised nuclear bomb. None of them was able to fulfill that goal. Yet, we should ask what would happen if any of the current active groups such as the Islamic State (IS) or Boko Haram, or any other in the future succeeds in taking the quantum leap between today's "low-tech" attacks and a "high-tech" one, involving a nuclear bomb?

The dismantlement of a nuclear smuggling network in Moldova, in 2015, put in evidence that there is an illicit market for nuclear weapons-usable materials and there are sellers in search of potential buyers. It also highlighted the dangers posed by vulnerable nuclear sites in many locations around the world, from which such materials can be easily obtained. Preventing the connection between traffickers and potential perpetrators is a battle against time to fight on all fronts.

According to the 2016 Nuclear Security Index by the Nuclear Threat Initiative, 24 countries still host inventories of nuclear weapons-usable materials, stored in facilities with different degrees of security. Such dangerous diversity is the consequence of a traditional mindset, which sees nuclear security as an exclusive matter of states' sovereign decisions. However, this report calls for a review of such traditional concepts, taking into account that a security flaw in a country can affect many others.

In terms of risk, it is not necessary to hold nuclear weapons or weapons-usable materials or facilities for a country to be functional to nuclear terrorism. Structural and institutional weaknesses may favor illicit trade of materials. Permeable boundaries, high levels of corruption, weaknesses in judicial systems and consequent impunity may give rise to a series of transactions and other events, which could end in a nuclear attack.

In light of these considerations, this document calls on all governments to acknowledge their responsibilities as key actors in the global effort to prevent these acts. It is our purpose to influence leaders in a positive way, to make this issue a priority in all governmental (and non-governmental) agendas. This effort should involve all relevant actors, in every nation.

As we announced last March during the 2016 Nuclear Security Summit in Washington DC, we feel that this is the right time to release our report. Global leaders discussed then the future of joint international efforts against nuclear terrorism, in all its forms. Now it is essential to put those ideas into practice, and even enhance them by closing the current nuclear security gaps. In this sense, we are proud to make an original contribution to such an important discussion.

Finally, the goal that we set when we started this project will be completely fulfilled if this report serves as inspiration for further innovative thinking and for actions to enhance nuclear security. We at the Latin American and Caribbean Leadership Network see these steps as essential to implement a comprehensive approach to reduce nuclear risks, which stands as one of the guiding principles that drives our action.

Irma Argüello

Founder and Chair, NPSGlobal Foundation
Head of Secretariat, Latin American and Caribbean Leadership Network (LALN)

Executive Summary

Why this report?

Urgency and need for prevention: IMMINENT RISK

This report focuses on the analysis of an hypothetical case: the detonation of a nuclear bomb built by terrorists in a large city of the developed world. It is a "low-probability" event; however, the potential damage that such attack would cause makes it a "high-risk" one. There is little doubt that an attack of this kind would trigger unprecedented chaos and negative impacts worldwide, but there are few details regarding what such negative impacts truly involve. This makes it critical to perform a thorough analysis of the ways in which it could happen as well as of the impacts if it were to happen, all this to enhance prevention and to shape a reasonable preparedness for response.

Evidence is clear: no country that holds nuclear weapons-usable materials is able to grant full protection to them from theft and subsequent black market sales or from direct use by terrorists to make a bomb. Likewise, no country that does not possess such materials may believe that its territory is free from the reach of organized groups trying to conduct criminal operations involving them.

This document highlights not only the need to protect nuclear materials (which is, of course, paramount) but also the threat posed by their illicit trade across the world. In this regard, all countries must feel involved because the risk is common to all.

The identification of three types of countries, as we suggest in this document, enables readers to picture the main impacts that a deliberate terrorist explosion of an improvised nuclear device (IND) would cause to the international system and, differentially, to countries of similar profiles.

After the last Nuclear Security Summit, in April 2016, the challenge is now to keep this topic high on the political agendas of governments and non-governmental organizations, as a first step to prevent an attack that neither any country, nor the international community as a whole, could successfully face.

This Executive Summary shows the LALN/ NPSGlobal Expert Group's most relevant findings and recommendations for governments and non-governmental actors. Thus, this research has the main purpose of encouraging such actors to make positive decisions for prevention of nuclear terrorism at national, regional, and global levels.

The least desired future

Summary of global and national impacts of a nuclear terrorist attack

A small and primitive 1-kiloton fission bomb (with a yield of about one-fifteenth of the one dropped on Hiroshima, and certainly much less sophisticated), detonated in any large capital city of the developed world, would cause an unprecedented catastrophic scenario.

An estimate of direct effects in the attack's location includes a death toll of 7,300 to 23,000 people and of 12,600 to 57,000 people injured, depending on the target (geography and population density).

Total physical destruction of the city's infrastructure, due to the blast (shock wave) and thermal radiation, would cover a radius of about 500 m from the point of detonation (ground zero), while ionizing radiation greater than 5 Sievert, compatible with the deadly acute radiation syndrome, would expand within an area of 850 m of radius from that point.[1]

However, consequences of a nuclear terrorist act of this kind go far beyond the effects in the target country. Due to global inter-dependence and interconnection, negative impacts would promptly propagate worldwide.[2]

Global and national security, economy and finance, the international governance and the national political systems, as well as the behavior of governments and individuals, all would be put under severe trial.[3]

This analysis intends to give more precision to what our intuition can tell us. It shows that at global level, the sequence of events definitely would bring with it a series of negative impacts.

An overwhelming panic would hit individuals, societies and governments worldwide. It is likely that there would be an unprecedented chaos and consequent disruption of human activity, in all its dimensions and in all countries, which could last for years. A terrorist nuclear detonation would affect global security and regional/ national defense schemes.

The analysis predicts an increase of global distrust and consequent rise of tensions among countries and blocks that could lead to the escalation of present conflicts and the emergence of new ones. Some of the potential symptoms would be:

- Decrease in states' self-control, leading to possible hostilities and antagonist positions alongside a general rise of tensions.
- Increase of unilateralism in the use of military power (conventional and nuclear).
- Increase of military expenditure (modernization/ growth in numbers) for conventional and nuclear arsenals.
- In the worst scenario, potential nuclear weapons exchanges between states, depending on the evolution of international tensions.

Regarding the economic and financial impacts, the experts concluded that the terrorist act would lead to a severe global economic depression, which would likely last for years after the attack. Its duration would be strongly dependent on the course of the crisis. The main indicators of such crisis are:

- Two percent (2%) fall of growth in global GDP in the next two years following the attack.[4]
- Four percent (4%) decline of international trade after two years.
- Fall of foreign direct investment in developing and less developed countries.
- Increase of unemployment and poverty in all countries. Global poverty would raise about 4% after the attack, which implies, at least, 30 million more people living in extreme poverty, in addition to the current estimated 767 million.
- Severe decline of the international humanitarian aid toward low-income countries.

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[1] See section on "The Detonation of a Terrorist Nuclear Bomb."

[2] In this document, we primarily will use the term *effect* as an outcome variable (and less frequently, the term *consequence* as its synonym). Such effects/consequences can be direct (related to the detonation) or indirect. We will reserve the term *impact* for the big scale changes, usually negative ones, derived from such effects; thus, the term impact will denote influence. Hence, in some cases, small effects may trigger big scale impacts.

[3] See a detailed analysis of impacts for each dimension in the corresponding sections.

[4] Equivalent to the decline in economic activity due to the 2008 Global financial crisis, seen as the most severe since the end of the Second World War.

As to impacts on international relations, it is expectable a breakdown of key doctrines involving politics, security and relations among states, including concepts, instruments, and institutions. The international tensions could lead to a collapse of the nuclear order, as we know it today, with a consequent setback of nuclear disarmament commitments.

The behavior of governments and individuals would radically change after the attack. Internal chaos fueled by media and social networks would threaten governance at all levels, with greater impact on those countries with weak institutional frameworks.

Social turbulence would emerge in most countries, with the consequent attempt by governments to impose restrictions on personal freedoms to preserve order (possibly by declaring a state of siege or state of emergency).

Legislation would surely become tougher in terms of human rights. Other negative impacts include:

- Increase of social fragmentation, with a deepening of antagonistic views, mistrust, and intolerance, both within countries and towards others.
- Resurgence of large-scale social movements fostered by ideological interests (antinuclear groups, defense of individual rights, etc.) and easily mobilized through media.
- Circulation of fake information through social media, raising panic, which might result in misguided actions that deepen the existing crisis.

It is worth noting that the severity of impacts at national level will depend on countries' level of development, geopolitical location and resilience, as the research shows.

A nuclear attack by terrorists would lead to a worldwide economic depression as severe as the 2008 Global financial crisis. At least 30 million more people would fall into extreme poverty.

Recommendations

It is evident that given the magnitude of the global impacts, it is unlikely to achieve an effective post-attack mitigation following a nuclear bombing incident by terrorists, regardless of the resources involved.

Considering this situation, it is essential for countries to make every effort to prevent nuclear terrorists from fulfilling their goals.

Similarly, to prevent any attempt by non-state actors to sabotage nuclear facilities – with conventional or cyber means - or to conduct a dirty bomb attack. In other words, prevention is the way forward to counter nuclear terrorism.

The "primitivism" of currently active terrorist organizations gives a certain space to do what is necessary to enhance the current nuclear security effort, concerning prevention and response. However, the perception of "low likeliness" of a nuclear terrorist attack neutralizes the required sense of urgency in decision-making.

It is clear that the international community should avoid procrastinating about doing what is necessary, before the terrorists increase the sophistication of their means.

In this regard, it is important to take into account that:

- As a universal threat, nuclear terrorism requires universal action.
- Although a terrorist nuclear detonation is a "low-probability" event, its vast negative impacts, make it a "high-risk" scenario. Therefore, it is imperative that governments consider this reality when setting priorities, and making decisions about nuclear security.
- There are shortfalls in the current nuclear security regime that shrink its ability to deal successfully with the threat, and then it should be improved based on international cooperation.
- As a security issue of global common interest, all countries should involve in strengthening nuclear security. Such essential involvement relates directly to the degree of understanding of policymakers about the many ways in which nuclear terrorism threatens their countries' national interests.

How to avoid the catastrophe?

Summary of national measures of prevention

Every country should adopt preventive measures to reduce the risk of occurrence of a nuclear terrorist attack, and consider how to keep negative impacts to a minimum level, if it were to occur.

It is essential that governments understand how an incident in their territories could affect not only themselves but also other countries, so as they can take full responsibility for preventing any criminal act involving nuclear materials and facilities.

The international community should jointly work to enhance nuclear security. It is clear that national and international actions are synergic and necessary to build a strong global prevention system. In practical terms, the essential measures that all countries should take include:

Given the magnitude of the global impacts, it is unlikely to achieve an effective post-attack mitigation following a nuclear detonation by terrorists. In other words, prevention is the only way forward to counter nuclear terrorism.

- Secure all their nuclear materials and facilities (civilian and non-civilian) to an agreed minimum acceptable level.[5]
- Reduce/ eliminate HEU/ separated plutonium (civilian and non-civilian) with the support of reactors conversion, non-HEU production of medical radioisotopes, and down-blending nuclear technology, among others.
- Become accountable for their nuclear security practices toward the international community.
- Implement reliable border control systems.
- Be a state party, and implement the provisions, of the key treaties that regulate prevention of terrorism and nuclear materials. It is especially important to become a party of the Amended Convention on the Physical Protection of Nuclear Materials (CPPNM), currently re-named Convention on the Physical Protection of Nuclear Materials and Nuclear Facilities (CPP) and of the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT).
- Implement global measures within the scope of the United Nations Security Council (based on Resolutions 1373 [2001] and 1540 [2004]). They complement the existing treaties through the inclusion of new monitoring instruments, which allow strengthening of supervision over nuclear materials and weapons.
- Establish strategies to comply with nuclear security commitments, as well as establish sound plans to put them into practice. To this end, countries should consider the INFCIRC/869 ("Strengthening Nuclear Security Implementation") as a valuable reference.[6]
- Participate in voluntary international partnerships aimed to strengthen the global capacity to prevent, detect, and respond to nuclear terrorism, such as the Global Initiative to Combat Nuclear Terrorism (GICNT), the Global Partnership (GP) against the Spread of Weapons and Materials of Mass Destruction and the Proliferation Security Initiative (PSI). It also includes building confidence with other countries, by promoting transparency and information sharing.
- Seek to train the nation's personnel at all levels involved in handling and securing nuclear materials (and facilities) as well as their associated technology, including manufacturing, transportation, use, recycling and elimination.
- Coordinate nuclear security efforts with nuclear disarmament and non-proliferation ones. Countries should also work to make operational the essential arms control and disarmament international tools, such as the Comprehensive Nuclear-Test-Ban Treaty (CTBT), a Fissile Material (Cut-Off) Treaty (FMCT).It implies embracing a comprehensive approach for nuclear risks reduction.

[5] There is big controversy about whether or not to include the security of non-civilian facilities and materials (83% of total), as well as the security of warheads currently in the arsenals. Taking into account that non-civilian materials and facilities can be as vulnerable as civilian ones, an effective prevention should include such materials and facilities. The challenge is to advance the recognition of the risk, in order to define a joint strategy to protect and prevent incidents involving not only civilian but also non-civilian nuclear assets.

[6] See "Recommendations."

How to face it better, if it occurred?

Summary of national and international measures of preparedness and response

A sound prevention strategy is crucial, but countries need to have adequate mechanisms and capabilities in place to manage the crisis, if it occurs. These capabilities of preparedness and response should include:

- Negotiation and approval of innovative crisis management protocols, worked out jointly within the UN Security Council, or at least certain guidelines that may facilitate international cooperation.
- Enforcement of national policies and contingency plans, to respond possible attacks, based on best practices, but avoiding causing panic in society.
- Establishment of mechanisms for prompt decision-making, which may include the creation of crisis management teams/committees or "ad hoc" action groups. These types of mechanisms should be fostered in all government agencies, including legislative and judicial bodies whose intervention may prove essential immediately after an attack. It is of utmost importance to train the personnel responsible for such mechanisms, on the various related topics, including communications and media contacts.
- Creation of contingency funds to mitigate the economic impacts.
- Improvement of the international control over measures taken by states that could affect human rights and individual guarantees. Fostering a culture of respect, tolerance and encouragement of diversity, and identifying civilian populations as a group victim of terrorism will help reduce the upcoming social chaos.
- Definition of protocols of response in the public and private sectors. For example, mechanisms for backup of information, replacements in the chain of command, and alternative sites in circumstances in which headquarters/central offices are disrupted. Similarly, evacuation systems, identification of alternative transport systems and hospitals, definition of secondary communication routes (airports, ports, neighboring roads), rules of displacement in emergency management systems, catastrophe prevention, and adjustment of health systems to cope with these types of events, as well as protocols that define the armed forces and security forces role in the response. Such protocols can help avoid confusion and contradictions or overlapping of intervening agents.
- Priority-setting in economic terms, to secure sustained fast access to basic goods (water, food, fuel, medicine).
- Design of crisis management mechanisms to secure the continuity of payment systems, within the procedure guidelines of national economic agencies.
- Creation of crisis management mechanisms in formal multilateral institutions (community banks, interstate cooperation blocks) to mitigate impacts and secure aid flows.

How to strengthen the global nuclear security effort?

Set a successful legacy of the Summits

Recommendations highlight the importance of keeping up momentum for the efforts made to date, as well as the need to enhance them in the future.

It is essential to maintain quality spaces of dialogue where countries can discuss and agree on cooperative actions to improve the current architecture, beyond any bureaucratic burden.

The initiative of 40 states, together with the UN and Interpol, which establishes a monitoring team, the Nuclear Security Contact Group (NSCG), is promising in this regard. It is also positive that this brand-new space, a sort of continuity of the Sherpa group, opens up the possibility of interaction between governments and non-governmental organizations.[7]

[7] See more details in "Recommendations."

Reach global participation

In a similar way, it is essential to make the nuclear security debate and implementation as inclusive as possible. Getting commitments on prevention, preparedness and response from just the 53 participants in the Summits process is not enough. The ultimate goal is to achieve an active participation of every country around the globe.

In the post Nuclear Security Summits era, it is crucial that the international community finds sustainable political forums to discuss and agree nuclear security strategies, and a roadmap for further improvements.

For this purpose, and as a complement of what the Nuclear Security Contact Group and the IAEA can do, it is essential what Summit participants can generate in their regions, through the appropriate regional forums.

A central point is to restore nuclear security cooperation with Russia, despite its withdrawal from the Summits process. In this sense, countering a common threat, as it is nuclear terrorism should be a matter of union rather than of conflict among states.[8]

In addition, promotion of awareness and debates with multiple actors about nuclear security should also include a vast interaction between governments and the expert community. In this regard, joint work as well as academic and educational events can help raise awareness and understanding of the threats and improve technical knowledge.

Countries to bind themselves to a minimum acceptable set of nuclear security rules

After four Nuclear Security Summits, the international community should be able to build up over that positive experience, in order to design a suitable (and sustainable) global nuclear security system, which represents a clear improvement over the current architecture.

This ultimately implies a challenge to the current traditional mindset, which sees nuclear security decisions as a matter of sovereignty of each state. It is essential to reach broad agreements about a minimum acceptable level of nuclear security, a baseline that all countries commit to implementing, in the understanding that a security flaw in one of them will surely affect others.

Such a baseline should include a set of best operating practices to implement, as well as agreed mechanisms for confidence building, information exchanges on security measures, and policy coordination.

Combating nuclear terrorism, a universal undertaking

A nuclear terrorist attack will definitely threaten the world order, as we know it. Beyond any doubt, the new scenario will demand new paradigms in politics, law, economy, security, and international affairs**.**

It is in every nation's interest to implement policies aimed at prevention, preparedness, and response to a nuclear attack, irrespective of how close or far from their national borders, it may occur. In this sense, our research counters the belief that certain countries would benefit more than other do from prevention measures.

The Latin American and Caribbean Leadership Network has already expressed in its public documents the importance of warning of such scenarios, in order to raise awareness and to encourage action in every country around the globe.

Today there is more need of leadership than ever to move towards a less insecure world. With the agreement of states about appropriate international rules, the identification of clear priorities at national, regional and global levels, and a quality policymaking worldwide, there is hope that such a catastrophe will turn out to be less likely in the future.

[8] It should be noticed that Russia refused to participate in the 2016 Nuclear Security Summit and its previous preparation process, based on sherpa meetings.

The Detonation of a Terrorist Nuclear Bomb

This section studies the events immediately following the detonation of a rudimentary nuclear bomb, a so-called Improvised Nuclear Device (IND). For the research, we assumed that terrorists built such device with fissile materials obtained from vulnerable storages, located in different parts of the world. The attack takes place in a large capital city of a developed country, herein referred to as the *target country*, which turns out to be a key global power, an international pacesetter. The conclusions here do not intend to be specific to any country in particular, rather to identify the effects and impacts derived from an attack of this kind in any major city in the developed world, whichever it might be.

Given the unique characteristics of the event and the lack of previous historical experience, in terms of speculations and conclusions, the experts decided to stay on the conservative side of the problem. We applied this criterion at the time of making assumptions, defining the dynamics of events, qualifying effects, and quantifying the magnitude of macro impacts. It is worth highlighting, however, that even when we shun an extreme view, the assessed effects and impacts raise powerful warnings, which the international community should take into account.[9]

The device

In our scenario, terrorists detonate a simple highly enriched uranium (HEU) fission bomb of 1-kiloton yield. The manufacture of such device would require acquiring about 50 kg of HEU, with enrichment in uranium 235 close to 90% (weapons-grade material). The volume of the required fissile material is equivalent to a 14 cm cube or a 25 cm diameter sphere. Such material could have been stolen in small quantities from low-security civilian and military facilities in several countries, possibly with the help of insiders to those facilities.

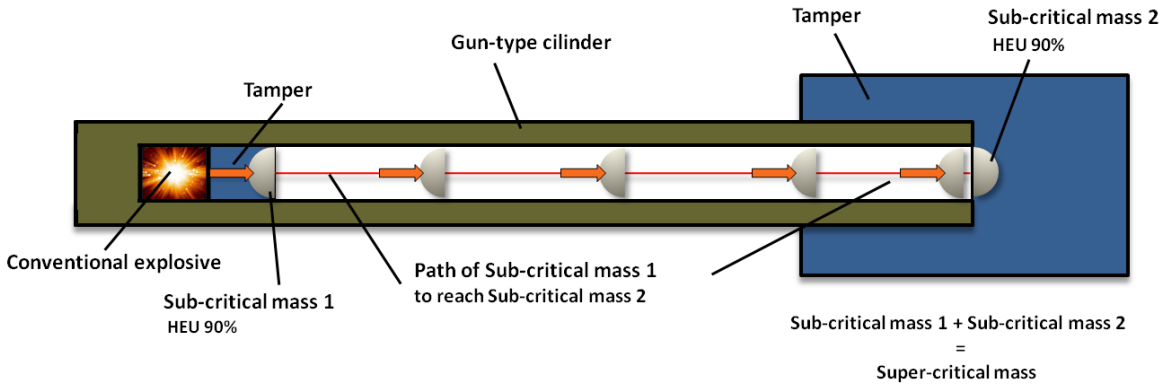
Terrorists could directly have stolen the material or obtained it through dealers in the nuclear black market.

It is reasonable to think that the process of purchase and storage/accumulation of the fissile material (and other materials required to build the bomb) could have taken several years. In addition, that the shipping of the weapons-usable material from the places of origin would have been done by trespassing permeable borders, likely sharing paths and methods with drug traffickers and human trafficking rings, for example.

[9] The methodological criteria that geared this report appear in "Annex 1."

Also, that the country selected by the terrorists as the *haven* to build the bomb, has an institutional situation, which can guarantee the impunity of perpetrators along the process.[10]

After some technical discussions, terrorists would have decided to build a gun-type device, broadly accepted as the simplest configuration for a nuclear bomb and, for that reason, the easiest to manufacture, once in possession of enough weapons-grade HEU. From the beginning, they surely discarded an implosion bomb based on plutonium 239. The reason is clear: although it requires much less fissile material (only 6 kg or a 12 cm-diameter sphere), it involves a more sophisticated technology, unlikely to be implemented with success by non-state actors.



Simplified scheme of a gun-type fission bomb, the configuration that nuclear terrorists would likely use.

Direct and indirect effects of the attack

Within the scope of this analysis, the detonation of such device generates two kinds of effects: direct and indirect. The *direct effects*, whether immediate or delayed, primarily relate to the detonation itself. They are of physical nature, and caused by the interaction of energy released during the fission of the uranium 235 (or plutonium 239) with matter, mainly in the area of the detonation.

On the other hand, the *indirect effects* are secondary to the explosion and may include multiple factors. They create complex causal chains beyond the physical location of the attack. The dynamics of such indirect effects drives the major negative impacts stemming from the terrorist act.

Because of their importance, this report focuses on the indirect effects of the attack. As less obvious, they have been largely underestimated and understudied compared to the direct effects, but it is clear that they generate all kinds of negative impacts reaching global scale.

Direct effects

Briefly speaking, when a fission bomb goes off, an uncontrolled chain reaction produces a ball of fire at the place where the bomb detonated, the so-called *ground zero*. At that moment, *thermal radiation*, a shock wave or *blast*, and a large amount of *ionizing radiation* propagate almost simultaneously from that point.

The interaction of those phenomena with living creatures, the infrastructure, and the environment brings about immediate physical destruction, radiation exposure, contamination, burns and the consequent loss of lives and injuries.

The explosion produces radioactive materials that project onto the atmosphere and circulate to distances away from ground zero, causing the so-called radioactive rain or *fallout*. It expands with the shape of a plume, with an extension depending on the wind direction and speed, as well as on other meteorological factors.

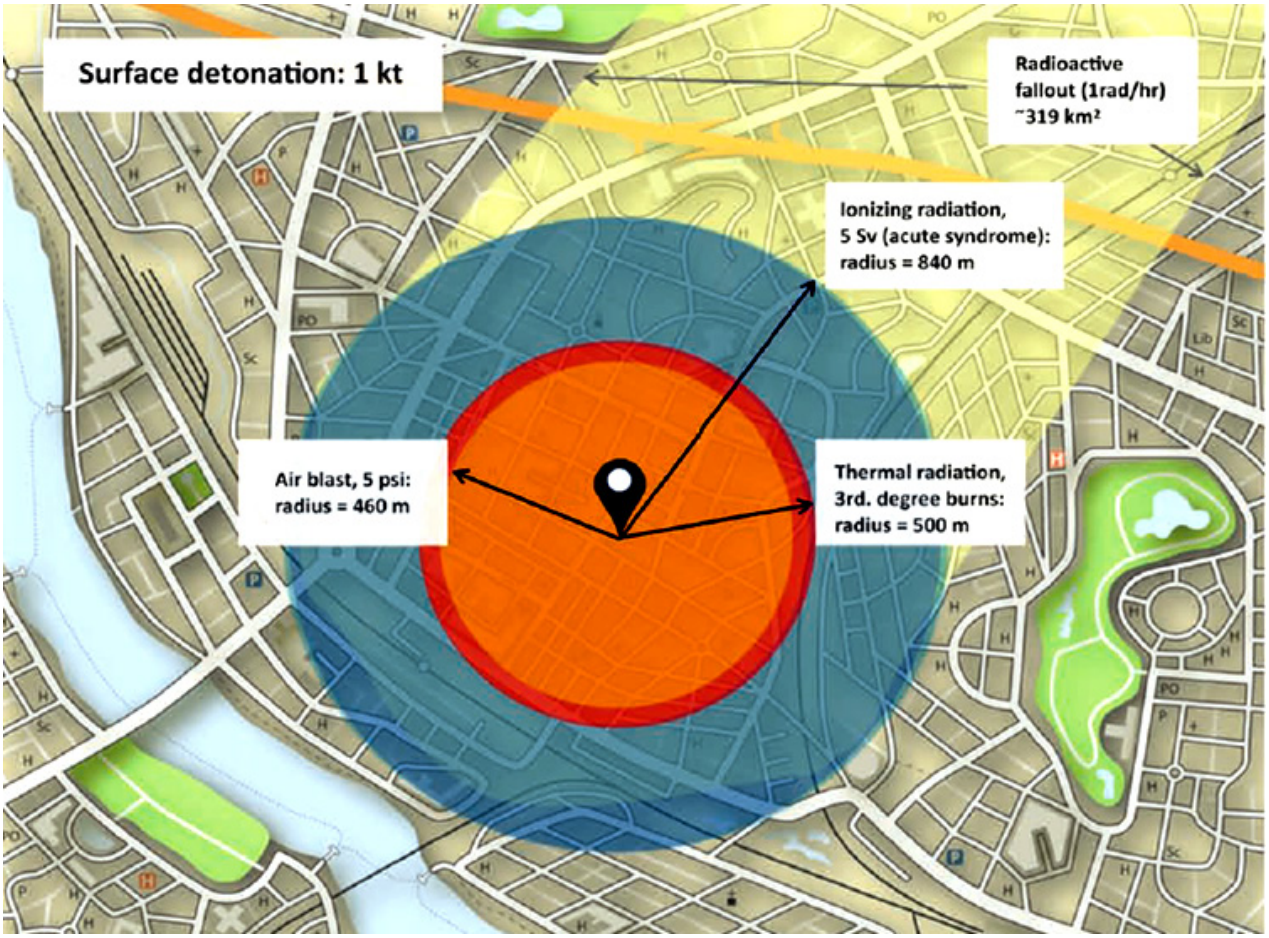
[10] Another possible *haven* would be a country with ideological affinity with the terrorist group.

The fallout can contaminate vast areas far from the explosion. The interaction of the released ionizing radiation with biological matter leads to several types of biological effects, including an increase in the probability of appearance of certain types of cancers and leukemia in exposed individuals. These effects may show up many years after exposure.

The scope, reach, and duration of the direct effects will therefore depend on factors such as the bomb design and yield; the geography and environment of the target; the density of population; and the meteorological conditions, at the time of the explosion.

Range of direct effects

The graph and table show the direct effects of a 1-kiloton crude bomb detonated in a typical large capital city of the developed world. The death toll and number of injured, depend on the population density around ground zero.



Map showing the extent of the direct effects of a 1-kiloton nuclear terrorist bomb in a populated city.

If the yield of the device increases from 1 kiloton to 10 kilotons (a more complex device but still achievable by terrorists), fatalities would rise to about 23,000 to 103,000 and injured people to 78,000 to 213,000, in the same conditions as described.

In the proposed scenario, the attack takes place in a densely populated area, which houses central government offices, the Parliament, and other key economic/financial and commercial headquarters, as well as important private buildings and historical landmarks. It occurs during a rush hour, when the local population is at its peak.

Fatalities	~ 7,300 to 23,000	Depending on the target city
Injured	~ 12,600 to 57,000	
Air blast radius	460 m	5 psi (houses crushed)
Thermal radiation radius	500 m	3rd degree burns, probability 100%
Ionizing radiation radius	840 m	5 Sievert, acute radiation syndrome (50% to 90% mortality without medical care)
Fallout total dose (1 rad/hr)	319 km^2	Irradiation plume

Source: Wellerstein A.,Nukemap.

Indirect effects

Once the detonation occurred, the following events and decisions made by several actors trigger complex causal chains with effects that project onto the global sphere, well beyond the location of the attack.

Such indirect effects can be based, either on facts (without human intervention) or on human decisions. In the latter case, the effects come from human actions/decisions, which determine other higher order consequences, as well as ways in which those effects/consequences unfold.

Assuming the nuclear explosion as the *cause*, primary mortality and physical destruction and contamination of buildings by thermal radiation, blast, and ionizing radiation (*direct effects*) triggers a breakup in the logistic chain. Such breakup will lead to shortages of medical supplies and practitioners in areas distant from ground zero, which will increase, in turn, the number of deaths at hospitals (*fact-based indirect effects*).

On the other hand, due to the terrorist attack, governments decide a reduction of humanitarian aid flows to less developed countries to redirect those funds to security purposes, with an increase of poverty in those countries, *(decision-based indirect effect).*

As mentioned, the assumption that the global system would show sufficient resilience to re-establish a reasonable balance a few years after the attack is one of the bases of this research. This assumption implies in no way a return to an identical situation prior to the attack: even in the most favorable scenario, major global changes would occur.

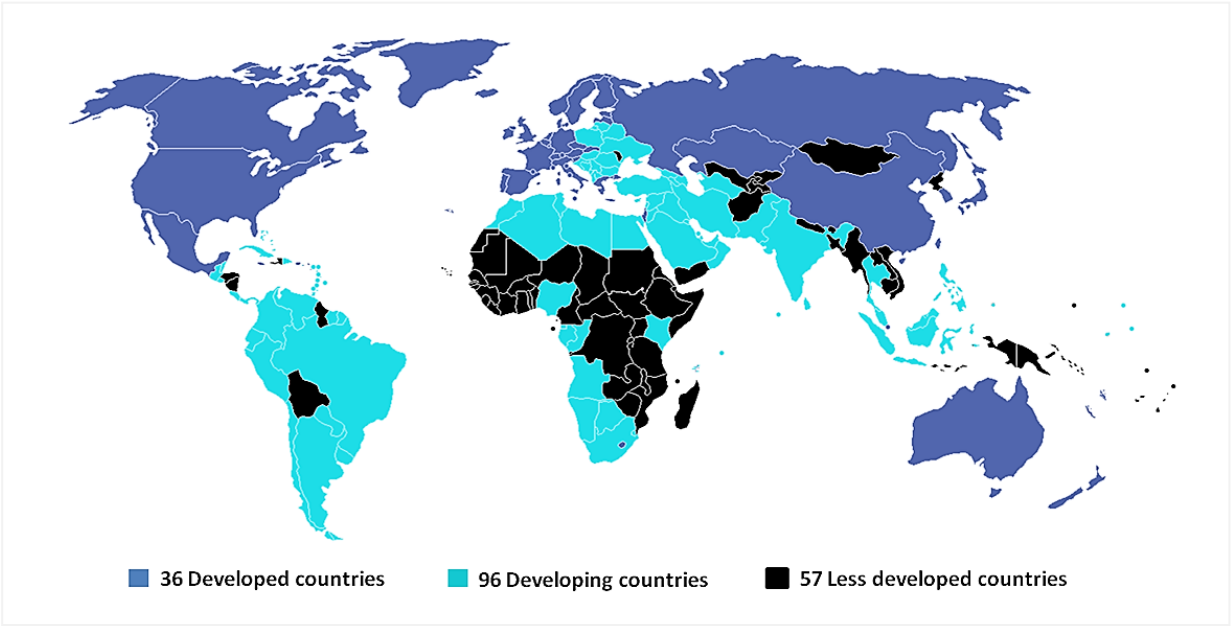
In addition, chaotic sub-scenarios involving either potential secondary terrorist attacks, or even possibly a nuclear exchange between states might emerge, which would lead to a deepening of negative impacts as well to an uncertain recovery of the global balance.

In order to assess the indirect effects and the consequent negative impacts associated with this scenario, the Expert Group chose four dimensions, seen as the most representative and strategic at global and national levels. They are *Security and Defense*, *International Relations*, *Economy and Finance*, and *Government and Society*.

- *Security and Defense* includes the analysis of impacts on the dynamics of international and regional security, and on homeland security. In addition, an assessment of national defense policies and potential decisions concerning doctrines, relationships, and operations, as well as military affairs, intelligence, and issues related to nuclear and conventional arsenals.
- *International Relations* assesses potential changes in relationships among states, foreign policy, and the evolution of the international legal framework, deriving from the attack.
- *Economy and Finance* focuses on the effects on the main economic and financial variables, at global and national levels, as well as the consequences of the incident on foreign trade and on the flow of international aid.
- *Government and Society* addresses the impact of the incident on the institutional framework of countries and potential changes in culture and values, as well as the changes in the behavior of individuals, governments, and non-governmental actors.

Global and national impacts

In order to classify countries in groups of similar profiles, this report used as a basis criteria formulated by the International Monetary Fund (IMF), which distinguish countries in terms of their economic development. This assessment identifies differential impacts in three groups of countries: *Developed*, *Developing*, and *Less developed* ones, as well as for the *world*.[11] [12] [13]



Categories of countries used in this report, based on the IMF economic criteria and data 2014.

A high-risk scenario

A nuclear terrorist detonation is a "low-probability" scenario, which involves huge potential damage. Therefore, it is a "high-risk" event.[14]

However, a common misleading belief, is that "low-probability" incidents are necessarily "low-risk" ones. Because of this belief, impacts on countries' national interests deriving from such type of events tend to be underestimated. Another generalized belief is that an attack of this kind would only affect the target country and, to a lesser extent, neighboring countries.

Due to such misunderstandings, many nations, especially those who see themselves "peripheral" to global power centers, find it difficult to justify investments on prevention of nuclear terrorism, as they view the threat very remote and as of exclusive interest to the "big powers".

Largely because of such ways of thinking, there is currently no consensus-based system for nuclear security to establish a minimum level of binding measures and responsibilities for all members of the international community, beyond what each country can do by itself. In other words, there is no binding system to prevent nuclear terrorism, similar to the comprehensive safeguards (CSAs) regime, which derives from the non-proliferation commitments under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).

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[11] There are other valid taxonomies to classify countries according to their profiles, so that the one selected here is only referential. Annex 1 includes criteria on how this report addresses global and national effects.

[12] The study does not intend to carry out a detailed analysis of the impacts for any particular country, but to outline the way such catastrophic act would affect countries of similar profiles and the entire world.

[13] Although the IMF typifies Russia and China as members of the group of developing economies, given their strategic weight as permanent members of the UNSC and their condition as legal nuclear weapons possessors, we included both in the group of Developed countries for the dimensions "Security and Defense" and "International Relations."

[14] See "Annex 1" for references about risk assessment.

Terror unleashed

Immediately after the explosion, in a radius of five blocks from the place of impact, ground zero, the heat wave triggers uncontrollable fires with thousands burned, while the pressure wave causes most of buildings in the area to collapse, increasing the death toll. Fragments of all sizes hit everything in their path and increase the number of victims. At the same time, thousands suffer exposure to the ionizing radiation.

There is panic and confusion. A countless number of people lie buried under debris. Even beyond ground zero, there are victims and destruction, resulting in more chaos and confusion. There are power outages and gas leaks in the vicinity.

Traffic havoc throughout the city hinders rescue units from reaching the most affected areas. Hospitals and other services cannot operate effectively due to the sheer number of victims and casualties, including those who panic and go to health care units demanding attention. However, most of the people affected have no chance of rescue, due to the inability of any responders to reach them.

According to wind direction and distances, tens of kilometers away from ground zero, people, animals, and the environment begin to feel the exposure from ionizing radiation and contamination due to fallout. The number of victims increases, though it is still unknown.

The first few hours are of utter confusion and panic, and the response from authorities seems too slow. The world already knows about the attack. The media and social networks rapidly spread the bad news including homemade pictures and videos. Amateurs upload videos to the web that hint at a nuclear bomb. This triggers an international alert.

Damage to people and infrastructure, as well as disruption in the functioning of the city are hard to assess. The scope of the area involved, the type of damages, together with the first samples taken, speak of a low yield crude bomb of about 1 kiloton, compatible with an unidentified terrorist attack.

Later on, eyewitnesses in distant areas and the CTBTO detection stations that make seismic and radiation readings in the atmosphere confirm the hypothesis of a nuclear explosion.

There is a cutoff of basic services including gas and electricity in vast areas of the city, either because of the detonation or as a preventive measure from authorities. Areas in and around ground zero suffer telephone, internet and mobile phone disruptions as well.

There is undoubtedly an initial lack of communication, which increases panic and has consequences on the efficacy of the response. It would depend on the city's preparedness levels, but would never be sufficient for the scale of the attack. Destruction and blocked roads alter the ground transportation, making aid difficult and slow to arrive.

Under the circumstances, only some government authorities come out unharmed from the attack. This increases the level of the crisis from a human and operative point of view.

Authorities immediately summon the National Crisis Committee. It enforces an emergency plan, which seems insufficient in light of the situation. Chaos and the collapse of emergency systems mark the aftermath.

Four hours after the attack, the country's head of state who survived the attack, addresses the public on the scope of the catastrophe and categorizes it as a nuclear terrorist bombing.

Shortly afterwards, two fundamentalist terrorist organizations separately lay claim for the attack and hint at the fact that there are more devices ready for detonation in other large capital cities in the world. This leads to panic and evacuations in key cities around the globe.

The first reactions to the attack begin and international aid is set in motion.

In a few hours after the incident, measures to respond and to face immediate consequences are already in place.

Intelligence services begin to work to identify the perpetrators and their potential accomplices and sponsors. This is particularly relevant as no sole group claims full responsibility for the attack. It generates multiple possible explanations.

The United Nations Security Council (UNSC) calls for an urgent meeting.

Security and Defense

The leap from transnational-terrorism attacks using conventional explosives or other almost conventional means (such as the 9/11 planes) to a nuclear detonation, would break the unwritten rule, which reserves the potential use of a nuclear device exclusively to states. Within this brand-new scenario, a catastrophe of global dimensions, even much worse than 9/11, could well come from an invisible face, anywhere in the world.

The crisis would raise tensions and distrust worldwide to a disruptive level, not only because of what happened but also because of what it could happen. A world entering in a new age of uncertainty could create the perfect environment to challenge the notion of security, control, and liberty. The immediate consequence would likely be an increase of unilateral or combined use of force.

This scenario might be a wakeup call to governmental decision makers: “small amounts of weapons-usable fissile materials in the wrong hands can change the course of world events in an irreversible way.” The impact of such a reality is so overwhelming that it would define new lines of action, beyond the rhetoric of the alleged “security” of the world.

How the *sub-scenarios* unfold will determine the potential derivations in practical terms of this paradigm shift. In this regard, several possible sub-scenarios arise. They depend on whether the international community identified any state as sponsor, in any way, of the terrorist group involved in the attack.

First reactions in the target country

The research anticipates that immediately after the attack, once the shock is over, the target country’s government would articulate two levels of response: National Security and National Defense ones.

The first level, National Security, involves the use of armed and security forces to facilitate an immediate response to the disaster, to investigate the attack and its potential local accomplices, to neutralize the potential perpetrators remaining in the territory, and contain the population to avoid panic-driven revolts.

The second level, National Defense, includes actions to maintain a high state of military alert for the protection of territory and national interests within an environment of high vulnerability caused by the attack. The nation would be compelled to give an appropriate response, although not necessarily a proportional one, to the aggressor, transnational-networks involved, and/or to the nations sponsoring them, if identified.

These actions could mean military operations conducted shortly after the attack, as well as possible covert military missions.

It is worth noting that both, government decision-making processes and resources required to implement them, including the approval for any military action, would surely lead to a limited response in time and scope, even in the case of the most developed states.

From the military point of view, given the target country's size and role in the international community, it can be anticipated that the so-called forces for full-spectrum of operations to deal with multiple enemies, scenarios, and potential risks would be available for its use, stand-alone or through strategic alliances. Although their capabilities would be limited, as stated above, we can think of several scenarios in which these forces could effectively operate.

Global impacts

Once the world knows the nature of the terrorist attack, it would enter into immediate alert-status. The great powers would, at first, work to identify the true perpetrators, their accomplices and sponsors, in terms of individuals, organizations, and countries. This early work includes rapidly discarding opportunistic groups who falsely claim to be the perpetrators of the attack. At this point, the research identified four different sub-scenarios, which would result in different decisions and consequences:[15]

Sub-scenario 1

The terrorist group acted stand-alone, with no identifiable sponsor state. It took advantage of security flaws in vulnerable facilities to acquire the fissile material.[16]

(a) The HEU used in the attack, either came from a state permanent members of the UNSC (United States, Russia, China, France, and UK) or from any of its strategic allies.[17]

Once the initial mistrust dissipates, it is likely that explicitly and by consensus, measures would focus on the fight against terrorism in general and nuclear terrorism in particular. While in the short term, distrust among the great powers might increase, once clarified the issue of non-complicity of the owner of the stolen material, it is expected that there would be a strengthening of the cooperative relations between the UNSC permanent members. They might build a common front under the idea that any country with nuclear weapons-usable materials could be liable to experience the same situation.

(b) The material was stolen from facilities located in other different states.

It is possible that the UNSC permanent members promote a greater degree of control and even certain kinds of punitive measures toward that country. This could lead to disproportionate actions in the short term, especially if that country does not have the direct support of any of the major military powers.

Sub-scenario 2

The perpetrators acted with direct or indirect support of a sponsor state.

(a) Although very unlikely, if a permanent member of the UNSC contributed in any way to the attack

A deep international crisis would occur with a strong increase of militarization in all regions. In the worst case, the situation could escalate uncontrollably up to a stage of direct nuclear conflict.[18]

(b) Other different state was sponsor of the attack

The international community would surely turn against the sponsor state. Major global powers, which could have supported such a country in the past, would refrain from such support. Moreover, a military retaliation, conventional or nuclear, would surely take place.

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[15] See also the section on "International Relations."

[16] As said, the protection of nuclear materials is a sole responsibility of each state, thus the protection procedures change from one to another. For more details, about the countries where nuclear-weapon usable materials are located and how they are currently protected see NTI, *Nuclear Security Index 2016* (Washington DC, 2016), <http://ntiindex.org>.

[17] Nuclear forensic procedures can determine the origin of fissile materials.

[18] With a development even more severe than the Cuban Missile Crisis, October 1962.

States would launch their national security mechanisms with the main objective of preventing further terrorist actions, while potentially cooperative or collective actions in regions or within strategic alliances also would promptly start.

A number of countries might take explicit actions to distance themselves from any involvement with the perpetrators, to avoid becoming potential targets for retaliation. These countries would publicly condemn the incident and its perpetrators and would carry out demonstrations of solidarity toward the affected country. A series of rapid exchanges of information and consultations among the heads of state would take place in the first hours with the aim of establishing global strategies for prevention and response.

Environment of global surveillance

One of the most relevant short-term global consequences would be the installation of comprehensive monitoring measures that may shape an environment of intrusive surveillance, strongly endorsed by most of the members of the international community.

A key part of the industrial military complex, with a high strategic value would be that of software and communications. It would be broadly imposed a push for more restrictive policies of knowledge sharing.

The global climate of tension would make security and defense budgets rise significantly, at domestic and international levels, despite the international economic crisis caused by the terrorist act. States would likely prioritize military spending over other national needs; even at the expense of resources for economic recovery. In other words, security and defense priorities would surely take preeminence at the time of defining expenditure plans.

The situation might result in military actions, both preventive and anticipatory, against weak countries or focused on those generally considered to sponsor terrorism, regardless of whether they hold nuclear weapons or weapons-usable materials. In this sense, it might increase the risk of a major military action because of an escalation from a specific operation that goes wrong.

These direct actions, together with a possible polarization of countries with nuclear weapons, could also increase the risk of direct exchanges among them, to the extent of reaching the worst-case scenario of a nuclear exchange.

A terrorist nuclear attack would affect regional and national defense schemes worldwide. The increase of global distrust and tensions could lead to an escalation of present conflicts and to the emergence of new ones. Under certain conditions, the post-detonation dynamic could even take the world to the brink of nuclear weapons use by states.

It is important to note that this situation of *global low intensity warfare* involves high risks of escalation, because of military actions between powerful countries and weaker ones, with potential clashes among the most powerful ones.

In all cases, the world would define new rules for nuclear global governance. There would be stronger pressures to establish a more restrictive system in the dissemination of nuclear technology, even for "peaceful purposes." This brand-new governance style would try to raise the standard for nuclear binding obligations of a state towards the international community.[19]

Instruments such as the United Nations Security Council Resolution 1540 (2004) and the Proliferation Security Initiative (PSI) launched in 2003 could evolve to become more intrusive.

In terms of nuclear security, countries holding inventories of weapons-usable nuclear materials for civilian use (17% of the total in 2016) could be compelled to increase their protection in a substantive way, since otherwise they might hold responsibility for any catastrophic situation that could occur in the future.

However, in the aftermath of the terrorist attack, it could be increasingly difficult for countries to submit to scrutiny the security of their military nuclear complexes, both in terms of warheads and fissile materials to manufacture them (83% of the total). This could constitute a major problem since according to experiences in

[19] See section on "International Relations" and "Recommendations."

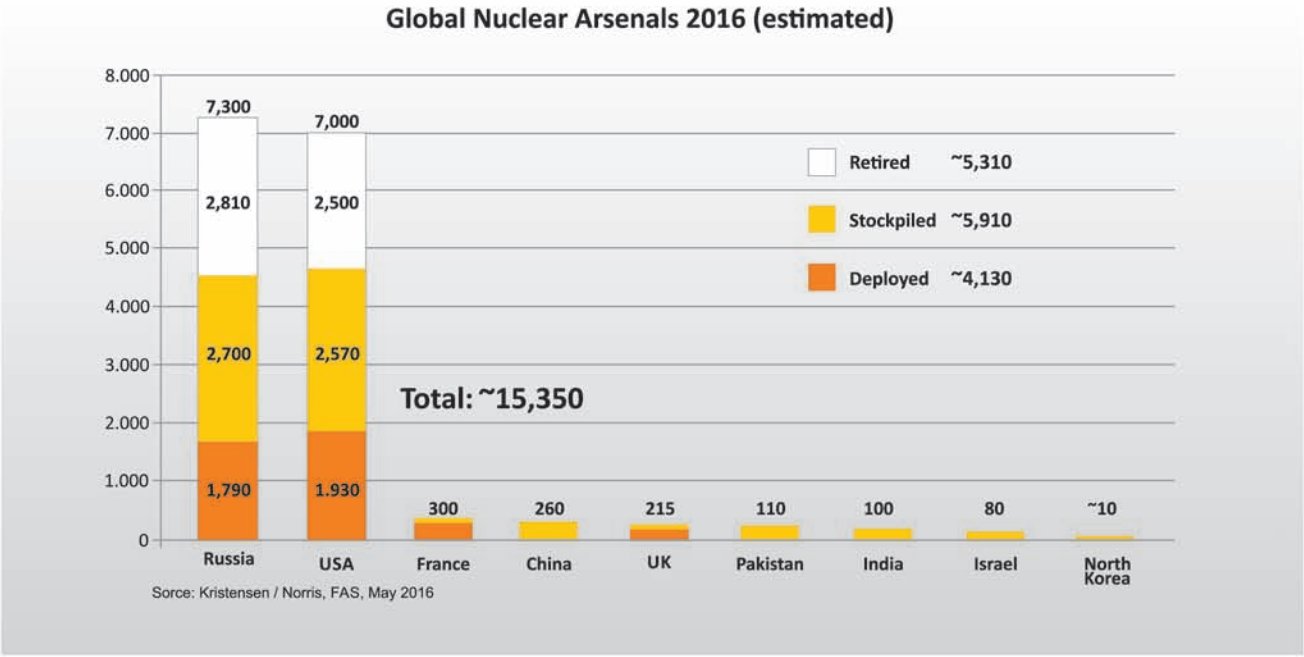
facilities under military control are far from being free from potential security flaws. Therefore, an undesired gap in the control of both types of materials could increase significantly.[20]

Setback of nuclear disarmament efforts

An environment of global distrust and increasing insecurity would surely prevail, so that nuclear disarmament efforts as well as those to prevent horizontal proliferation would appear overpowered by the evolution of events.

This context involves risks of a new arms race as well as of horizontal and vertical proliferation. In addition, it is possible that many actors would raise serious questions about key disarmament and arms control international instruments such as the NPT and the START-type bilateral agreements, which may include scheduled warheads reductions.[21]

The figure shows as a reference the current size of nuclear arsenals in terms of the number of warheads. They could increase significantly because of the mentioned reasons, if the terrorists succeed in making the attack. Moreover, the situation could create incentives to develop a new line of low yield nuclear weapons to punish countries which harbor or sponsor terrorist groups.



The state of the world in terms of nuclear arsenals.

Despite some reductions in numbers, current investment in nuclear weapons is increasing in all nuclear-armed states, mainly due to modernization programs. However, some countries are also increasing the size of their arsenals (China, Pakistan, India, and North Korea).[22]

Although the scenario under analysis never occurs, the current growing global insecurity poses a complex challenge in terms of nuclear disarmament. It is evident that nuclear-armed states are reversing their efforts in this sense.

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[20] See Des Browne, Richard Lugar and Sam Nunn, Co-Chairs, "Bridging the Military Nuclear Materials Gap," NTI, November 2015, <http://www.nti.org/analysis/reports/bridging-military-nuclear-materials-gap/>.

[21] See section on "International Relations."

[22] Hans Kristensen and Robert S. Norris, "Status of World Nuclear Forces," Federation of American Scientists, May 2016, <http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/>. For modernization issues see: Hans Kristensen and Robert S. Norris, "Slowing nuclear weapon reductions and endless nuclear weapon modernizations: A challenge to the NPT," *Bulletin of Atomic Scientists* 70(4) 2014.

Developed countries

As mentioned before, in terms of Security and Defense, Russia and China were analyzed as members of the group of developed countries.

The first issue to note is that the terrorist attack means that none of the existing capabilities concerning nuclear early warning worked properly. The attack would provoke a serious debate within the international intelligence community about methodology and effectiveness of information exchanges, particularly among strategic allies.

Prolonged state of alert and its effects

Military forces of developed countries, with personnel deployed in sensitive geographical areas would immediately raise their alert levels, fearing the possibility of a second imminent attack, either on their territory or on overseas targets of interest (the clearest antecedents on the subject come from 9/11 and 7/7).[23]

Should the state concerned be a Western power, the highest level of alert would reach the deployed forces in the Middle East, Africa, and those operating in Central Asia, since these geographies house groups identified as possessing incentives to attack Western territories.

In order to avoid ambiguous situations or additional stresses at this stage of confusion, it would be essential that the authorities of these countries maintain efficient communication and provide reassurance about their intentions and potential regional military movements.

The alert level of forces would rise for two reasons: (a) because of the possible redeployment to support secondary contingencies or a second attack, and (b) because of the possibility that something similar could occur in another developed country.

After the attack, there would be a re-assessment of existing security doctrines, and a deep review of concepts such as nuclear deterrence, no-first use, proportionality, and negative security assurances.

Due to the extraordinary circumstances, the highest authorities of the target country might decide to send troops overseas immediately to conduct military activities. In this case, the government could carry out a military deployment outside its borders. Other developed countries could replicate with similar moves.[24]

In this scenario of global crisis, one important issue of concern is the potential removal of *no first-use commitments*, either explicit or tacit, taken by some nuclear-armed states. Likewise, it is possible that they put aside explicit or *negative security assurances* toward non-nuclear weapons states.

As said, such a crisis, in the most unfavorable circumstances, could lead to the fall of any unwritten constraint, which could have self-regulated nuclear-armed states regarding the use of their arsenals, the so-called *nuclear taboo*.

Most of relevant countries would likely revise their security doctrines as well. An extended will of use of force, consistent with the post-attack scenario, could even prevail over peace and rationality. Deployments of military units among big powers could be the most common practice, as well as stealthy monitoring of these forces to prevent unforeseen strategic surprises of any kind.

In this sense, those actors that effectively combat all types of terrorism would be the center of military cooperation. It is evident that developed countries would not tolerate any ambiguities or double standard positions by others. Although certain logic of proportionality would prevail, countries would move to make it clear that in the aftermath of such a terrorist attack, a symmetrical or proportionate response should not be taken for granted.

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[23] The exception was Madrid: on March 11 (3/11) it was first stated that the attack came from ETA, and after some time it began to bear impact on the alert of the AF but to a much lesser degree than that in New York and London.

[24] There could be non-conventional methodologies to legally deal with terrorists at the borders, depending on each state, and justified by large sectors of the civil society. A nuclear attack would be a sufficiently significant shock to accept important reductions of individual rights, as analyzed in detail in the section on “Government and Society.”

Neither would developed countries feel a special restriction on those military elements at their disposal. There are weapons with fewer effects than nuclear devices, yet with great destructive power. This type of weaponry would be actively deployed in scenarios of future confrontation. It is possible that some of these weapons could be used against those countries suspected of performing destabilizing actions.

The doctrine of deterrence as we know it, would suffer strong shifts in light of nuclear use by non-state actors, so as the security dilemma would emerge once again.[25]

In this regard, the establishment of the logic of deterrence from the military point of view would give space to new arguments for preventive actions of any kind, anywhere in the world, with no need to occupy a country. Those developed countries able to project power would take strategic advantage of that situation. The mere suspicion of harboring a terrorist group and a minimum nuclear capability could open space for any military measure.

It is possible that nuclear-armed states produce a series of tactical nuclear devices or high technology and low yield nuclear bombs to act as future deterrents or to limit the damage that weapons with larger loads could generate in the already stressed ecosystem.

Developing countries

A number of developing countries would join in to the initial outrage and the widespread shock of a nuclear terrorist attack. Even those countries with usually ambivalent positions concerning the established international order previous to the attack, will likely find incentives to show sympathy, in order to neutralize any possible suspicion of involvement.

Again, geography and political decisions play their part in the aftermath of the attack. Countries in regions identified as traditionally harboring transnational terrorist groups would suffer the greater constraints.

In this sense, some countries could be subject to pressure by developed countries to accept troops and equipment necessary to fulfill certain missions. This dynamic could begin to influence the social fragmentation of host countries harboring troops or joint bases, since they could become pockets of resistance and are liable to appear as potential targets by terrorists. Increased deployment could also generate greater opportunities for terrorist actions against deployed troops, likely conventional.[26]

The risks to their security would rise and together with this, the fear and distrust of their populations. Some could use this as an opportunity to strike the weakest allies in a coalition, while others could use this as a political tool to gain internal visibility.

Overall military spending and budgets in many developing countries would also increase, either to join a certain type of action or to try to protect from regional actors wanting to take advantage of the global crisis. It is clear that developed countries might be selective in defining their military allies in the developing world for this type of international situation, whether for punitive actions or prevention of future attacks.

If these types of relationships unfold, some of these countries would be able to access new weapons systems and technologies, as long as those countries acted as military proxies in certain “ad hoc” coalitions. This could generate new arms races, possibly following regional defensive-offensive dynamics.

The more distant and peripheral countries in this group could receive international pressure to adjust their political systems, institutions and intelligence strategies to avoid becoming terrorist havens. In this sense, the degree of active participation in the global action to prevent and fight international terrorism would split this large group of countries.

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[25] The security dilemma, also referred to as the spiral model, is a term used in international relations. It refers to a situation in which actions by a state intended to heighten its security, such as increasing its military strength or making alliances, can lead other states into responding with similar measures, producing increased tensions that ultimately create conflict, even when no side really wishes it.

[26] This type of event took place after the deployment of troops in the Persian Gulf, after the First Gulf War, as it also happened after the 9/11, in many Middle East and Asian locations.

Less developed countries

It is possible that these countries would receive prompt attention from the major powers and from developing countries eager to collaborate in the elimination of any regional problem. The clearest example of such a situation was the temporary alignment of Russia and China with the United States in 2001, to try to neutralize the threat of the Taliban in Afghanistan.

It is reasonable to expect these countries to become an intersection between primary and secondary military scenarios, where special operation forces and drones intended primarily to attack high profile targets usually operate. Previous experiences –such as the special operation against Osama Bin Laden and the Taliban in Afghanistan–would imply that planning would take at least a month to complete. There would be huge pressure to show that the international community is fighting the threat, wherever it may be located.

Likewise, there would be some obstruction to the flow of small arms to these countries as well as a greater combat to arms black markets, although such efforts may not necessarily be entirely successful given there are already a significant portion of light weapons scattered around the world.

It is also possible that non-state actors based in such countries make efforts in developing countries to secure resources needed to continue with their purposes of international destabilization.

In terms of Security and Defense in a post-attack scenario, less developed countries would feel their isolation, as well as the weight of their different capabilities. It is likely they would be under the radar of developed countries, for a while, and the focus would not be placed on improving their living conditions or integrating them into the international system.

If they manage to neutralize the groups operating in their territories, they might receive higher levels of attention. In this regard, for a limited period, certain countries, even with weak leadership, could get military assistance to strengthen internally.

People in these countries would surely live with an even higher level of violence than the one they had prior to the terrorist attack.

International Relations

In light of the scenario set forth, the fact there are no previous cases to act as a point of comparison is a crucial element. Analogies could be established; for this research, between historical turning points in the recent past, which can help us understand the way in which a terrorist bombing in a central country and the events following may mark the future dynamics of international relations and of the associated international legal framework.

If the reference point were the attacks against Washington DC and New York City on September 11, 2001 (known as "9/11"), the terrorist detonation, although more serious, may not be enough to overturn the current paradigm of international relations, in terms of current legislation. Nevertheless, the impacts for all members of the international community would be serious and destabilizing.[27]

Except for the initial reactions from the target country and its allies, it would not be possible to detect an immediate impact on the international legal framework. This has to do with the very nature of international negotiation, which moves slowly and to the extent that countries feel that conditions are set toward their commitment, manifesting in their sovereign consent. It is obvious that the scope of the crisis and the rapid acceleration of time pursuant might lead to a perilous breakdown between reality and the legal framework that should represent it.

It is true that, should a single attack as described take place, one could assume that the conceptual framework that establishes links and bonds among nations would not essentially change, although it is expected that nations' interests could be reoriented, in accordance with the new situation.[28] [29]

However, as a second alternative scenario, the subsequent evolution of the legal framework would be very different if there were secondary catastrophic events, such as new terrorist attacks or a nuclear exchange between states, which could eventually target the international system as a whole.

As already indicated, this second scenario (escalation of nuclear violence) would imply the establishment of a new paradigm –in the hands of nuclear-weapon states– based upon the elimination of the nuclear taboo.

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[27] In a paper submitted to the Swedish Institute of International Affairs in April 2002, Barry Buzan upheld that after 9/11 the usual International relations theories have not re-signified or altered (neo-realism, globalism, regionalism, and constructivism). S. Dobson has expressed the same: "The Day Nothing Much Changed," 2006, <http://www.foreignpolicy.com>.

[28] See sub-scenarios outlined in "Security and Defense."

[29] Michael Cox, "Paradigm Shifts and 9/11: International Relations after the Twin Towers," *Security Dialogue* 33.2, 2002.

In the first scenario, which is more likely to occur, changes in the international system, though not radical, would lead to enhanced insecurity and distrust among nations; in this context it is expected that the changes to the legal framework would not be apparent in the short term. It is likely that, as the understanding about the facts of the incident grows, information at the disposal of nations will set the pace for new regulations to adapt to the said realities.

In terms of international politics, a conservative assumption as the one foreseen in the first scenario would show that, even though a reallocation of possible alliances and selective cooperation is expected, the situation as described would lead to political changes in the short and long-term agendas of all nations.

The use of force and terrorist activities

In the sphere of international relations, a terrorist act would entail the possibility of unilateral use of force on behalf of the target country or its allies. Force against the state supposedly harboring terrorists would find its way to become legitimated in multilateral organizations under the argument of the inherent right to self-defense against armed attacks. If the affected country is a member of any military alliance, some regional collective security mechanism could likely be implemented.[30]

With the onset of unilateral and collective actions as described, the UNSC would be summoned to act pursuant Chapter VII, especially if the affected state is one of its permanent members or a close ally to one of them.

In addition to the possible use-of-force against countries suspected of harboring terrorists, the UNSC might take brand-new resolutions aligned to the text and severity of UNSC Resolution 1368/2001 (which condemns terrorist acts as a threat to international peace and security as well as enables the right to legitimate defense.) And, in addition, aligned to UNSC Resolution 1373/2001 (which obliges states to freeze assets/financing of terrorists, pass anti-terrorist laws, prevent those suspected of committing acts of terrorism from crossing international borders, and investigate those seeking asylum on the grounds of possible connections with terrorists). Consequently, the international community might surely create a more robust legal fabric, aimed at strengthening legal controls on terrorism.[31]

Main nuclear regulatory schemes

In the most unlikely event of secondary attacks and/or of a nuclear exchange between states, the current nuclear order based on the NPT would face a deep and unrecoverable crisis. In this least favorable scenario, should a new nuclear weapons race occur, current commitments for nuclear disarmament as defined under the article VI of the NPT as well as under bilateral agreements, would weaken and these instruments could even lose their purpose.[32]

Within a more conservative scenario – in which no nuclear weapons are used by states because of the terrorist attack – certain developed countries would likely request more restrictive governance over all aspects of nuclear weapons and materials, as well as over those related to weapons of mass destruction.

The change in political agendas might result in an increasing demand for governments to endorse binding or non-binding- international instruments, relating to terrorism, nuclear security, and non-proliferation. These would include the Amended Convention on the Physical Protection of Nuclear Material (CPPNM), now called Convention on the Physical Protection of Nuclear Material and Nuclear Facilities (CPP), and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), both of which are legally binding and of crucial importance for the prevention of such criminal acts.

It is likely that an attack with such characteristics would lead to an acceleration of universal adherence to "de-centralized" international tools, keeping measures under each state's sovereign decisions instead of granting power to multilateral organizations or agencies. A crisis such as the one described here would promote international dialogue but at the same time would strengthen the discretional powers of sovereign states to guarantee national security.

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[30] In the case of a NATO member, for example, it would be invoked Article 5 of the North Atlantic Treaty (Washington Treaty), as it occurred after the 9/11 attacks in Washington, DC, and in New York.

[31] Priti Patel, "Ensuring Accountability: International Law and Post 9/11 U.S. Detention Policy," *Human Rights Brief* 12, no. 2. 2005.

[32] For more details about these sub-scenarios, see section on "Security and Defense."

If we consider that the IAEA's role in terms of nuclear security is currently under debate, and that this role involves only 17% of weapons-usable materials stored at civilian facilities, a question would arise on the need for finding alternative means to secure the remaining 83%, which lies under non-civilian control. After a terrorist nuclear attack, this current dilemma related to non-civilian materials would be even more acute as states would be eager to increase their power over nuclear assets.

The international tensions could lead to a collapse of the current nuclear order based on the NPT. The risk of proliferation would surely increase.

As for the nuclear weapon arsenals, as explained before, nuclear-armed states would likely consider that in light of the recent events, it would be essential for them to keep and increase their inventories of weapons to guarantee national security and protect their political independence and territorial integrity. On the other hand, developing countries would reinforce a discourse on the humanitarian impacts of nuclear weapons, stressing the importance of discussing new legal frameworks, with the interests of victims outweighing the will of possessing states. According to the latter countries, there would be an imperative need to achieve a world free of nuclear weapons as soon as possible.

Impact on individuals of the new regulatory framework

As an immediate consequence of the terrorist act, there would be population displacements. In terms of internal policy and legislation, measures on border security and border migratory control would dramatically tighten, first at the target country and its neighbors, and later in other countries around the world.

There would be interdictions and blockades to states suspected of harboring terrorists, and attempts to adopt national security legislation, of the kind of the U.S. Patriot Act, which followed the 9/11. All this imply a suspension of individual rights in favor of an emergency state that even could justify the application of extreme methodologies such as *targeted killings* in very specific cases.

Developed countries

In terms of International Relations, developed countries can be separated in two differentiated sub-groups: nuclear-weapons states (as acknowledged as such by the NPT) and other developed countries, mainly non-nuclear weapons states. The first group would surely cooperate with the target country and would likely support unilateral or multilateral military actions.

In this sense, a conventional action of retaliation would be very likely, even though it is uncertain whether it would get support from allies or it would be unilateral in nature. Developed non-nuclear-weapon states would likely be more opposed to the use of force and would possibly try to set restrictions on military interventions, if they occurred.

The five states in the first group (the United States of America, the United Kingdom, France, the Russian Federation, and the People's Republic of China) would be in favor of military interventions in territories believed to be sponsoring terrorists. They find the UNSC an adequate environment to channel their political objectives, precisely because of their right of veto, granted by the UN Charter.

Faced with an act of this magnitude, it is quite possible that the five legal nuclear-weapons states support the action of the Security Council by passing a resolution (although depending on involved countries, some abstentions are to be expected). If it is detected that one of these states has had some kind of intentional implication in materializing the fact, the international conflict could escalate to an unprecedented level, and even reach a nuclear exchange.

If the UNSC passed a resolution, developed non-nuclear-weapon states would likely criticize unilateral actions. Some of them would likely condition their support depending on the proposed measures. Nevertheless, they would endorse collective use of force against responsible states or states supporting the attack.

In the medium term, developed countries could also lead criticism of the existing international system, including possible renewed attacks against the discriminatory nature of the NPT. In the most benign case, where neither secondary terrorist events nor an escalation to a nuclear conflict between states occur, this response would not carry denunciation or withdrawals from the NPT by developed-non-nuclear-weapon states.

However, they could promote complementary regulatory mechanisms in concrete and specific issues such as nuclear terrorism. It is evident that the most severe scenario of nuclear use by states would undermine the current weak stability of the NPT.

Developing countries

In light of unilateral steps and actions by the UNSC, this group of countries would heighten the use of force in the international arena as well as an increasing distrust of the existing regimes. It would configure a new stage in the crisis of legitimacy of international supervision and monitoring bodies.

It is likely that countries in this group would foster alternative international regulatory schemes to deal with important subjects in a non-traditional fashion, and/or promote the role of confidence-based interaction among states with similar interests (for example, regionalization).

The current legal framework falls short to deal with the consequences of a nuclear terrorist act, in terms of both, prevention and response.

After the initial chaos, in which independent national responses are expected, cooperation in common areas would increase. This would lead to state-to-state negotiations to consolidate the existing regime, but hardly to a will of replacing the current paradigm. Historical ties between developing and developed countries would prompt these countries to reproduce the positions already described for developed ones.

The reality arising from the terrorist attack would monopolize international negotiations in the short and medium term. New spaces for negotiating formal and informal agreements, particularly linked to nuclear terrorism would open up, fostering exchange of intelligence information.

Less developed countries

Instead of focusing on nuclear issues, less developed countries (which do not possess nuclear weapons) would likely apply pressure to introduce new regulatory schemes regarding small weapons. These actions would especially consider the progress shown in the negotiation of the Arms Trade Treaty (ATT) and the meeting of experts on the UN Register of Conventional Weapons, where many countries thought it imperative to include Small Arms and Light Weapons (SALW) into the discussion. These common causes, along with shared opposition to traditional non-proliferation regulatory mechanisms in the international sphere, could boost reinforcement within the scope of regional cooperation (or south-south cooperation) using instruments to avoid the impact of the global crisis stemming from the attack.

Shortages of all kinds in less developed countries would entail their need to participate within the framework of legal and diplomatic negotiations. However, since these states are mostly isolated from efficient diplomacy and they barely contribute to raising issues for negotiation, they would probably accept innovative legal developments coming from developed and developing countries, as long they can get some support and economic advantages. Less developed countries are of easy access to terrorists and they have little control of the activities in their territories. This means that developed and developing countries have a practical interest in exercising international supervision over these countries. This would lead to an increasing distress in these states, which would feel subject to over-vigilance and interference in their internal affairs.

A preliminary conclusion

Regardless of the type of country, the effects of a nuclear terrorist bombing would demonstrate the lack of preparedness at national level, and globally. Unless secondary events such as a new nuclear terrorist attack or any kind of nuclear weapons use between states leads to a deepening of the international crisis, paradigm shifts are unlikely during the aftermath.

It is also evident that pragmatic implementation measures should complement the legal framework. Only from a clear awareness that these episodes are equally harmful for the target country, as for any other country in the world, regardless of their geographical proximity, political, economic or ideological profile, will it be possible for us to begin drafting concrete action paths to reduce the risks of nuclear terrorism, and threats posed by the extreme (but possible) use of nuclear weapons by states.

Economy and Finance

We took as references for this section, the economic and financial impacts following the 9/11 attacks in the United States and the 2011 incident at Fukushima, Japan. In the first case, the U.S. Bureau of Economic Analysis estimated that the direct cost of 9/11 amounted to 21.4 billion dollars, equivalent to 0.25% of the U.S. Gross Domestic Product (GDP). One of the reasons why the impact, in terms of GDP, was moderate is that although the attack caused large initial destruction, it gave impetus to activity in many sectors involved in the recovery and reconstruction, as well as in those related to defense and national security spending.

Previous research show that the total impact of the terrorist attacks on the U.S. economy was a decline of 1.2 points of the GDP in 2001 (concentrated in the last quarter) and almost zero in 2002.[33]

The incident at Fukushima occurred when the Japanese economy was in an expansive process. It had grown 4% in 2010. The economic impacts of the incident, combined with the earthquake and tsunami that had preceded it led to a decline of 6.6% and 2.9% in Japan's GDP during the first and second quarters, and 7.8 % and 10% fall in industrial production respectively over the previous year.
Both events were, then selected as proxies of the nuclear terrorist attack because of the availability of information, but assuming that the effects of the latter and consequent impacts would be significantly more powerful.

Annex 2 shows sets of data that can be useful to understand both cases in greater depth.

[33] In the 9/11 attacks, the initial disruption of the transportation system and the financial and commercial sectors was significant. Airports kept closed for 4 days and the stock exchanges ceased to operate during 4 days. Attendance at commercial centers fell about 5%. As far as activities of employment and profitability, airline companies were the most severely hit sector. In the Quarter immediately following the attack, the volume of passengers dropped 20%, leading to 80,000 layoffs (8% of the crew). Decrease of the sector's value also dropped 20% in the US and 15% in Europe and Japan.

Impacts on other sectors associated with airline services were significant: hotel occupancy and employment in the US fell by 3%, dragging tourism into the fall; sector company stock fell 15%; they also reached other related activities such as tourist agencies, car rentals, and restaurants. As a whole, the impact of a 20% dive in the activity represents a 0.5% drop of US yearly GDP, which could be mitigated through a larger activity of some substitute activities (such as land transportation). On the demand side, consumer' confidence plummeted after 9/11 in the US, falling from 120 points to 80. The indicators, which measure entrepreneurs/businessmen confidence, also fell sharply. France, Germany, and Great Britain simultaneously noticed the drastic fall of both indicators.

Economic effects in the target country

From the moment of detonation and during the first week, generalized disruption would happen in all activities in the state victim of the attack. During the first few moments of the crisis, all essential services would be surely affected, but the most important immediate effect in economic terms is the disruption of the country's supply chain.

In order to secure the supply of required goods and materials, the normalization and reconstruction would only be undertaken once the necessary logistics was restored. This task would be in full operation by the third month and would last at least two years, unless other secondary crises occur.

Our estimates show that the increase in public expenditure required to address the crises (without including the substantial increment in security and defense expenses) would total 10% of GDP over two years. Part of the taxable basis would disappear during the explosion, directing part of the expenses towards subsidies and tax reductions. Fiscal deficit would therefore stand in the range of 7% to 10% of GDP, during two years.

Logistics

The crisis would severely affect operations at the attacked city's airports and ports. Reorganizing the airports and ports would take time, which would surely increase transportation costs of people and goods.

During the first week, the fear of potential additional incidents that might occur in other cities with major ports and airports would help deepen the crisis. As long as the likelihood of such events decreases, unless other issues heightening the level of mistrust and global tensions emerged, after three months, it could be implemented a transition plan to restore a reasonable level of operation.[34]

The issue of insurances is very important, economically. The destruction would deeply affect the system of insurance. Without this system, the world's logistics would experience a severe damage, and it could enter into a situation of great uncertainty. If any of the most important global reinsurance centers were located in the target country, this could entail heavier spillover impacts.

Financial system

A deep financial and commercial disorganization (or even a paralysis in the most severe scenario) is likely to occur after the attack, particularly concerning transactions based in the target country.

From the experience of 9/11, it is expected that there would be banking, currency, and securities interruptions of at least one week (or possibly two), and a de facto extension of debt and tax maturities for five days, all this without implying a claim of breach of due date or non-compliance. During that time, banks with headquarters near ground zero should reestablish command centers elsewhere, in the target country or away, where they have branches.

Moreover, authorities should necessarily add a 48-hour bank holiday to give room for organizing alternative emergency head offices.

Two basic conservative assumptions are the following: (a) clearing centers were not affected, and (b) there are *backups* with banking information. If these two conditions are positively resolved, one week later transactions in target country' markets would resume. Financial and currency exchange transactions would go first, and the stock markets a couple of days later (eventually suspending transactions of companies particularly affected by the explosion on a temporary basis). This would not avoid an initial destruction of value due to dropping prices, once the markets reopen.

There would certainly be ample cooperation among the different economical and financial supervisory agencies in all countries supporting the system. Following the 2008 Global financial crisis the capacity to collaborate has increased.

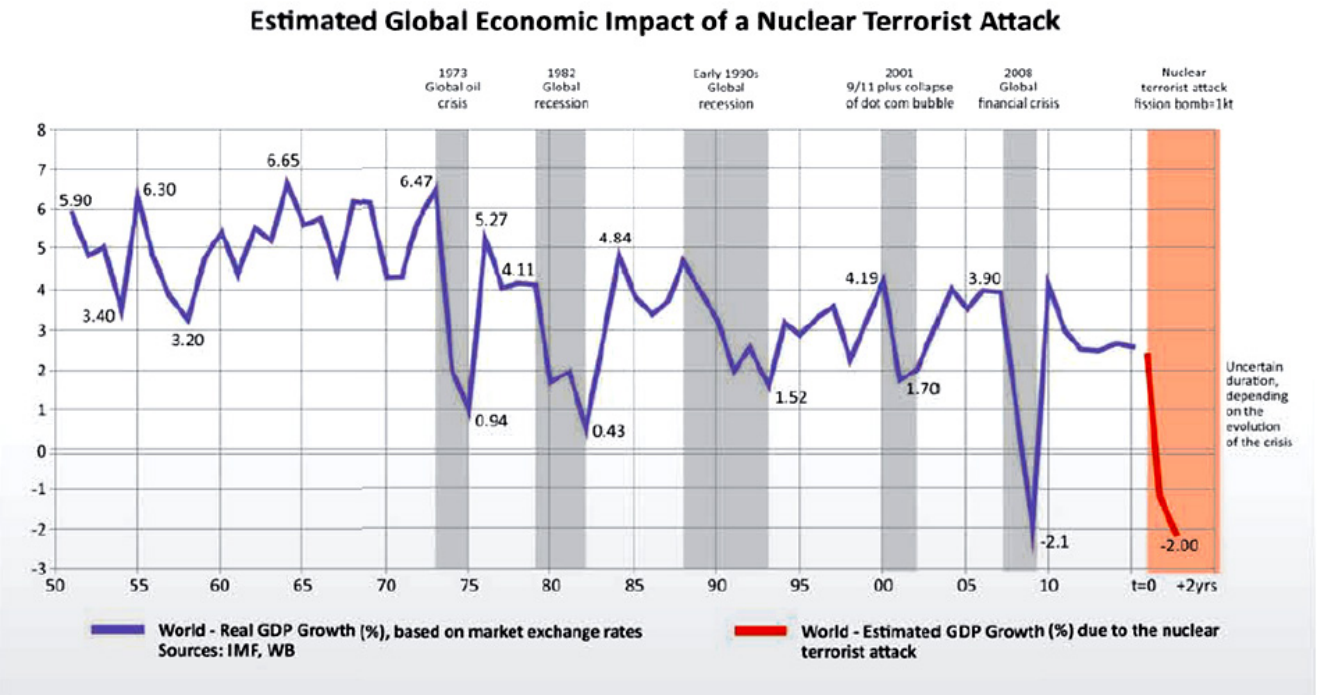
The experts estimated that the overall impact in the target country would be 3% GDP decline at the end of the second year.

[34] For further analysis on sub-scenarios of a larger or lesser secondary conflict, see the section on "Security and Defense."

Economic and financial impacts at global and country levels

The attack would make the world economy fall dramatically. But how much?

The analysis shows a 1% decline in global GDP during the first year, reaching a 2% loss of growth by the end of second year, assuming no secondary catastrophic incidents following in the short-term. This drop represents a crisis in the world economy, similar to the severity of the 2008 Global financial crisis, which has been the worst after the Second World War. The graph shows a timeline with the global economic and financial crises since the 1950 to date, compared to the estimated impact of a nuclear terrorist attack (in red).



The estimated global recession caused by a nuclear attack by terrorists equates the negative impacts of the 2008 Global financial crisis.

The table in page 32 illustrates the estimates the about overall impact of the attack in key economic and financial aspects (GDP, international trade, financial flows, and investment) globally, and for groups of countries as defined in the research. It shows these impacts at three different moments within the time span of two years under study.[35] [36]

The decline in economic activity is the result of the effects in the country and region affected, and of the damage of the supply chain in the rest of the world. It also reflects the impact of the poverty effect, assuming an elasticity of 2 (the expectable minimum) compared to growth, both in the advanced economies and in the developing ones.[37]

[35] See "Annex 1."

[36] GDP variations should be read as the difference between the value of the GDP at any moment after the incident and the expected value if no incident had occurred, assuming a continuous growing trend. We use a similar criterion for the international trade variable.

[37] The problem is that even a year after the economy resumes its growing trend, recovering such loss would call for a higher rate for some time. This is where doubt abounds: the USA has recovered its growth rate trend since 2010, but it has been unable to recover its loss from 2009. The question here is if whether the same would happen should an attack as the one described herein took place.

The poverty effect is the notional loss of wealth or capital available, following the event. Taking into account the above-mentioned elasticity, global poverty would raise about 4% after the attack. This implies 30 million more people living in extreme poverty, in addition to the current 767 million, accounted by the World Bank Group.[38]

	1st. week	3 months	2 years
Economic activity			
World	Disruption	-1.0% GDP	-2.0% GDP
Developed countries	Disruption	-1.2% GDP	-2.2% GDP
Developing countries	Partial disruption	-0.6% GDP	-1.3% GDP
Less developed countries (aid receivers)	Partial disruption	-1.5% GDP	-2.5% GDP
International trade			
World	Disruption	-2.3%	-3.75%
Developed countries	Significant disruption	-2.5%	-3.5%
Developing countries	Partial disruption	-1.5%	-4.0%
Less developed countries (aid receivers)	Significant disruption	-2.5%	-2.5%
Financial flows and Investments			
World	Disruption	Reduction	Normalization
Developed countries	Disruption	Increase	Normalization
Developing countries	Disruption	Decrease	Normalization
Less developed countries	Disruption	Decrease	Normalization

Overall impact of the attack in key economic and financial aspects (e).

International trade would be one of the transmission channels of the effects of slower growth in the world economy, through two ways: drops in quantities traded and in prices of raw materials.

With regard to the first aspect, the drop in the physical volume of international trade would stand at 3.75%. The fall in prices, assuming that there would be 22% increase in freights caused by (a) the disruption in logistics, (b) the larger track in maritime transport, (c) storage problems (saturation in the operative capacity of alternative destinations), etc., and also 15% participation of the cost of transport in the overall cost, leads to a 3.3%drop in prices received by exporters of commodities and mass products.

[38] In 2013, the year of the latest comprehensive data on global poverty, estimates show that 767 million people have been living below the international poverty line of US$1.90 per person per day (extreme poverty). Almost 11 people in every 100 in the world, or 10.7 percent of the global population, were poor by this standard. For more details, see World Bank, *Poverty and Shared Prosperity 2016: Taking on Inequality,* 2016, Washington, DC.

This would be a huge blow during the first three months and even in the first year, to gradually disappear, if the world moves away from the brink. It would affect emerging export countries (hurt by logistics over costs) and very poor countries that are importers of food. The commodity-producing countries would thus pay the higher prices in freight.

The financial sector would likely be another problem-conveying highway. Initial volatility of financial markets, coupled with an increase in risk-aversion, would cause a reduction in capital flow towards developing economies. This could not be solved through a lowering of nominal interest rate in advanced countries, which would trigger a monetary facilitation wave (increase in risk premium compensates the drop in nominal terms). In addition, the actual interest rate would climb for commodity producing sectors, given the drop in prices for their products.

In this case, the most severely affected countries would be the debt-ridden ones (because of the heavy load of interest) and those with high deficit in their current account (because of the difficulty to continue financing it). In addition, countries with strong investments in the attacked country would suffer capital repatriation constraints.

In the short term, during the first week and perhaps during the first two months, a substantial impact would be a dramatic drop in global confidence. This drop in confidence would project itself on countries that, for one reason or other, are perceived as targets of similar attacks.

An expression of this effect would be the decline in consumer confidence. Likewise, indicators measuring business climate and investment expectations would fall, especially in developed countries. Hence, there would be paralysis in consumption and investment decision making and a consequent negative multiplying effect over production.

On the other hand, the collapse in stock markets would be unavoidable, even though mitigated by the stock-and-capital markets closings, and the temporary exclusion of the companies most hit by the event and the establishment of shorter stop-loss.[39]

In a globalized world like the one we live in today, these instruments have a short-term utility to prevent spreading and are likely to be employed by regulators. Different from what occurred in 9/11, the effect on financial markets might be more long lasting.

Market uncertainty will bring about currency-depreciation in the target country. This is, in part, due to an instinctive reaction from investors looking for greater hedging and expectations of a larger monetary expansion and fiscal deficit, as a response by the authorities in light of the need to mitigate the effects from the detonation. With this in mind, the target country would lengthen the expiration terms of credits, bonds, etc., and avoid charging penalties to debtors, following emergency guidelines especially regarding international obligations. Public and private banks should secure cash availability in all the affected areas and in other countries since securing such availability in the short term is critical to preserving social peace.

Another relevant impact is a strong fiscal expansion and an increase in public expenditure worldwide, so that the fiscal deficit might reach 3.7% of the global GDP two years after the attack.

Role of regulatory organizations

Addressing complex logistical problems, just like measures towards normalization of financial operations, call for a prompt response and cooperation from national regulatory organizations (i.e. Central Bank, Security Exchange Commission and their equivalents for capital markets in other countries). This cooperation should span to transportation (air and maritime) and international trade regulatory agencies. International forums such as the G20, which operated well during the 2008 crisis, could be very helpful to transmit recommendations to national governments.

In economic terms, international agencies (IMF, World Bank and IDB) would have a very important mitigating role in the international credit shortage, by opening “ad hoc” lines for the most affected countries.

[39] Considering the experience in the U.S. in 2001 (11.6% drop the week after the attack, see “Annex 2”) and worldwide in 2008, it could be estimated 25% drop in the main stock markets of the target country, 20% in the UE and US in the 15 consecutive days after reopening, 15% in Asia and 15% in Latin America. Note that the drop in stock markets is less severe in the emerging world than in the most advanced economies.

In a major risk-aversion context, it is feasible that multilateral banks would be able to issue bonds at low rates to recycle monetary liquidity. In other words, they would bear an important role as fund recycling agents.

It would also increase risk premium (as long as it takes into account the expectations of investors; by increasing interest rates, countries should agree on monetary rates). Consumption will decline while individuals increase their savings. There would be liquidity preference, as long as there remains a perception of a drop in the price of shares and a collapse of the stock markets prevailed. As a real global impact, individuals would perceive themselves as more impoverished and would spend less.

Production

The attack would deeply affect the production chain, mainly of those depending on goods coming from the country attacked, and of those depending on less available credit lines. In a scenario of world crisis and uncertainty, the search for new suppliers to replace the original ones, while preserving the same quality standards to establish a commercial chain, can take time. It would be deemed a success if such substitution could be operative in less than three months. The seriousness of the issue is huge because in the context of a highly integrated world economy, the interruption in the supply of small crucial sectors can disrupt the entire manufacturing processes of certain goods.

Business management

A paralysis in decision-making might likely happen in businesses with headquarters located in the affected area~~s~~ and operations in other countries. It is important to take into account that much like during 9/11, entire company headquarters and management could have disappeared. In some cases, it would be possible to transfer the chain of command to centers elsewhere in the country or abroad. This point is crucial for the prompt normalization of the financial system and for capital and insurance markets as well.

Developed countries

The affected country would surely require aid from the international community and from other developed countries, in particular those in the G7. They could offer their help in terms of material and human resources.

Cooperation among Central Banks in the region, those from other developed countries, and other markets' supervising agencies would be essential. This ranges from helping with cash supply, bank holidays, restrictions to the drop in share prices from deeply affected companies (insurance companies, banks, airlines, to name a few) and support to the value of currency from the target country in currency exchange markets to soften the fall.

As the world economy rate of growth drops, there would be two adverse effects for producers in developed (and developing) countries: (a) a price effect (due to greater distances to compensate areas next to the target country), and (b) a quantity effect (less demand due to slowing down of world economy growth). Detouring of maritime and air transportation increases the cost of transportation of people and cargo while at the same time, it increases the cost of increased storage which would be required.

Due to uncertainty, there would be a noticeable tendency to over stock critical products at all levels, primarily goods coming from the target country.

The estimates show that the initial decline in financial and capital markets would, over the first weeks, impact the stock markets of advanced economies as indicated before. This contagious effect is, in part, the result of globalization: (a) stocks of companies from the country affected are likely traded in many of these countries, (b) companies from this state have interests in other countries, (c) there are businesses whose profitability would be impacted including tourist companies, airlines, shipping companies and logistic enterprises.

In this scenario, it is expectable that during the third month after the attack, market values could have returned to normal, unless there is a lengthening of the crisis due to secondary incidents, which could take place.

Developing countries

For these countries, short-term losses are low, in terms of drop in the GDP growth rate, as compared with developed economies, even though in the medium-term the set of global effects would cause a strong deceleration in their economic pace.

Developing countries could render limited assistance to the affected country. Their usual perception is that they are far from any potential effect following such an attack. This perception encompasses economic and financial issues, it would soon be proved wrong when the impacts from the attack become visible.

In fact, given the global expansion and the condition of the country affected by the incident, the presence of its goods and services-producing companies would remain strong, decisive, and influential in almost all developing countries.

In general, credit-access conditions would be limited two years following the incident and there could be a re-directing of financial flows from developing economies to developed ones in order to address internal priorities, mainly regarding security of their territories, their population, and their productive sector.

As with developed countries, there would be a clear drop in consumer confidence (reflecting expectations in light of a new reality) and therefore a drop in the consumption curve to a level closer to the income. This would lead to larger levels of savings with a preference toward liquidity. As for investors' expectations, risk premium would climb as interest rates rise and countries should agree on a monetary rate. Like with developed countries, a perception of generalized poverty looms over their societies.

Developing countries often see nuclear terrorism as a matter of exclusive concern to developed countries. However, the attack would cause a sudden (and unfortunately untimely) awareness, since all aspects of their activities, including their economies, their access to high technology products, and their overall global status, would be affected.

In the international commercial sphere, commercial flows change destinations, with the result of an increase in the cost of freights and a drop in the price of commodities. These effects would be principally heavy on those developing countries, which base their foreign trade on such products, with a consequent impoverishment of the mentioned countries.

On the other hand, the financial impact of reconstruction of the attacked city would run against those developing countries and less developed ones since the capital to finance such a task (10% of the GDP of a standard developed country, about 250 billion dollars) would be mainly withdrawn from the funds available for those countries.[40]

Additionally, there would be capital outflow (along with earnings) efforts by companies from the target country operating in their territories with the aim of recovery. In the case of Fukushima, for instance, the outflow from Brazil of Japanese capitals, back to Japan was very significant. The capital outflow poses a dilemma on developing economies: maintaining the level of imports (sacrificing reserves) or reducing the level of imports (to pay such capital outflows with larger surpluses in the current- account), while preserving reserves.

Less developed countries

These countries are not part of the main circles of commercial exchange, but they rely strongly on international aid. They would be severely affected by logistics difficulties and therefore suffer all kinds of shortages, including those of essential goods and financial resources.

A clear negative impact of the attack would be a significant decrease in resources from international financing organizations available to assist these countries, surely reoriented toward the target country and others primarily affected by the attack.

[40] To put this in perspective, the net flow of private capital towards developing countries was 400 billion dollars during 2011-2013 (yearly average) out of which 75% was absorbed by emerging Asia (by China, in this case).

A humanitarian crisis is feasible to happen, due to lack of food and medical supplies (increases in infant mortality rate, an increase in endemic disease outbreaks and the possibility of the onset of pandemics).

In short, it is almost unavoidable a clear worsening of the structural poverty in those nations.

Economic repercussions on a country suspected as sponsor of the terrorists

Should a country be identified as sponsoring the terrorists perpetrating the attack, social reactions, both in the target country and the rest of the world, would be extremely serious. It is possible that there would be widespread demands; for instance, economic sanctions against the terrorist sponsoring country. Along these lines, the country presumed to be backing the attackers could become financially isolated, with potential severe economic sanctions by the UNSC. This would include a veto on loans from international credit organizations, or higher loan rates, or even the disappearance of private financing, as well as the freezing of both public and private assets abroad. If the country in question is among the most indebted ones, perspectives would become harder and more complex and with more adverse effects from poverty on its people and social situation, bearing further repercussions in terms of political instability. Lack of confidence would bring about changes and re-direction of investment flows and of tourism. A country isolated from the international community does not appear alluring, neither for capital nor for tourism. This situation could also contaminate neighboring countries and a whole sub-region.

Measures of prevention and preparedness

From an economic and financial standpoint, prevention measures so that the attack never happens are necessary. These include implementing appropriate measures against terrorist financing and money laundering, such as endorsing an extreme action of financial intelligence units and agencies aimed at measuring the fight against terrorism (Financial Action Task Force -FATF).

With regard to economic-financial measures to mitigate the impacts should the event take place, the most relevant are:

- Design and implementation of procedural guidelines for Central Banks and economic authorities, in order to ensure the reestablishment of the payment system within a reasonable timeframe.
- A priori design of a joint strategy to mitigate crisis impacts and to provide assistance, together with the intervention of formal supra-national organizations such as the G20, European Central Bank, regional blocks.
- In the case of the private sector, there should be guidelines similar to those companies tagged as strategic, such as financial and transportation companies. For example, in the case of financial companies, to secure the payment system and in the case of transportation to assure the “safe” transportation of people from their home to work (so as not to cut off the commercial chain).
- For banks, in particular, there should be procedural guidelines in case of a complete destruction of its headquarters. This should include not only information backups, but also pre-set procedures for a quick reconstruction of their chain of command and decision-making processes. For instance, if the head offices of Bank X, with its CEO “inside” vanished from the Y city, as a result of the bombing, decisions would automatically be taken up by an officer in the Z city, in a branch preferably located in the capital city of another country.
- Such emergency response management models should be designed and implemented in each of the regional/global reach organizations.

Government and Society

As far as the actions performed by governments and their effects on societies are concerned, the nuclear bombing's repercussions would greatly surpass the 9/11 antecedent. Concerning individuals, perplexity and panic will likely ensure that no person anywhere in the world, regardless of age, social group, race, ethnicity, ideology, etc. would feel safe from falling victim to a terrorist attack.

The situation would overwhelm leaders on two counts: (a) they must respond promptly to demands from their societies, including decision making in light of the crisis, and at the same time, (b) they suffer the same effects from the unprecedented event as every other individual. This would create a common set of behavioral patterns, described below.

The scenario portrayed herein shows the combined synergy of a terrorist attack and the use of a weapon of mass destruction. In addition, the state of insecurity and helplessness in societies would be high, due to the possibility of a new attack. As for the nuclear component, the unprecedented use of a device with such technology provides the terrorist act with the worst catastrophic element. It is a culmination of what some groups could have aimed for throughout the years, motivated either by nihilism or by a radicalized interpretation of a religious mandate.

One consequence of the attack is a sense of people's own helplessness and lack of protection against such actions, either because of an absence of or because of failure of effective prevention mechanisms. This would perceived by society as the state's failure, mainly in the target country but also worldwide as "the global system's failure".

This translates into a deep questioning by the public towards governments in place, and multilateral organizations, such as the United Nations and the IAEA, not only in the target country but also in the rest of the world.

At that moment, and depending on societies' styles, all opinions, informed or not, would seem to have the same ability to feed panic. The situation might get even worse when these opinions grant significant importance to the humanitarian impacts of potential future acts.

Global impacts

The sense of vulnerability and uncertainty would spread all over the world, in light of the perception of possible new attacks within an unknown timeframe. Such vulnerability would be immediately associated with the intense ongoing processes of globalization and inter-dependence.

These processes, related to information dissemination in real time, in practice dissolve borders between countries, by blurring the classical conceptual differentiation between internal and external spheres. Before such "self-assumed evidence", societies begin to close themselves, but, at the same time, inner unrest and destabilization could dramatically increase.

People's prevailing reactions could be expressed in two ways: (a) a hostile actor coming from another part of the world, who has tapped into the progress made in the fields of transport and telecommunications, has the chance to inflict damage of unheard proportions using a nuclear device, (b) such hostile actor could be a person nearby, an unexpected member of the community.

In this framework of insecurity, vulnerability and uncertainty, the role of the media and social networks is essential. Capitalizing on the interest brought about by the attack, the media would provide extensive coverage of the event, supplying information all day long from multiple sources, not all of them reliable. Such information tends to be fragmented, and is usually presented differently from traditional news formats, using less structured and more superficial formats (infotainment) where more information does not necessarily imply more knowledge.

Social media could turn into a powerful weapon, not only to contribute to misinformation but also to generate feelings of distrust and panic, and moreover to make these feelings actionable by individuals and groups. In light of a crisis of such proportions, media and communicators' irresponsibility in social media could deeply worsen the already complex situation. It would become difficult, if not impossible, to escape that climate of fear and uncertainty. This would affect the daily lives of individuals and institutions, including governments.

Increase in the level of distrust in each society would lead to an exponential climb in the number of calls reporting suspicious behaviors or objects. This situation is very difficult and adds to anonymous calls of terrorist threats. All this takes societies to a situation of stress and collective psychosis.

An unprecedented feeling of fear, distrust and uncertainty would arise around the world, affecting the everyday way of living in all societies.

Governments would face an unprecedented crisis, which would jeopardize their stability. Police and first responders (firefighters, emergency systems, civilian defense) and security forces would appear overwhelmed, and in some cases even collapse. Security and armed forces personnel might require reinforcements, perhaps leading to summoning of retired personnel, budget allocations would also increase; however, resources are limited and those funds would come from the reallocation of budget items originally assigned to other purposes, giving rise to sector claims and discomfort. Some countries would count on their legal framework, which might allow them to deploy military personnel, thus assigning them to internal security tasks.

In many countries, laws would be enacted and special security (and/or intelligence) orders approved, which could severely affect individual rights and freedoms, as well as the right to privacy, transit and gathering. It is likely governments declare a state of emergency or a state of siege.

Consequently, there would be an increase of imprisonment of citizens as well as use of lethal and non-lethal arms by security forces, as well as derived fatalities. Societies could split up in terms of acceptance or rejection of these measures limiting individual rights and worsening social tensions.

Collective activities in public spaces, whether sports or cultural events, would suffer significant restrictions, related to the implementation of government measures curtailing the right to transit and gather. They also would affect citizens' social interaction, leaving them to seek shelter at home, likely urged to do so by the same government. A change in consumer behavior could become noticeable with the stocking of imperishable goods, medicine and water supplies, fearing an eventual nuclear attack that could lead to lengthy quarantines. The shortage of some products would lead to a severe price markup of others.

The vulnerability and insecurity in the domestic situations of several countries might lead to sudden population migrations from large cities to smaller ones and rural areas, on the assumption that large cities could be the potential targets of new terrorist attacks.

This unexpected migratory movement, in addition to affecting negatively on some service operations (education and health, among others) couples with the increase in unemployment in urban centers after businesses close down, as a result of the economic implications of business resettling in areas deemed safer.

The nuclear bombing could bring about two other psychosocial global effects. First, a reactivation of religious practices, whose negative side could be the revival of minority sects and groups that carry an apocalyptic message, and second, a rapid strengthening of antinuclear environmental groups that blame the use of nuclear energy for the catastrophe, rather than attributing it to the existence of criminal fundamentalisms or extreme beliefs. The "no nukes" movement could regain ground in the political arena, by gathering support from vast sectors in society, including some people with a heavy media presence, likely artists and intellectuals.

In some countries, government leaders could respond to social pressure by shutting down or temporarily closing nuclear facilities, as well as with cancellation of nuclear projects. The impact of such decisions to the global energy arena will lead to a setback on the nuclear energy options for an uncertain length.

Another impact is the widening of social gaps worldwide. Perhaps the most important would be that dividing those that consider the attack as an example of certain incompatibilities in ideology, culture, or religion (the strongest accusations are against Islam), and those that believe it is not possible to extrapolate responsibility for the event to any faith holders or people adhering to a certain ideology or belief. At the end, a debate revolves around parameters of cohabitation at the international level.

Internal chaos fuelled by media and social networks would threaten governance at all levels, with a greater impact on countries with weak institutional frameworks.

A relevant question arises: within the framework of the crisis, would societies integrate or exclude individuals? This debate could potentially be translated into the adoption of different government immigration measures, such as a decline or suspension of visas and work permits to foreigners, a hardening of immigration policies, an increase in the number of deportations. In addition, it could trigger reductions of commercial flights (of local and foreign airline companies) to and from places deemed "sensitive" from a terrorist point of view. Because of this debate around cohabitation, those that see the attack as evidence regarding the incompatibility between different ideologies and cultures are prone to accept the adoption of a response that includes the intensive use of military power as retaliation.[41]

This position also favors the rise of a significant gap in societies, with the tendency to adopt hostile positions against minorities perceived as associated with the aggressors. On the other hand, the antagonistic viewpoint vindicates the possibilities of coexistence and cohabitation between different ideologies and cultures, indicating that the explanations of the attack have to do with the foreign policy adopted by the target country, rather than ideological or cultural issues.

Media would be a sounding board in this important debate, where no historical precedents are available. First, there would be a need to understand why an attack of such nature could occur. Secondly, there would be a search for the responsible party, be it a government official, an organization or state; and thirdly, there would emerge the will to make sure that such kind of incident would never happen again.

It would be expectable a more proactive role of civil society organizations, calling for new ways of governance regarding nuclear security, disarmament, and non-proliferation, including strong demands for the implementation of existing conventions, treaties and regimes, and of new ones surged as a consequence of the attack.[42]

[41] See section on "Security and Defense."

[42] See section on "International Relations."

Developed countries

There would be differential common impacts on developed countries, which are strongly interdependent on the political and economic dimensions. The first repercussion, because of such interdependence, is the likeliness of citizens migrating from the target country to their country of origin in the short-term. If interested citizens were not able to cover the repatriation costs, the government of the developed country would surely bear those expenses without major inconvenience.

The global crisis and economic deterioration in developing and less developed countries would generate large numbers of migrants trying to reach developed countries, in search of better life conditions. The situation could deplete the receiving governments' capacity to handle such migrants. For some individuals coming from the affected country there could be rejections due to fears of radioactive contamination. As a result, it is possible that these countries strengthen their migration policies. It could lead to more restrictions to the entry and transit in their territories**.**

Because of the latent threat of a second nuclear attack, developed societies also would begin to worry about the threat of a dirty bomb as well as of sabotage of nuclear facilities, especially of nuclear power plants.

Misleading information and fear would likely have strong economic impacts in the aftermath. As an example, fear of radioactive contamination might lead to rejection of all kinds of goods coming from the target country.

Developing countries

The catastrophic event would have some specific impacts on these countries, different from those in developed ones. Both, governance and quality of institutions in developing countries would be placed under severe strain. There would likely be an increase in organized crime and corruption, in light of the economic and social restrictions described previously.

States in this group with nuclear-weapons usable materials would generate the biggest concern due to the potential instability of these countries, which could aggravate because of the global crisis. From an external point of view, resources allocated for the protection of facilities where such materials are stored could fall short from the minimum protection internationally acknowledged. Such situations would lead to demands for vigorous international monitoring.

There could be tensions between the unwritten obligation of providing acceptable protection to the nation's nuclear assets, regardless of a scarcity of resources, and the will to maintain independence over sovereign decisions relating to nuclear security issues.

Political unrest could severely affect governance in many developing countries. In this sense, some countries in this group with weaker institutional foundations and high levels of corruption and impunity run greater risk of becoming fragile states and/or havens for terrorism and organized crime. This same phenomenon also occurs in the less developed countries.

Less developed countries

The extraordinary security measures enforced by the target country and other nations whose governments feel they are vulnerable to new terrorist attacks would significantly affect the life of citizens from the less developed countries, as their nationality is likely to be labeled as sensitive. Denials of residence visas, work permits, and even country entry are some possible enforced measures.

Governments of this group of countries might have difficulties in complying with some of their new obligations, such as to exercise effective control over their territory (borders) and enforce the use of force within that territory. In this regard, the concern is linked to the less developed countries future use of their territory by terrorists or criminal organizations. The social impacts of international humanitarian aid restrictions are of extreme relevance and would worsen even more the internal crisis, jeopardizing both the governance and existence of such states. As has been indicated under Economy and Finance, such aid, both in funds and other goods (including medical or food supplies) would be restricted and redirected towards reconstruction efforts in the target country, and towards stabilization of the international system.

Recommendations

This report highlights the unprecedented global and national damage caused by a low yield bomb detonated by terrorists, anywhere in the world.

If such attack were to happen, the mitigation process would be extremely painful and complex. Given the nature and extension of the damage, such efforts would lead to disappointing results, despite the resources involved.

To worsen things, this research points out the likeliness of an escalation of the crisis including a nuclear exchange between states, under certain conditions. In fact, the dynamics post-attack could even lead to a potential brink of weapons-use between nuclear-armed states, as was explained before.[43]

Thus, preventing terrorists from "going nuclear" is the only acceptable way forward to preserve global stability, as we know it today.[44]

While the international community has been pursuing a significant effort to head off a nuclear catastrophe by terrorists, and mainly since the launch of the Nuclear Security Summits political process, in 2010, there has not been enough progress.

In fact, there is a broad consensus that the present international nuclear security regime falls short to cope with the dimension of the threat, in many ways. Therefore, the need for its drastic improvement has been a central part of the discussions in many governmental forums. The issue also has been a matter of a deep analysis by the expert community, during all these years.

In practical terms, the "primitivism" of current terrorist groups, either because of their own nature, or because they find it easier to accomplish their goals by employing "low-tech" (low-cost) means, opened a window of opportunity to make the necessary enhancements to the current nuclear security regime.

The question is: for how much longer will that window stay open?

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[43] See section on "Security and Defense."

[44] Similarly, due to their negative impacts (which deserve a separate study), efforts should be placed upon prevention of conventional and cyber sabotages to nuclear facilities, as well as of an attack with a radiological dispersal device (RDD), the so-called called a "dirty bomb."

It is evident that at any time in the future, terrorists will migrate from their current "low-tech" means to "high-tech" ones, such as nuclear bombs or cyber-attacks. Thus, policymakers around the world should be aware that the technological component of nuclear risk will grow eventually. It imposes on the issue a sense of urgency, which should be seriously taken into account.

On the other hand, a nuclear bomb detonated by terrorists is mistakenly regarded as a "low-risk" event. Such misleading belief significantly affects priority-setting processes in many governments and even in multilateral organizations, by weakening national and international willingness to do what is necessary to prevent these nuclear catastrophes.

This document confronts such belief: a terrorist nuclear detonation is a "low-probability" but a "high-risk" event, in terms of potential damages. Consequently, this report alerts about this fact and places a strong call for action, concerning prevention.

This section specifically proposes key lines of action seen as essential to improve the ability of the current international nuclear security regime to prevent a nuclear terrorist detonation (and, by extension, other criminal acts involving nuclear assets). In addition, it offers suggestions of preparedness measures to help reduce the damages, if the attack were to occur.

Finally, it highlights the challenges the international community faces to take the prevention effort to the next level.

These recommendations have a direct translation into a set of core measures that every country should take, in order to become a part of the solution, rather than of the problem.

That sort of "check list" for national implementation is included as a core part of the Executive Summary.[45]

Promote understanding about how nuclear terrorism threatens national interests

It is not necessary for a country to possess nuclear weapons-usable materials to become functional to nuclear terrorism. Structural and institutional weaknesses can create an environment conducive to illicit trade of those materials, which could end up in a nuclear device.

An effective prevention at national and global levels depends on political will, flexibility and cooperation among countries. In this sense, adequate decision-making requires clear awareness and understanding of the threats that countries face and of the damages to national interests derived from such threats put into action.

Without a sense of imminent risk, prevention of nuclear terrorism either turns formal or, even worse, disappears from the national agendas versus other ever-present priorities. Active decision-making in governments as well as the will for a positive international cooperation are directly related to a clear understanding about how close to national interests is the threat of nuclear terrorism.

In addition, it is important that all countries get an accurate picture about how they could be favoring a terrorist act, despite the fact that they are free of nuclear weapons or weapons-usable materials. They can be functional to terrorists' ends because of their national weaknesses: low quality of institutions, corruption, and poor borders control, among others, can make a country preferred for illicit traffic or as a terrorist haven.

Build an improved global nuclear security system

It is evident that the intention after the end of the Summits, in April 2016, has been to protect and even increase the efforts by taking advantage of all that international experience in nuclear security.

It can be done by weaving together the required international agreements that lead progressively to achieve the before mentioned improved global nuclear security system.

[45] See "Executive Summary."

Key functionalities

The improved system should be functional enough to:

- Define a set of minimum acceptable nuclear security standards, and look for their universal acceptance (increasing the number of participating states).
- Promote countries' accountability for their nuclear security practices in the international community.
- Support universal implementation of the key binding international instruments, in particular of the Amended Convention on the Physical Protection of Nuclear Materials (CPPNM) —currently re-named Convention on the Physical Protection of Nuclear Materials and Nuclear Facilities (CPP)— and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT). In addition, it should promote and give support to the implementation of global measures within the scope of the United Nations Security Council (on the basis of Resolutions 1373 and 1540) that complement existing treaties through the inclusion of new monitoring instruments to strengthen supervision over nuclear materials and weapons.[46]
- Favor countries' participation in voluntary international initiatives aimed at strengthening the global aptitude to prevent, detect, and respond to nuclear terrorism, such as the Global Initiative to Combat Nuclear Terrorism (GICNT), the Global Partnership (GP) against the Spread of Weapons and Materials of Mass Destruction and the Proliferation Security Initiative (PSI). It also should encourage the adoption by countries of the IAEA nuclear security guidelines.[47]
- Seek full protection of weapons-usable materials (civilian and non-civilian), nuclear facilities, radiological sources, and information, from theft, illicit trafficking, and sabotage, conceptually the nuclear assets under threat.
- Promote minimization and further elimination of weapons-usable materials, HEU and separated plutonium (civilian and non-civilian) with the aid of diverse nuclear technologies, such as reactors conversion, non-HEU production of medical radioisotopes, and downblending. Recognize nuclear arsenals around the world as a source of risks from the nuclear security point of view, and the elimination of nuclear weapons as the ultimate way to reduce such risks.
- Encourage transparency and shared best practices, while protecting countries' critical information.
- Protect by design the legitimate right of states to peaceful nuclear development and use.
- Be affordable and practical for low-resource nations. In terms of implementation and compliance, promote international cooperation and funding.
- Be dynamic and flexible enough to provide adequate responses to the future evolution of nuclear threats.

At its final stage of implementation, the improved system should efficiently rule the entire international prevention effort, particularly in relation to the scope in terms of materials (civilian and non-civilian materials and facilities) and of countries' participation. It would propose a fair balance between sovereignty and international accountability; practical measures to promote universal ratification and national implementation of the key international instruments; ways to simplify general reporting and bureaucracy; systematization of peer reviews and voluntary commitments, and definition of a sustainable leadership scheme and roles in place.

Among other important contributions to outline these core ideas, the campaign entitled *Five Priorities for Global Nuclear Security* points out relevant areas of work to strengthen nuclear security. They are: (a) comprehensiveness of the effort, which should cover all of the nuclear security risks, (b) global confidence about the nuclear security system, including peer reviews, (c) commonly accepted standards and best practices in place, including information sharing about them, (d) sustainability for continuous improvement, and (e) minimization/ elimination of stocks of weapons-usable materials (HEU and separated plutonium).[48]

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[46] The Convention on the Physical Protection of Nuclear Materials and Nuclear Facilities (CPP) entered into force in May 2016, and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), in July 2007.

[47] A valuable path for implementation of national nuclear security commitments comes from the Joint Statement "Strengthening Nuclear Security Implementation". The IAEA's INFCIRC/869 (originally subscribed by 35 states during the 2014 Nuclear Security Summit) establishes strategies of compliance as well as sound plans to implement them.

[48] Campaign "Five Priorities for Global Nuclear Security," 2015, <http://www.5priorities.org>.

It is interesting to note the way the international expert community has reached an ample consensus over most of these ideas, which permeated from there into the governmental world, and into the Summit process itself. It is easy to perceive such alignment of ideas in the documents that emerged from the successive Summits.[49] [50]

To put these core principles into action, beyond the vicissitudes of diplomatic negotiations, is perhaps the main challenge of this post-Summits period. To enable such progress, is important to discuss and agree on a roadmap for the future.

Define and implement a set of preparedness measures

Although a difficult task, it is possible to spot a set of specific measures to mitigate the impacts of the attack, if it were to happen. A correct estimate of national and global impacts is an essential first step to define the most adequate preparedness measures. In practical terms, suggestions are:

- Negotiation and approval by the UN Security Council of crisis management protocols, or at least, certain guidelines that facilitate cooperation among countries, in case of major crises.
- Inclusion of crisis management mechanisms in the procedural guidelines of formal multilateral economic and financial institutions and treasuries. It would let secure the continuity of the international system of payments. In addition, mechanisms of regional cooperation in formal supra-national organizations (community banks, interstate cooperation blocks) to mitigate negative impacts and secure aid flows.
- Creation of contingency funds that let countries mitigate the impact of expense redistribution due to the crisis and therefore secure humanitarian aid in terms of supply of medicine, food and other basic goods, and services.
- Set up of specially designed mechanisms for prompt decision-making at global and national levels, which may include the creation of crisis management teams/committees or “ad hoc” action groups. This kind of mechanisms should be fostered in all spheres of multilateral organizations and governments.
- Design and implementation of national contingency plans to respond to possible attacks based on international best practices, including an appropriate public communication strategy aimed at controlling social fear and chaos. It is of the utmost importance to train in advance the people in the different areas in charge of supervising and implementing such mechanisms.
- Pre-defined priority-setting concerning national measures to secure fast access of population to basic goods (water, food, fuel, medicine).
- Strengthening of national legal frameworks to prevent impulsive restriction of human rights and individual guarantees due to chaos. Improvement of international control over such national measures.
- Approval of crisis preparedness and response protocols in the national public and private sector. They should include anticipatory mechanisms to ensure information backups, replacements in the chain of command and alternative sites in case of headquarters/central offices’ disruption, evacuation systems, identification of alternative transport systems and hospitals. In addition, definition of secondary communication routes (airports, ports, neighboring roads), rules of displacement in the emergency management system, and catastrophe prevention and adjustment of health systems to cope with these type of events.

  They also should include a clear roles definition for the relevant players, such as government agencies, as well as for armed and security forces. Such protocols will help avoid confusion, contradictions and overlapping of intervening agents.

[49] Fissile Materials Working Group (FMWG), <http://fmwg.org>; Nuclear Security Governance Expert Group (NSGEG),<http://nsgeg.org>; NTI Global Dialogue on Nuclear Security Priorities, <http://www.nti.org/about/projects/global-dialogue-nuclear-security-priorities/>.

[50] See Communiqué and other documents of the 2016 Nuclear Security Summit, <http://www.nss2016.org/>.

Current challenges

As was explained, the post-Summit era poses a major challenge: to take the international prevention effort to the next level, within a reasonable time span. It will require renewed energy and countries' commitments, continuing when the "formal" duties deriving from the Summits' bi-annual cycles have been left behind. In this sense, there are several essential goals to fulfill:

Define a strategic roadmap for further improvement

To keep the momentum alive after 2016 Summit, it is of the utmost importance that the international community find appropriate high-level political forums to discuss and agree on nuclear security strategies in general, and on a roadmap for further improvements, in particular. Defining a roadmap for the future in the short-term is essential to reduce post-Summit uncertainties in the current environment of increasing global insecurity, and to coordinate the action of different stakeholders, as well as to provide strategic direction to the entire nuclear security effort.[51]

The joint statement endorsed by 40 states and two international organizations (UN and Interpol), which proposed a monitoring team, the Nuclear Security Contact Group (NSCG) to oversee advances after the end of the fourth Summit last April, is a promising move whose effectiveness has to be confirmed during the current year. Such a Contact Group could become a space, not only to review the fulfillment of the Summit era commitments, but to discuss fresh ideas for the future and to design the required strategic roadmap.

As originally put forward, this brand-new space also opens up the possibility of interaction between governments and non-governmental organizations. With two meetings during 2016 (on the side of the IAEA General Conference, in September, and of the IAEA Ministerial Conference, in December) it is expected that the NSCG will play a leading role in the future, especially if it opens to a broader membership.[52]

Achieve universal commitment and participation

Countering global threats requires global action. The challenge here is to include and promote strong commitment from as many countries as possible, in addition to the 53 countries participating in the last Summit. In this sense, countries should act in their respective regions, bilaterally or through the appropriate regional forums, to promote the debate about nuclear security as well as an increasing participation of all countries. In other words, regional action is essential to complement the NSCG's and the IAEA's efforts.

One of the most critical issues is the need to restore a positive cooperation between Russia and the international community concerning nuclear security matters, despite its withdrawal from the Summits. In fact, early in November 2014, Russia announced that it would not participate in the fourth and last Summit in Washington, DC, and so happened.

To reverse Russia's absence poses one of the biggest challenges for the future. The setback in terms of cooperation between Russia and the United States (and its allies) turns out to be one of the most powerful drivers of international insecurity. It is difficult, if not impossible, to achieve an improved global nuclear security system without the full participation of Russia. Opening up opportunities for dialogue with Russia about the future strategies to prevent nuclear terrorism should be a priority, which would surely require a degree of strategic versatility.

Close the gap between the civilian and the non-civilian world

Another key challenge is the creation of a joint strategy to protect, not only civilian, but also non-civilian nuclear assets. It was pointed out that in the case of nuclear weapons-usable materials, civilian ones (those within the scope of the Nuclear Security Summits and the IAEA) only represent 17% of the total. This is required to cover 100% of nuclear threats —and therefore of materials— by including the remaining non-

[51] The need for post-Summit coordination is clear in light of the 2016 Nuclear Security Summit's five separate Action Plans for: UN, IAEA, Interpol, GICNT and Global Partnership together with about 20 gift baskets, <http://www.nss2016.org/2016-action-plans/> and <http://www.nss2016.org/2016-gift-baskets/>.

[52] "Joint Statement on Sustaining Action to Strengthen Global Nuclear Security Architecture", April 5, 2016, <http://www.nss2016.org/document-center-docs/2016/4/4/joint-statement-on-sustaining-action-to-strengthen-global-nuclear-security-architecture>.

civilian 83%. Concerning the nuclear "non-civilian" world, countries involved are extremely reluctant to set up any line of cooperation, which poses an extremely difficult situation.

There is a common belief that associates non-civilian or military facilities with higher levels of security, but this is not always the case. There have been many incidents over time, which showed the vulnerability of non-civilian facilities, even in the most developed nuclear armed-states. Thus, focusing on the 17% of the problem clearly falls short in taking the world to a less insecure status.[53]

Promote joint work between governments and the non-governmental community

The international non-governmental community, acting freely, has worked in exploring options to design and implement an improved global nuclear security system. Its experts have been pioneers in proposing brand-new ideas for nuclear risks reduction. This has resulted in multiple concrete actions, such as the organization of *knowledge summits*, parallel to the Nuclear Security Summits in Washington DC 2010 and 2016, Seoul 2012, and The Hague 2014.

Certain non-governmental organizations also put forward campaigns for public awareness and for promoting key governmental measures. This is the case of the Latin American and Caribbean Leadership Network (LALN), which worked with positive results to gather ratifications in the region to take the 2005 Amendment to the CPPNM into force.[54]

In this context, it is essential to promote future joint work between governments and independent non-governmental organizations, in all environments in which key nuclear security issues are discussed and decisions are shaped.

Adopt a comprehensive approach to reduce nuclear risks

In general terms, a comprehensive approach coordinating nuclear security efforts with nuclear disarmament and non-proliferation ones, has proven to be the most efficient to reduce nuclear risks. It is because in today's world, the risks posed by current arsenals, further proliferation and nuclear terrorism are inter-related.[55]

Under this innovative mindset, still to be accepted by every member in the international community, to favor nuclear security, countries should also work to make operational the essential arms control and disarmament international tools, such as the Comprehensive Nuclear-Test-Ban Treaty (CTBT), a Fissile Material (Cut-Off) Treaty (FMCT) and, ultimately, a Nuclear Weapons Convention.

[53] Des Browne, Richard Lugar and Sam Nunn, "Bridging the Military Nuclear Materials Gap."

[54] See "Annex 3" for an example of non-governmental action.

[55] Irma Argüello, "The Need for a Comprehensive Approach to Reduce Nuclear Risks," *Public Interest Report, Federation of American Scientists*, 67, Number 3, Summer 2014, < https://fas.org/pir-pubs/need-comprehensive-approach-reduce-nuclear-risks/>.

Annex 1

Methodology

The proposed scenario is a terrorist attack using an *Improvised Nuclear Device* built with highly enriched uranium (HEU) with enrichment in uranium 235 of about 90%. The attack is perpetrated in the capital city of a first level world power with a high socio-economic and technological development. The report refers to it as *target country*. The choice of such relevant *target country* is a key to outline a scenario, which maximizes the impacts of the burst for different kinds of nations and the global ones. Although methodologically speaking, the group fully addressed the case of a specific city, as a second step, and through further analysis, the experts removed such specificity. So that, the consequences of the bombing as described herein are valid for any city in the world, considered as a first level node of human activity.

In absence of a specific historical experience, the experts took as basic references some other disruptive events such as the experience of *nuclear weapons testing* and consequent research of their physical effects; the *atomic bombs on Hiroshima and Nagasaki* in 1945, with their effects on inhabitants and infrastructure of a densely populated city.

In order to outline the global dynamics of a crisis within a recent international context, the group used two key references: the *9/11 attacks* in the United States and the event at the *Fukushima* nuclear power plant in Japan, dated March 11, 2011.

Concerning the *risk assessment*, the proposed case represents a "low-probability" scenario, but with a large potential damage, if it were to happen. The methodology of risk analysis methodology typifies these cases as of *"high-risk"*. Because of that, to invest in *prevention* and *response* turns out an essential measure of protection.[56]

Types of effects

For the purpose of this report the *effects* (or *consequences*) of a nuclear detonation were classified as *direct* and *indirect* ones.

Direct effects

Changes caused by the detonation, not affected by other variables in the system. Thus, for instance, a nuclear detonation with the propagation of its thermal radiation, over pressure, ionizing radiation and other effects bears direct effects on living creatures, facilities and infrastructure, and the environment. Such direct effects of the detonation are precisely destruction, radiation, and contamination not only in the place where the burst happened but also in areas away from that ground zero, in the way of radioactive fallout.

As for temporal evolution, those direct effects can be prompt or delayed, as the fallout. The physical phenomena involved in a nuclear explosion and their direct effects, both immediate and delayed ones on people, materials, and structures have been studied in a great detail.[57]

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[56] A common mistake of decision makers is to suppose that an unlikely event also implies a low risk, but the definition of risk level accounts a combination between likelihood and impacts of the event, so that an event of low likelihood could pose a very high risk, if the impacts are high enough. For a more detailed explanation of the level of risk of unlikely events, see Patricia Lewis, Heather Williams, Benoît Pelopidas and Sasan Aghlani, "Too Close for Comfort. Cases of Near Nuclear Use and Options for Policy," *Chatham House Report*, April 2014.

[57] See the emblematic book on the issue: Samuel Glasstone and Phillip J Dolan, *The Effects of Nuclear Weapons* (United States Department of Defense and Energy Research and Development Administration, 1977). Online simulators like "Nukemap," designed by Alex Wellerstein, offer a quick and illustrative reference of prompt and delayed effects of a nuclear explosion, once the main parameters were set relating to the type of device and geographical location. Explore at: <http://nuclearsecrecy.com/nukemap/>.

Indirect effects

Changes where there is influence from other intermediate variables, giving rise to a chain of cause-effect relations. These indirect effects will appear in all dimensions of human activity while the direct ones are namely physical. Indirect effects can be classified as fact-based ones, and decision-based ones.[58]

Dimensions of analysis

The modeling of the reality used herein classifies, for the purpose of this analysis, four dimensions of most interest. They are:

Security and Defense

Includes the analysis of governments' reactions from a practical perspective, in terms of decisions about national security and defense, as well as regional and global security. It takes into account changes in strategies and international security doctrines and in the dynamics of alliances, blocks and affinity groups.

It comprises consolidation or redefinition of military power as well as the strategic weight of nuclear and conventional arsenals and the role of armed forces, and security and intelligence agencies. Analysis of this dimension also implies noticing changes in the efforts on research and development of war technologies, and also the allocation of related financial resources.

International Relations

It encompasses the analysis of indirect effects and further impacts in the relationship among states and governments' foreign policy decisions, as well as the performance of multilateral organizations, bearing in mind the international cooperation and competence schemes, whether in their bilateral, regional or global dimensions. Assessment of the international legal framework is particularly relevant to this dimension as well as the reaction of different kinds of states in light of the existing legal and institutional frameworks (confirmation or modification), strengthening or displacing alliances through trust agreements and considering proposals for new frameworks for action in the inter-states organizations and in multilateral decision-making forums. Perceptions and mistrusts among states are also analyzed herein. For practical purposes, even though states act through manifestations that define a course of action, this dimension assumes that the international relations among states are expressed in terms of "collective" decisions regardless of personal and community reactions, which are touched on in Government and Society.

Economy and Finance

Focuses on impacts on the main economic and financial variables, both on a national and global scale. Includes the analysis of event effects on the logistics, GDP, foreign trade, balance of payments, inflation rate, employment, and other micro and macroeconomic indicators. It also surveys the impacts on activities related to the exchange of capital goods and services, and the directionality of investment and other financial flows such as credit and international aid. It includes issues relating to national and international financial management. Likewise, we analyze the effects in economic policies of both state and multilateral organizations.

Government and Society

Addresses the influence on the institutional framework of countries, as well as potential changes in culture and values. In addition, the effects and consequent impacts in the behavior of governments and non-governmental actors, and of individuals and reactions to the international commotion derived from the terrorist attack. Includes analysis about the appearance of behavioral trends (at individual and community level) and of new social practices, which could be results of the traumatic situation. It also includes the influence of media at large and, particularly, of social networks in shaping public opinion and decision-making. The behavior of states in their international roles is addressed under Security and Defense and International Relations.

[58] See examples in the section "The Detonation of a Terrorist Nuclear Bomb."

Time span

As mentioned before, the crisis posed by a nuclear terrorist attack generates *immediate effects (direct and indirect)* as well as *delayed* ones. To analyze such effects, the report considers a primary point of reference, immediately after the attack, *time zero*, and then other later instances. For purposes of this analysis, time zero is the moment when direct effects occur.

A diachronic analysis of the effects allows seeing the way these unfold and trigger consequences at different levels. Thus, for instance, a few days after the attack, it is possible to analyze the post-attack dynamics and the short-term indirect effects that have arisen in their full magnitude. A few months later, it is feasible to monitor the evolution of such effects and when monitored in a longer-term in years the primary impacts of the attack will be quite attenuated. The time span of this report is *two years since the moment of detonation.*

Classification of countries

The analysis identifies effects and impacts affecting groups of countries of specific profiles, and those affecting the world as a whole (global ones).[59]

Of all the categories possible, this research adopted as a basis the classification of countries made by The International Monetary Fund for the 2014 World Economic Outlook (which takes, among other indicators, the percentage of the Growth Domestic Product (GDP) over global GDP as an assessment index).[60]

Although an economic classification, it is an acceptable representation of the global structure in terms of country profiles.

The IMF categorization includes *advanced economies*, which are characterized here as *Developed countries*. This group is made up by 36 countries which, accounting for 14.7% of the world population, represent 43.6 % of the global GDP, and export 61.2 % of all the goods and services traded worldwide. States with the largest economies in this group make up the G7, the United States, Japan, Germany, France, United Kingdom, Italy, and Canada. A second group of countries is the so-called *emerging and developing economies*; it encompasses 153 countries, which account for 85.3% of the world population. For research purposes, this large group has been split into two different groups:

- *Developing countries:* includes 96 countries, among which there are Russia, China, India, Pakistan, Argentina, South Africa, Mexico, and Brazil, among others. This group represents 62% of overall world population, 36.7%of the global GDP, and 35% of goods and services exports.
- *Less developed countries:* a group of 57 countries that the IMF report calls "poor economies and strongly indebted low income countries" which account for 28.3% of world population but only 5.4% of global GDP and 3% of the world's overall exports in goods and services.

Below appears a summary of the distinctive characteristics of each of the three groups, but not a thorough description in itself.

Developed countries

They have high economic and human development (high Human Development Index), high industrial production, technological development (in most cases with nuclear technology capability and many of them actually hold nuclear weapons), foreign trade, and interconnection.[61]

They generally focus their foreign trade on exporting high technology goods and services while they tend to import "commodities". Such countries participate actively in international negotiations at diverse regional and multilateral forums promoting political-institutional schemes and directly influencing the discussion agenda. They are fully involved in and integrated to the international community.

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[59] One of the most important methodological problems to solve was to model the diversity of countries within the international community through a sufficiently representative profile categorization.

[60] International Monetary Fund, *World Economic Outlook. Legacies, Clouds, Uncertainties*, October 2014.

[61] United Nations Development Programme, "2014 Human Development Report – Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience," <http://hdr.undp.org/en/content/human-development-report-2014>.

They tend to have long-term political strategies in term of national interests and are generally related through political-economic international alliances. For the analysis of the dimensions Security and Defense and International Relations, China and Russia were incorporated as developed countries, given they are legal possessors of nuclear weapons, permanent members of the UNSC and, therefore, because of their role in the global power scheme.[62]

Developing countries

These countries bear emerging economies and an intermediate/high intermediate Human Development Index (HDI). Some of them have a high industrialization level and an active foreign trade while in some other cases the industrial development level is medium and medium/low. They tend to import high technology products from developed countries.

They participate actively in international forums and are present in the multilateral sphere. This group is diverse, as far as its geopolitical presence and national goals. Among these countries appear India and Pakistan, with large military apparatus and nuclear weapons, hence mighty actors in the global power scheme. However, the vast majority have opted to develop their nuclear capabilities specifically for peaceful purposes only and others have opted out of nuclear technology altogether.

Many of these countries face practical difficulties in drafting and contributing their own agenda at international forums. Some of them are frequently affected by economic crises and in many cases have fluctuating political systems and difficulties when it comes to building medium/long-term national interest political guidelines.

Less developed countries

These are countries with economic hardships —in most cases, they have a strong structural poverty—and significant social debts regarding education, health, and infrastructure. They generally have a low intermediate/low Human Development Index. Their industrialization level is low if compared with the other two groups; the same applies to their foreign trade, which is mainly geared towards export of primary goods and import of basic technology goods.

In general, they portray great political instability regimes and, in most cases, are highly dependent on international aid. Their international connection is relatively low and they lack their own nuclear development. This analysis includes, in addition to the previous classification, other international policy considerations especially regarding the protection of countries stemming from their strategic alliances with more powerful and resourceful countries.

Please note that analysis of the regional component here becomes less prevalent versus groups of countries with similar international situations. In other words, regional belonging, more than an independent variable, is herein treated as a secondary level sensitivity factor in the discussion regarding country profiles and international strategic alliances.

[62] The Human Development Index considers both countries as medium development ones.

Annex 2

The economic impacts of 9/11

The terrorist attacks in the United States that occurred on September 11, 2001 (9/11) resulted in a tragic loss of lives and destruction of property as well as in a disruption of activity in the short term. The table shows an estimate of the direct costs of the attacks, which reached 21.4 billion dollars.

Direct Cost of 9/11 Attack
(Billions of USD)

Structures, equipment and software	16.2
Private	14.0
Government	2.2
Other losses	5.2
Casualties	2.6
Workers' compensation	1.8
Homes and other	0.8
Total (1+2)	21.4

Source: International Monetary Fund.

An initial dislocation of the transport system, of financial markets, and of trade was the most noticeable effect in terms of activity. The airports closed for four days and the stock market stopped operating for four days. Attendance at shopping centers fell by 5%.

Airlines received severe impacts in terms of activity, employment and profitability. In the quarter immediately after the attack, the volume of tickets fell 20%, resulting in 80,000 layoffs (8% of the crew). The sector lost value at about 20% in the US and 15% in Europe and Japan.

In other activities related to services, the impact was significant: in hotels, occupancy and employment throughout the US fell by 3%, dragged down by the drop in tourism; the shares of companies in this industry fell 15%, tourism agencies, car rental, restaurants and activities related to tourism were severely affected, as well. As a whole, the impact of a 20% drop in that sector accounted for a 0.5% fall in the US annual GDP. The total impact was mitigated by increased activity in some other areas.

On the demand side, consumer confidence plummeted in the US after 9/11, from 120 to 80 points. The indicators that measure business confidence also fell sharply. A sharp drop in both indicators was simultaneously observed in France, Germany, and the United Kingdom. The initial negative effect on commodity prices was significant. The price of a barrel of oil dropped from $25 to $18 (November 2001 value). The demand for food weakened, prices went down by 6% between the end of August and November (14% cumulative decline since the end of 2000). To some extent, it was a kind of coup de grâce for products such as coffee, cotton, copper, wood, etc.

The fall in commodity prices improved the chances of developed economies, helping them control domestic costs at the expense of deteriorating export-economies-terms of trade and, hence, their external balances. The fall in demand resulting from 9/11 attacks and its impact on earnings of exporters hit them. The greatest impact was, supposedly, on oil exporters.

At the end of the day, projected performance of the world economy immediately after the attack was extremely negative, when contrasted with reality, as shown in the following table.

World Economic Projections
(% growth)

	Before attack (e)			After attack (e)			Real		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
Developed Countries	3.9	1.9	2.7	3.9	1.1	0.8	3.9	1.0	1.8
U.S.	4.1	1.5	2.5	4.1	1.0	0.7	3.8	0.3	2.4
E.U.	3.4	2.4	2.8	3.4	1.7	1.3	3.5	1.5	0.9
Japan	2.2	0.6	1.5	2.2	-0.4	-1.0	2.8	0.4	0.2
Developing Countries	5.8	5.0	5.6	5.8	4.0	4.4	5.7	4.1	4.6
Asia	6.8	5.9	6.3	6.8	5.6	5.6	6.8	5.8	6.4
America	4.2	3.7	4.4	4.2	1.0	1.7	4.0	0.7	-0.1
World	4.7	3.2	3.9	4.7	2.4	2.4	4.8	2.4	3.0
World Trade Growth	12.4	6.7	6.5	12.4	1.0	2.1	12.6	0.1	3.2
Raw Materials [1]	6.4	1.0	4.2	1.8	-5.5	1.7	4.5	-4.0	0.6

[1] Excludes oil
Source: International Monetary Fund and J. P. Morgan

In terms of the global economy, the attacks left behind a negative impact in terms of growth. In 2002, it was not as much as what was estimated immediately after its occurrence. It is also proved that the impact on international trade measured in physical volume was very significant, and the same happened with commodity prices.

The economic impacts of Fukushima

Almost a decade after the 9/11 attacks another event, differing in origin and characteristics shocked the world: the Fukushima nuclear accident, which began on March 11, 2011. Its starting point was an earthquake, the fifth in intensity since the end of World War II, followed by a tsunami that hit Japan's East coast, 380 km from Tokyo. These natural phenomena led to a series of events at the Fukushima Daiichi nuclear power plant that included explosions in the buildings housing the reactors, failures in the cooling system, core meltdown, and release of radiation.

Population containment actions initially included the evacuation of inhabitants within a radius of 10 km around the plant, [quickly expanded to a radius of 20 km (170,000 people) and, by March 25 it had reached 30 km]. The affected area generated 4.2% of Japan GDP and concentrated a population of 5.7 million people, representing 4.4% of the total country population.
Initial estimates of destruction of capital were about 3% of GDP, a figure that, while seemingly small, is equivalent to 15% of gross domestic investment in Japan. Analysts argued that the disruptive effects of disasters (mainly natural) would dissipate quickly when the reconstruction was carried out; at that time, for example, March 17, 2011, J.P. Morgan estimated the cost of disaster at 2% of GDP, based on the experience of Kobe (1995), with limited impact on the rest of the world.

Initial mitigation measures in the economic side were of a monetary and fiscal nature. The Bank of Japan injected 15 trillion yen in the first week following the incident, and increased availability by 40 trillion in banks in their demand deposits. At the conceptual level, analysts identified the consequences of the accident as supply and demand shocks that occurred simultaneously. On the demand side, there was a drop of aggregate

spending, both of families and of businesses. As far as households go, it would be due to the uncertainty, which reduces consumption and investments, but also due to the practical restriction to access of the desired goods. In the case of companies because of damages in plants, logistics bottlenecks, power outages, and chain breakups.

The supply shock, at the same time, reduces exports and expands accident effects onto client countries. The greater trade relationships with the rest of the world are – and Japan´s is large - the greater the effect.

The fall in industrial production in April and May was around 15% over the prevailing level in February. In April, the scenario indicated that it would take until October to recover February production levels.

As the table shows, the reality of the second quarter was worse than initial estimates. The fall in industrial production was much higher than originally estimated, and the same applied to GDP. The cause of this gap does not seem to be related to the fall in domestic spending - which in fact was driven by public investment - but to the collapse in exports.

The Economic Impacts of Fukushima
Expectations and Reality
(variation rate)

	Before the incident			Inmediately			Real		
	1Q	2Q	Year	1Q	2Q	Year	1Q	2Q	Year
GDP	2.2	2.2	1.7	1.2	-1.0	0.9	-6.6	-2.0	-0.9
Consumption	0.8	0.5	0.4	0.2	-3.0	-0.5	-4.9	1.1	0.0
Private investment	3.0	5.0	5.0	1.0	-5.0	1.3	-3.5	-2.1	0.2
Public investment	-10.0	-5.0	-10.7	-5.0	10.0	-1.1	-7.2	29.8	-3.3
Government expenditure	0.8	0.8	1.0	1.2	1.0	2.0	1.9	2.9	2.1
Exports	12.0	10.0	7.8	8.0	2.0	5.1	-0.2	-21.7	0.0
Imports	4.5	5.0	5.6	4.0	4.0	5.0	4.5	1.7	5.9
Industrial production	28.0	3.0	5.6	7.0	-5.0	2.0	-7.8	-15.0	-3.4
World GDP (PPP)	4.8	4.8	4.5	4.2	4.2	4.2			

Source: J. P. Morgan, Global Datawatch.

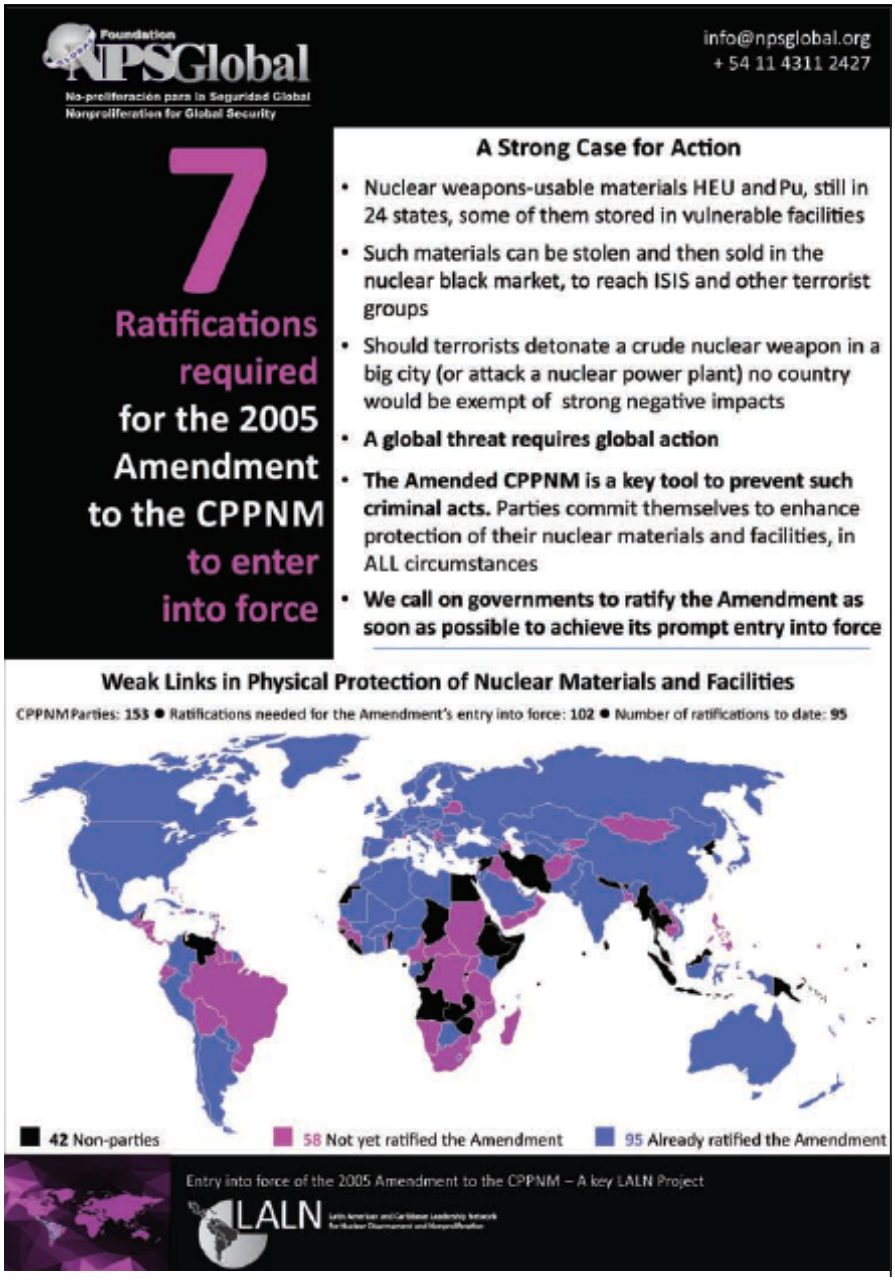
Initial expectations predicted a strong impact on neighboring countries, particularly in the industrial sector in which Japan has a high share of value added. The drop in production in Japan would affect the supply of raw materials, components, and finished goods throughout the world, particularly in the automotive and high-tech industry.

The emerging Asian countries with close trade relations with Japan were expected to be the most affected (for instance, the expected growth of China and ASEAN countries for the first half fell by 0.5 points of GDP).

Annex 3

An example of non-governmental action

This piece of information encouraging ratifications was broadly distributed early 2016, articulated with the LALN Statement on the following page, entitled Latin America and the Caribbean Can Make a Difference previously released on November 2015. The 2005 Amendment to the CPPNM entered into force on May 8, 2016, after gathering the necessary ratifications, including those of Paraguay, Uruguay and Nicaragua between March and April of the current year.



Statement

Latin American and Caribbean Leadership Network
for Nuclear Disarmament and Non-proliferation

Latin America and the Caribbean Can Make a Difference

Call for the entry into force of the
2005 Amendment to the Convention on the Physical Protection of Nuclear Material

November 2015

The need for greater physical protection of nuclear materials suitable for weapons, including highly enriched uranium and plutonium, is becoming more pressing every day as illicit trafficking networks expand their action around the world. These criminal networks seek to obtain such materials illegally and sell them to the highest bidder among terrorist groups, or eventually, states with proliferating intentions. Several frustrated attempts of late have led us to reflect that if security measures to protect them are not significantly strengthened, it is only a matter of time before this perverse connection may succeed.

If in wrong hands, such materials can be used to build an improvised nuclear device which detonation in any node of human activity on the planet will, no doubt, plunge the world into global chaos.

The Convention on the Physical Protection of Nuclear Material (CPPNM) is considered one of the most important international legal instruments that states count on to prevent such criminal actions. It entered into force in 1987 and currently encompasses 152 States Parties. As it was designed exclusively for physical protection during international transport, in 2005 an Amendment was opened to ratification. With the Amendment, states commit themselves to establishing measures of physical protection for nuclear material in situations of use, storage and transport, as well as for nuclear facilities used for peaceful purposes. Ten years have elapsed since that time, and there are 14 states Parties whose ratification is still pending in order to achieve the two-thirds required for such instrument to enter into force, and thus become a part of the international law.

In Latin America and the Caribbean, 28 states are currently Parties to the Convention but only 10 have ratified the Amendment, so 18 of them must still take this decisive step. In this respect, it is worth noting that the ratifications of States Parties in our region would be sufficient in themselves to allow the entry into force of the instrument.

From the Latin American and Caribbean Leadership Network we point out that in the current context, in which the nuclear threat is global in nature, awareness of the risk and responsibility toward the international community should bring light to those governments who have yet to commit, to speed up internal processes leading to ratification of the Amendment.

As in the past the Latin American and the Caribbean states were pioneers in establishing with the Treaty of Tlatelolco the first nuclear weapons free zone in a densely populated region of the planet, a brand-new historic opportunity arises for these countries to lead once again through their example and actions to make a difference in favor of global security.

We also extend this call to States Parties in other regions of the world to act accordingly, thus promoting universal acceptance of the instrument.

We are convinced that once in force, the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material will be a centerpiece of the international system for comprehensive nuclear risks reduction, which our Network has been promoting through its successive statements.

Released on November 10, 2015

[Signed by LALN members]

Expert Group

Irma Argüello. Founder and Chair of the NPSGlobal Foundation and Head of Secretariat of the Latin American and Caribbean Leadership Network (LALN). Under her leadership both organizations became a point of reference in the world for global security issues. Irma holds a degree in Physics, an MBA and completed graduate studies in Defense and Security. Early in her career, she worked on nuclear projects for the Argentine National Atomic Energy Commission (CNEA), and then she held managerial positions at the ExxonMobil Corporation. She is a member of the Steering Committee of the Fissile Materials Working Group (FMWG) and of the Nuclear Security Governance Expert Group. She is also a Chatham House Associate Fellow and participated in the World Economic Forum's Nuclear Security Council. Irma is the director of the NPSGlobal's Regional Postgraduate Course in International Security, Disarmament and Non-proliferation. Since 2010, she has participated in all the official non-governmental events on the side of the Nuclear Security Summits.

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Ricardo López Murphy. Economist and politician. Former Minister of Defense and of Economy. Member of the Latin American and Caribbean Leadership Network (LALN). He was a presidential candidate in 2003, and later, candidate to a variety of elective positions. He completed postgraduate studies at the University of Chicago. During much of his career he taught at university level. In the private sector, he worked as a consultant for institutions as well as national and international organizations. He is the Chair of the Fundación Cívico Republicana (FCR), an organization devoted to strengthening democratic institutions in Argentina. He was elected president of the Liberal Network of Latin America (RELIAL).

About the NPSGlobal Foundation

For the last 10 years, the NPSGlobal Foundation, a private non-profit organization based in Buenos Aires has increased its reputation as the non-governmental focal point in Latin America for disarmament, non-proliferation and nuclear security issues.

NPSGlobal develops its action through five main institutional programs: Knowledge without Boundaries (communication and outreach), Education for Prevention and Response (including the well-known Postgraduate Course in International Security, Disarmament and Non-proliferation), Proposals for Action (research and expansion of knowledge), Support for Decision Making (assistance to governments and multilateral organizations) and Networks of International Cooperation (partnership with institutions worldwide). All these programs have the purpose of supporting quality policymaking and its practical implementation, at all levels.

NPSGlobal promotes awareness, deep understanding of the international complexity and joint work among governments and civil society, to find practical solutions to reduce the current global insecurity.

The launch of its project, the Latin American and Caribbean Leadership Network (LALN) substantively increased its ability to influene policymaking.

The international community regards the organization as a source of innovation and of practical thinking, as well as an influential voice from the South contributing to global projects, and positively reaching governments and non-governmental organizations around the world.

It has been a pioneer in creating awareness on key nuclear security, disarmament and non-proliferation issues, as well as in promoting understanding and constructive debates on these relevant matters.

www.npsglobal.org/ info@npsglobal.org

Terror Unleashed

LALN Latin American and Caribbean Leadership Network for Nuclear Disarmament and Nonproliferation

Should terrorists detonate a nuclear bomb, anywhere in the world, catastrophic impacts would promptly reach global scale.

In their own national interests, all states should acknowledge their role in the joint effort to prevent nuclear terrorism.

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