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Original article

Research on The Damage Scale Analysis of South Korea from North Korea's Tactical Nuclear Attack

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ABSTRACT North Korea's nuclear weapons threat to South Korea is increasing day by day, and public interest is also growing. However, we have not been able to find an accurate answer to the question of whether North Korea's nuclear attack will take place, how much damage it will cause if it happens, and what we will prepare to minimize the damage. The subject of this research analyzed how much damage South Korea would get from various types of North Korea's nuclear weapons attacks. The scope of the research is limited to military and civilian airports among national important facilities, "A" grade in South Korea. There are various sizes and types of nuclear weapons in North Korea. Therefore, the scope of the analysis is limited to tactical nuclear weapons attacks. Through this research, we analyzed the damage scale of South Korea from North Korea's tactical nuclear attack through simulation. And we also suggested countermeasures such as establishing protective facilities and minimizing damage caused by damage to military and civilian airports among national important facilities, 'A' grade. The simulation program is NUKEMAP by Alex Wellerstein.

Key words: Nuclear Weapon Attack, National Important Facility, North Korea

1. Introduction

1.1. The purpose and focus of the research

North Korea's nuclear weapons threat to South Korea is increasing day by day, and public interest is also growing. However, we have not been able to find an accurate answer to the question of whether North Korea's nuclear attack will take place, how much damage it will cause if it happens, and what we will prepare to minimize the damage. Of course, the government, the Ministry of National Defense, and military experts say that they are fully prepared, but the public does not even know what kind of protection facilities and preparation manuals are available. Therefore, this research attempts to analyze the damage and effects of various types of nuclear weapons under the assumption that there is a nuclear attack from North Korea. In addition, through this analysis, we intend to provide policy alternative data on what scale of protection facilities are needed and where they are most effective. The nuclear weapons damage analysis simulation used in this research is NUKEMAP by Alex Wellerstein.

2.2. The scope of this research

The scope of this research is to analyze thoroughly the nuclear weapons on the scale of tactical nuclear weapons among North Korea's various nuclear weapons. The damage scale of the attack according to the type of tactical nuclear weapons in North Korea was analyzed through simulation. However, the scope of the simulation was limited to "A" grade, which are important national facilities. After that, the political and military issues according to the damage scale were suggested politically.

The research is organized as follows;

Chapter 1 presents an introduction that consists of the purpose, the scope, and the key questions related to the purpose of this research.

Chapter 2 reviews of related literature.

Chapter 3 presents the type of tactical nuclear weapons in

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Table 1. The nuclear test and scale of North Korea

Division	1st	2nd	3rd	4th	5th	6th
Period	2006.10.09	2009.5.25	2013.02.12	2016.01.06	2016.09.09	2017.09.03
Type of Bomb	Atomic bombs (Plutonium)	Atomic bombs (Plutonium)	Atomic bombs (Uranium)	Atomic bombs (Plutonium)	Atomic bombs (Plutonium)	Atomic bombs (Hydrogen)
Power (Estimated)	0.5~1kt	3~4kt	6~7kt	6kt	10kt	50~100kt
Magnitude of an earthquake	3.9	4.5	4.9	4.8	5	5.7

※ 1kt = TNT 1,000t

North Korea and the concept of national important facilities.

Chapter 4 presents the damage scale of the attack according to the type of tactical nuclear weapons in North Korea was analyzed through simulation.

Chapter 5 presents the conclusion.

2. Reviews of Related Literature

Hans M. Kristensen, Matt Korda, Eliana Johns & Mackenzie Knight (2024) analyzed that North Korea is enhancing and diversifying its missile force, most recently with new solid-fuel long-range strategic missiles, short-range tactical missiles, and sea-based missiles. Paul K. Davis & Bruce W. Bennett (2022) analyzed several hypothetical nuclear-use cases in a Korean conflict for application in a larger project. Robert L. Gallucci. (2021) analyzed that the real US objective in talks with North Korea should no longer be its denuclearisation. Toby Dalton & Jina Kim (2023) analyzed that with the growing dangers of conflict escalation and nuclear use, it is time to consider alternative policies. Matt Korda (2022) analyzed that DPRK could use its short-range and medium-range ballistic missiles early in a conflict to strike political and military targets in the Republic of Korea (ROK) and Japan.

3. The Type of Tactical Nuclear Weapons in North Korea

For military purposes, North Korea is currently far behind South Korea in the so-called symmetric power competition. North Korea itself is well aware that it is no longer a match for South Korea in conventional forces throughout the army, navy, and air forces. Currently, the GDP gap between the two Korea is more than 60 times, and the population gap is more than twice that, and the probability of this reversal naturally converges to zero. In other words, because the quality of conventional power and the ability to maintain is unmatched, the only way to make up for it is asymmetric power [1].

Currently, North Korea has already developed hundreds of kilotons of strategic nuclear weapons through its sixth nuclear test and it can force more than one million civilian casualties in Seoul.

According to a nuclear explosion 1st test conducted on October 9, 2006, the power of the nucleus is 0.5kt. The Little Boy dropped on Hiroshima in 1945 is 15kt. Even if you calculate it very simply, it is less than one-thirtieth of the power. They say they can't destroy any of Seoul National University's campuses. North Korea declared its absence from the six-party talks in April 2009 [2]. After that, North Korea, which insisted on "initiating reprocessing spent fuel rods at its Yongbyon nuclear facilities", conducted a 2nd nuclear test on May 25, 2009, the power of the nucleus is 3~4kt [3]. According to a nuclear explosion 3rd test conducted on February 12, 2013, the power of the nucleus is 6~7kt [4]. Unlike the first and second tests in which plutonium was used, the government estimates that highly enriched uranium was used in this test.

Starting with the 4th, and 5th tests in 2016 and the 6th test in 2017, the number of nuclear tests is increasing and its power is increasing compared to the previous tests in two years [5]. It is also believed that the miniaturization and weight reduction of nuclear warheads have also been achieved. Finally, on April 16, 2022, the self-proclaimed tactical nuclear operating weapon was released and test-fired [6,7].

4. The Concept of National Important Facilities

The term "national important facilities" means facilities that have a significant impact on national security and people's lives if they are occupied or destroyed by enemies, such as public institutions, airports, ports, and major industrial facilities, or are paralyzed from the ground up.

Table 2. The classification of national important facilities

Division	"A" grade	"B" grade	"C" grade
Concept	Facilities that are occupied or destroyed by the enemy, require the execution of integrated defense operations in a wide area in case of functional paralysis and can have a decisive impact on people's lives.	Facilities that are occupied or destroyed by the enemy, require the performance of integrated defense operations in some areas in case of functional paralysis and may have a significant impact on the lives of the people.	Facilities that are required to carry out integrated defense operations for a short period in a limited area when occupied or destroyed by the enemy or paralyzed from function, can significantly affect people's lives.
Classification Criteria	Cheong Wa Dae, the National Assembly, the Supreme Court, and the Government Complex Ministry of National Defense and National Intelligence Service Office Bank of Korea's headquarters, International Airport etc.	Central administrative agencies, departments and equivalent agencies, Supreme Prosecutors' Office, National Police Agency, and Meteorological Office Building, Domestic airport etc.	Government buildings of central administrative agencies, National Intelligence Service Branch, Regional Headquarters of the Bank of Korea, Port facility with a capacity of more than 100,000 tons etc.

The targets of national important facilities are as follows.

1. Major national and public institutions
2. Major industrial facilities such as steel, shipbuilding, aircraft, oil refining, heavy chemical, defense industry, large-scale gas and oil storage facilities, etc.
3. Major power facilities such as nuclear power plants, large-capacity power plants and substations
4. Major international and domestic airports
5. A port where large ships can enter and leave the port
6. Major water supply facilities such as large water intake and

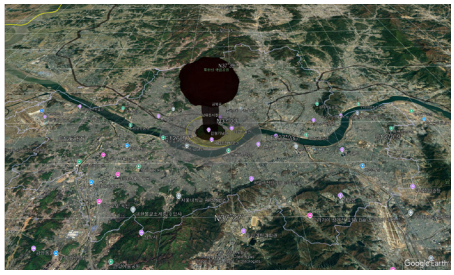
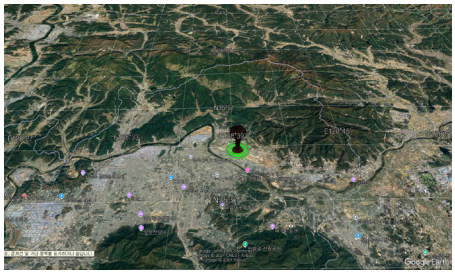
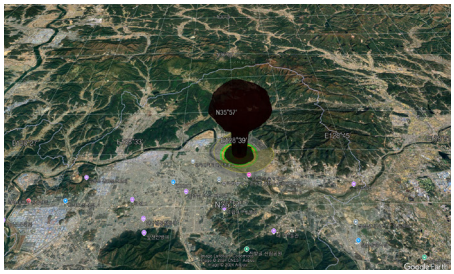
Division	Plutonium 0.5kt	Plutonium 10kt
"A" grade Incheon International Airport		
"A" grade Ministry of National Defense		
"A" grade Daegu International Airport		

Fig. 1. The damage scale simulation of tactical nuclear weapons.

Table 3. The toll of the estimated fatalities and injuries

Division	Incheon International Airport		Ministry of National Defense		Daegu International Airport	
	0.5kt	10kt	0.5kt	10kt	0.5kt	10kt
Estimated Fatalities Toll	970	1,690	2.920	19,890	1,240	14,930
Estimated Injuries Toll	800	1,210	5,880	65,010	5,060	46,500

water purification facilities and multi-purpose dams

The classification of national important facilities is as follows.

State important facilities shall be classified into national important facilities “A” grade, national important facilities “B” grade, and national important facilities “C” grade according to the degree of importance and value of the functions and roles of facilities, and the standards shall be as follows.

5. The Damage Scale of the Attack according to the Type of Tactical Nuclear Weapons in North Korea through Simulation

This simulation used NUKEMAP by Alex Wellerstein as mentioned in the introduction. The simulation analyzed the results using only two plutonium 0.5kt and 10kt of the tactical nuclear scale shown up to North Korea’s sixth nuclear test [8]. The tactical nuclear attack area was simulated with only three types: Incheon International Airport, Yongsan Defense Ministry, and Daegu International Airport at “A” grade of national important facilities. When attacking, it was also assumed that it was an aerial explosion rather than the surface, and the number of fatalities and injuries was analyzed except for the effect of wind [9].

This analysis of results is a simple analysis of fatalities and injuries in national important facilities, but the implications for us are great. North Korea's nuclear is our biggest national security threat. However, there is still little movement to accurately analyze and prepare for where they will be attacked and what damage they will suffer. Therefore, much research should be conducted starting with this analysis. Implications should be made in many parts, such as a more accurate damage scale, construction of preparedness facilities, emergency medical system, and supplementation of the integrated protection system of public and military force [10].

6. Conclusion

For military purposes, North Korea is currently far behind South Korea in the so-called symmetric power competition. North Korea itself is well aware that it is no longer a match for South Korea in conventional forces throughout the army, navy, and air forces. Currently, the GDP gap between the two Korea is more than 60 times, and the population gap is more than twice that, and the probability of this reversal naturally converges to zero. In other words, because the quality of conventional power and the ability to maintain is unmatched, the only way to make up for it is asymmetric power.

Currently, North Korea has already developed hundreds of kilotons of strategic nuclear weapons through its sixth nuclear test and it can force more than one million civilian casualties in Seoul.

North Korea’s nuclear weapons threat to South Korea is also increasing day by day, and public interest is also growing. However, we have not been able to find an accurate answer to the question of whether North Korea’s nuclear attack will take place, how much damage it will cause if it happens, and what we will prepare to minimize the damage. Of course, the government, the Ministry of National Defense, and military experts say that they are fully prepared, but the public does not even know what kind of protection facilities and preparation manuals are available. Therefore, this research attempts to analyze the damage and effects of various types of nuclear weapons under the assumption that there is a nuclear attack from North Korea. In addition, through this analysis, we intend to provide policy alternative data on what scale of protection facilities are needed and where they are most effective.

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test. The tactical nuclear attack area was simulated with only three types: Incheon International Airport, Yongsan Defense Ministry, and Daegu International Airport at "A" grade of national important facilities. This analysis of results is a simple analysis of fatalities and injuries in national important facilities, but the implications for us are great. North Korea's nuclear is our biggest national security threat. However, there is still little movement to accurately analyze and prepare for where they will be attacked and what damage they will suffer. Therefore, much research should be conducted starting with this analysis. Implications should be made in many parts, such as a more accurate damage scale, construction of preparedness facilities, emergency medical system, and supplementation of the integrated protection system of public and military force.

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