HISTORICAL IMPLICATION OF SPENT FUEL RISK: PERSPECTIVES FROM NAGASAKI

Recommended Citation

Fumihiko Yoshida and Tatsujiro Suzuki, "HISTORICAL IMPLICATION OF SPENT FUEL RISK: PERSPECTIVES FROM NAGASAKI", NAPSNet Special Reports, December 28, 2017, https://nautilus.org/napsnet/napsnet-special-reports/historical-implication-of-spen--fuel-risk%e2%80%95%e2%80%95perspectives-from-nagasaki/

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DECEMBER 28, 2017

I. INTRODUCTION

In this essay, Fumihiko Yoshida and Tatsujiro Suzuki conclude that: “nuclear weapon states and nuclear-umbrella states which own spent nuclear fuel must face the risk of possible military attack (or terrorism) on spent fuel. For those who depend on nuclear deterrence, confronting such spent fuel-related risk has not been carefully considered. Even if nuclear deterrence can work to prevent an attack using nuclear weapons by a potential enemy, it is hard to believe that nuclear deterrence would prevent attacks on spent fuel. Yet intensive attacks on one or many spent fuel pools may cause enormous damage to a nuclear weapon state without leading to nuclear war. Thus, the security benefits of nuclear deterrence for a nuclear weapon state may be drastically reduced if its enemies realize that improving their ability to attack spent fuel may be incorporated in their own strategy as a military tool to deter actions by nuclear weapon state.”

Paper prepared for Workshop *Reducing Risk of Nuclear Terrorism and Spent Fuel Vulnerability in East Asia* co-sponsored by Nautilus Institute and Research Center for Nuclear Weapons Abolition, Nagasaki University(RECNA), Nagasaki, January 20-22, 2017

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Banner image: Participants at the *Reducing Risk of Nuclear Terrorism and Spent Fuel Vulnerability in East Asia* co-sponsored by Nautilus Institute and Research Center for the Abolition of Nuclear Weapons, Nagasaki University, Nagasaki, January 20-22, 2017, RECNA photo.

II. NAPSNET SPECIAL REPORT BY FUMIHIKO YOSHIDA AND TATSUJIRO SUZUKI

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Introduction

The main message coming from Nagasaki/Hiroshima is “No more *hibakusha* (victim of nuclear bomb), No more war, and abolition of nuclear weapons.” In this context, how can we interpret the risk of spent nuclear fuel? Given what happened at the Fukushima nuclear accident in 2011, the risks associated with spent nuclear fuel can be as serious as potential nuclear attack. Therefore, regardless of positions on nuclear energy, it is imperative to analyze security implications of spent fuel risks. This paper overviews of the implications of spent fuel risks for international security, especially we will look at the issues from the above three points (no more *hibakusha*, no more war and abolition of nuclear weapons).

No more Hibakusha

The main objective of President Obama’s nuclear security policy was to prevent nuclear explosion by terrorists using fissile materials[1]. But, from viewpoint of *Hibakusha*, whatever the causes, we should prevent any more victims of radiation exposure caused by an intentional or accidental event even if it does not involve any nuclear explosion. The message, “No more *hibakusha*” contains strong

“human security” conviction that all human beings should be protected from any type of nuclear risk[2].

A nuclear reactor contains massive amount of radioactive materials compared with nuclear bombs. For example, a nuclear weapon contains only a few kilograms of plutonium or a dozen kilograms of uranium, whereas a nuclear power plant contains dozens or even hundreds of tonnes of radioactive materials. In fact, spent nuclear fuel stored in the reactor building contains most of radioactive materials on each site of nuclear power plant. Furthermore, a reprocessing plant contains even more radioactive materials since it gathers spent fuels from all nuclear power plants. If radioactive materials are released from the reprocessing plant, regardless of its causes, whether intentional or accidental, war or terrorism, the national economy and many people’s health can face seriously affected.[3]

Whether the events are caused by nuclear bomb or nuclear reactor, there are common measures to deal with nuclear crisis in order to prevent unnecessary exposure and reduce health risk. In case of an unfortunate event which may cause radiation exposure, experiences in Nagasaki and Hiroshima dealing with radiation illness would help to minimize health impacts. In fact, medical assistance have been given from these two cities to the new nuclear victims such as those of Semipalatinsk nuclear tests, Chernobyl accident and most recently, those of Fukushima nuclear accident.[4]

Ideally speaking, there should be no more victims of radiation exposure; and medical needs to treat victims should be limited only to existing sites. In this context, it is unavoidable for the international community to consider risk management of spent fuel as a part of assuring human security in order to prevent dispersion of radioactive materials from spent nuclear fuel.

It was the 2011 Fukushima nuclear accident which reminded us of this important risk. Dr. Allison MacFarlane, who was a professor of George Mason University then and later became Chairperson of Nuclear Regulatory Commission (currently a Professor at George Washington University), took note of this spent fuel pool accident. She noted then we may face similar radiation risk even if terrorists rather than some other cause destroy the pool.[5] As chairperson of NRC, she strove to strengthen the regulation against the terrorism attack against the spent fuel pool.[6]

When we face nuclear risk, human security can be threatened in a short time. The Fukushima nuclear accident reminded us of this danger, and thus we recognized the need for more realistic management of the risks associated with spent fuel. We must consider spent fuel risk management as a way to ensure human security. The nuclear security issues must be also dealt with from a humanitarian perspective. Objectively speaking, the nuclear risk posed by nuclear bombs is quite different from the risk posed by spent fuel. But it is consistent with the wish of all *Hibakusha* to raise the issue of risk management of spent fuel.

No More War

When the message of “No More War” was sent from the *Hibaku-chi* (sites of the bomb attacks) in early days, it was assumed that the “war” referred to was between the big super powers, as in the Cold War. But, since the 9/11 terrorist attacks, in addition to preventing nuclear war, it has become urgent to prevent conflicts and attacks by the non-state actors and to prevent radiation hazard. In this context, priority has been shifted to nuclear security from nuclear war. Thus it has become a heavy task for *Hibaku-chi* to connect nuclear security to the message of “No More War.” This nexus may be a natural evolution of mission of *Hibaku-chi* in a new nuclear security environment, but, at the same time, may be a new opportunity to assure “human security” against all the nuclear risks.

It is true that international concern over spent fuel risks has increased because mismanagement

may create nuclear disaster either by terrorism attack or by nuclear accident. But such increased concern originally came from the shift in security concern of the US. This shift took place in the US which had overwhelming military power but is still vulnerable to nuclear attacks caused by non-state actors such as terrorists. However, this nucleaer security concern is not equally shared by many other nations.[7] Many nations consider other troubling factors are more threatening than terrorism or even nuclear terrorism.[8] For a nation which has nuclear power plants and a potential enemy at neighborhood, spent fuel risk can be a potential threat caused not only by the terrorists or accidents but also by the war itself.

It is conceivable that in a war, one party can target their enemy's spent fuel if their strategy is to cause undesirable damages during the war. Small nuclear missiles can cause more radiological contamination and radiation damages to public health than those caused by small nuclear explosions if they hit the spent fuel pools. Although Japan could avoid catastrophic damages if a nuclear attack missed the major metropolis areas, Japan can be easily put into a crisis if a radiation cloud from distant spent fuel pools cover the populated cities and its national life-line is severely damaged. Conventional missiles may need higher degree of precision than nuclear missiles, but attack with many missiles can increase the chance of aggressor`s success. In the future, we have to assume that missile guidance technologies will have improved accuracy. Over the same time frame, spent fuel storage will be needed at exposed to attack. For national security strategy, it is necessary to "prepare for the worst" although it is not possible nor practical to imagine an infinite number of scenarios. Unfortunately a "spent fuel attack by conventional and/or nuclear missiles" is an entirely "thinkable" scenario. The spent fuel risk will increase further if the number of countries that own nuclear power plants also increases.

In this way, even without nuclear war, war among countries with nuclear power programs may involve attacks on spent nuclear fuel which could result in large number of *Hibakushas*. Thus, the significance of the message of "No More War" has not vanished at all.

Technological options exist such as dry cask spent fuel storage that can reduce such risks[9]. But we also need policy responses to such security risks. In order to avoid catastrophic risks associated with spent nuclear fuel, we need to have common understanding that spent fuel risk is real among countries which possess nuclear power plants. Moreover, these nuclear power countries should share the awareness of "No More War" which is essential for maintaining safe and secure civilian nuclear power programs. Undoubtedly, such common understanding is consistent with the long term wish of "No more *Hibakusha*".

Nexus with Nuclear Deterrence

Given all the above, how may one shift from a security policy dependent on nuclear weapons, or nuclear deterrence, to the one without such dependence? This is the major policy question to be answered for Japan and posed by Hiroshima and Nagasaki, the victims of nuclear attack who pursue elimination of nuclear weapons. There can be multiple paths to realize such policy shift. One approach is to compare the "benefit and risk" of nuclear deterrence and such comparison could lead to alternative security policies. Nuclear deterrence may have some security benefits, but risks associated with nuclear deterrence could be unacceptably high.[10] Such recognition can encourage the security policy to shift from the one dependent on nuclear deterrence to the alternative security policy.

It goes without saying that security policy dependent on nuclear deterrence could lead to catastrophic nuclear war, including accidental nuclear war, the moment that deterrence fails. From the viewpoint of victims of nuclear attack, even small scale nuclear explosions are inhumane and unacceptable. Catastrophic negative impacts of nuclear attack greatly exceed the potential benefits

of nuclear deterrence and thus would never be acceptable for those who wish to eliminate such inhumane risks. Such comparison of “inhumane risks” versus “potential benefit” of nuclear deterrence has not been clearly discussed in traditional security policy debates. Such a policy debate has not taken place among experts who believe that nuclear deterrence is essential in Japan’s security policy. It is not likely either that such their basic stance will change in the near future. Still, it could be effective to include spent fuel risk as part of nuclear policy debate, when comparing risk and benefits of nuclear deterrence. Such discussion may lead to increased recognition of the risks of nuclear deterrence since considering the nuclear or conventional missile attack on spent fuel as a “not unthinkable” risk may change the overall nuclear risk-benefit calculus.

Conclusion

In this context, the following points need to be considered important when we think the nexus of spent fuel risk and nuclear deterrence.

First, nuclear weapon states and nuclear-umbrella states which own spent nuclear fuel must face the risk of possible military attack (or terrorism) on spent fuel. For those who depend on nuclear deterrence, confronting such spent fuel-related risk has not been carefully considered. Even if nuclear deterrence can work to prevent an attack using nuclear weapons by a potential enemy, it is hard to believe that nuclear deterrence would prevent attacks on spent fuel. Yet intensive attacks on one or many spent fuel pools may cause enormous damage to a nuclear weapon state without leading to nuclear war. Thus, the security benefits of nuclear deterrence for a nuclear weapon state may be drastically reduced if its enemies realize that improving their ability to attack spent fuel may be incorporated in their own strategy as a military tool to deter actions by nuclear weapon state.

Assuredly, attacking spent fuel is an “inhumane” attack under international law and practically speaking; but nuclear attack itself and/or using nuclear attack as a threat is also “inhumane.” If any war can invoke possible attack on spent fuel, the value of nuclear deterrence is arguably far lower than it appears, due to a massive potential cost that has not been counted in the past. In fact, technological advancement in missiles, drones or even cyber security may increase the possibility of successful attack on spent fuel, further degrading nuclear deterrence net benefits. In short, the benefits and risks of nuclear deterrence may need to be reconsidered seriously in light of the possibility that spent fuel may be targeted.

Second, we must recognize the fact that it is difficult to prohibit and prevent attack on spent fuel merely by reference to international law or international regulations. The Additional Protocol to the Geneva Conventions (of 12 August 1949), Article 56 says that “Works or installations containing dangerous forces, namely dams, dykes and nuclear electrical generating stations, shall not be made the object of attack, even where these objects are military objectives, if such attack may cause the release of dangerous forces and consequent severe losses among the civilian population.”[11] Many nuclear weapon states, nuclear umbrella states and non-nuclear weapon states have ratified the Protocol, but it is not clear that they will not violate such conventions if they are under the threats of national survival or reprising an attack by another state. Non-nuclear weapon countries may be willing to neglect such conventions if they are threatened by the nuclear weapons or possible attack by the nuclear weapon states (and/or umbrella states). The effectiveness of the above Protocol may have been weakened by the existence of nuclear deterrence. The argument that attack on spent fuel is inhumane but that the nuclear attack presumed in nuclear deterrence can be acceptably humane is under severe challenge from the humanitarian movement. Such an argument will not be able to eliminate risks of attack on spent fuel.

We may hear counter arguments that attacks on spent fuel pools should be considered as “exceptional” and therefore not included in the risk-benefit calculation related to nuclear

deterrence. However, it is unavoidable to include in such calculations the risk of spent fuel in light of the consequences of the Fukushima accident. The balance sheet of "benefits and risks" may change significantly once such spent fuel risks are considered. Regardless of one's views on the efficacy of nuclear power, spent nuclear fuel already exists and the risk of spent fuel attack cannot be eliminated soon. If one accepts that nuclear power programs will grow, the risk of spent fuel attack will also expand geographically. Nuclear deterrence cannot prevent such spent fuel risk, but on the contrary such spent fuel risk would pose new challenges to nuclear deterrence at various corners of the world.

Whatever the causes, whether accidental or intentional, with or without nuclear explosion, deterrence failures that may affect spent fuel and increase the number of *Hibakushas* should be prevented. As we noted at the beginning of the paper, that is the essence of message of "No More *Hibakusha*." And considering the negative impacts of spent fuel risks on "human security," we should not overlook the fact that underestimating the spent fuel risk might increase national security risks.

We learned a lesson from the Fukushima nuclear accident that spent fuel management is not only an issue for civilian nuclear power program but also for national security. This long standing but neglected and now newly recognized risk can clarify the limits of "nuclear deterrence" and furthermore highlight the fact that dependence on nuclear deterrence can endanger the safety and security of the country itself.

III. ENDNOTES

[1] Then President Barack Obama said, in his remarks in Prague in 2009, "we must ensure that terrorists never acquire a nuclear weapon. This is the most immediate and extreme threat to global security. One terrorist with one nuclear weapon could unleash massive destruction".

https://obamawhitehouse.archives.gov/the-press-office/remarks-president-barack-obama--rague-delivered

[2] For instance, one of survivor said, at 71th Nagasaki Peace Ceremony, that we will also cooperate with the people of Hiroshima, Fukushima, and Okinawa. Until the day the last nuclear weapon is destroyed, we will continue to do this. We pledge to work with Nagasaki's youth to pass on the concept of "Human Security".

http://www.city.nagasaki.lg.jp/heiwa/3020000/3020300/p028743_d/fil/PDF.pdf

[3] One tank of liquid, highly radioactive waste left from reprocessing nuclear fuel exploded in a region of the Soviet Union called Kyshtym in the Ural Mountains of Siberia in 1957. About consequences of this accident, see http://www.nrpa.no/publication/nrpabulletin-8-2007-the-kyshtym-accident-29th-september-1957.pdf

About potential risk of more serious radioactive disaster, see Richard Stone, "Near Miss at Fukushima a warning for U.S., panel says", http://www.sciencemag.org/news/2016/05/burning-reactor-fuel-could-have-worsened-fukushima-disaster

The "panel" quoted in this article is "Lessons Learned from the Fukushima Nuclear Accident for improving Safety and Security of U.S. Nuclear Plants: Phase 2", National Academy of Sciences,

2016. Full text is available at https://www.nap.edu/catalog/18294/lessons-learned-from--he-fukushima-nuclear-accident-for-improving-safety-of-us-nuclear-plants

[4] About collaboration between Nagasaki and Chernobyl, see

http://www-sdc.med.nagasaki-u.ac.jp/abdi/bases/belarus_e.html

On medical contributions from Hiroshima, see http://www.hiroshimapeacemedia.jp/?p=27631

[5] For example, in 2011, then associate professor of environmental science and policy at George Mason University Allison Macfarlane had concerns about the vulnerability of spent fuel pools. The Fukushima accident made it clear in everyone's eyes that the loss of cooling water at pools can result in a radioactive leak crisis. "If pools were damaged by a terrorist attack and water was lost, the scenario would be the same as what occurred at the Fukushima plant," said Macfarlane

https://www.cane.org.za/nuclear-energy-related/nuclear-plants-must-not-turn-into-radi-logical-weapons/

[6] see written testimony by Allison Macfarlane .Chairman of U.S. Nuclear Regulatory Commission to the Senate Committee on Environment and Public Works, January 30 in 2014.

https://www.epw.senate.gov/public/_cache/files/d03a0a0b-0415-48dc-9-bd-e0f92eeddd0b/13014hearingwitnesstestimonymacfarlane.pdf

[7] Miles Pomper pointed out shortcomings of the Nuclear Security Summit, in his article "The Nuclear Summit will leave unfinished work", Bulletin of Atomic Acientists, as follows; "The lack of universal participation in the process—most notably Russia's decision not to attend the 2016 summit—has further contributed to the failure to reach Obama's goal of securing all vulnerable materials".

http://thebulletin.org/nuclear-security-summit-will-leave-unfinished-work9186

[8] For example, Natasha Ezrow of University of Essex list four other big threats. These are Civil Conflict, Organized Crime, Small Arms and Environmental Issues. Natasha Ezrow, "Five biggest threats facing world in 2016", The Conservation, January 1 in 2016.

https://theconversation.com/five-biggest-security-threats-facing-the-world-in-2016-52456

[9] Luiz Sergio Romanato, "Advantages of Dry Hardened Cask over Wet Storage for Spent Fuel", presented at 2011 International Nuclear Atlantic Conference (INAC 2011). http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/42/105/42105214.pdf

[10] On comprehensive research report about nuclear weapons risks, see

UNNIDIR, "Understanding Nuclear Weapons Risks", April 2017

http://www.unidir.org/programmes/weapons-of-mass-destruction/understanding-nuclear-weapon-risks

[11] For full text of Protocol Additional to the Geneva Conventions including Article 56, see https://www.icrc.org/eng/assets/files/other/icrc_002_0321.pdf

IV. NAUTILUS INVITES YOUR RESPONSE

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