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Articles

Protection of border regions-cities located between states possessing nuclear weapons and non nuclear weapon states: new norms in international law

Protección de regiones-ciudades fronterizas ubicadas entre Estados con armas nucleares y Estados sin armas nucleares: nuevas normas en el derecho internacional

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Abstract

The objective of this article is to analyze the border regions-cities between States possessing nuclear weapons and non-nuclear-weapon States for a norm proposal of protection to prevent the risk of a nuclear attack. The research identified States, the number of cities and population of border regions, and compared the amount of population of such regions with the population covered by the treaties of the nuclear-weapons-free zones and the treaties of nuclear-weapon-free geographical regions-areas. The study analyzed the humanitarian consequences of a hypothetical nuclear detonation in a border region between the United States and Mexico (Tijuana-San Diego case) and its geopolitical implications for international security. The conclusions expose that the border regions are vulnerable in the absence of norms, and the proposal is viable for the creation of an international norm of protection compatible with the treaties that seek nuclear disarmament.

Keywords: border regions and cities, protection norm, humanitarian impact, nuclear disarmament, international treaties.

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Resumen:

El objetivo de este artículo es analizar las regiones-ciudades fronterizas entre Estados con armas nucleares y Estados sin armas nucleares para una propuesta de norma de protección orientada a prevenir el riesgo de ataque nuclear. La investigación identificó Estados, cantidad de ciudades y de población de las regiones fronterizas y comparó la cantidad de población de las regiones fronterizas con la

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población cubierta por los tratados de zonas libres de armas nucleares y los tratados de regiones-áreas geográficas libres de armas nucleares. El estudio analizó las consecuencias humanitarias de una hipotética detonación nuclear en una región fronteriza entre Estados Unidos y México (caso Tijuana-San Diego) y sus implicaciones geopolíticas en la seguridad internacional. Las conclusiones exponen que las regiones fronterizas son vulnerables ante la ausencia de normas, y la propuesta es viable para la creación de una norma internacional de protección compatible con los tratados que buscan el desarme nuclear.

Palabras clave: regiones ciudades fronterizas, norma de protección, impacto humanitario, desarme nuclear, tratados internacionales.

Introduction

Due to the consequences of a possible nuclear detonation, this study presents different data on border regions-cities between states possessing nuclear weapons and non-nuclear-weapon states. Geopolitical tensions involving nine states[1] with a total of 13 130 nuclear weapons[2] (Recna Nuclear Warhead Data Monitoring Team, 2021) are conducive to global risk conditions. The analysis of the absence of international norms and the impact of nuclear weapons contributes to the exploration of proposals for the protection of these border regions by means of a treaty, agreement, amendment (hard law), or other mechanisms through United Nations (UN) resolutions, state initiatives, and international or regional organizations.

This study aims to analyze border regions-cities and the humanitarian consequences of a possible nuclear detonation in a city of a state possessing nuclear weapons whose border region adjoins that of a city of a non-nuclear-weapon state. The central argument of this study is that regions or cities of non-nuclear-weapon states whose borders adjoin states possessing nuclear weapons are vulnerable due to the absence of preventive international policies and norms because cities of states possessing nuclear weapons may be strategic points of nuclear attack by state adversaries if state policies—doctrines of deterrence of potential conflicts—fail.

The three conferences on the Humanitarian Impact of Nuclear Weapons (HINW), held in Norway, Mexico, and Austria between 2013-2014, considered in their main conclusions that a nuclear detonation does not recognize borders (Europe Integration Foreign Affairs, 2014). This is consistent with the findings: the detonation goes beyond borders; the nuclear impact and its consequences can affect nations not involved in the conflicts. The impact would be devastating because it would cause fatalities, injuries, and environmental, structural, and economic damage to the targeted city and the

[1] In total there are nine states possessing nuclear weapons. Five (United States, Russia, United Kingdom, France, United Kingdom, China) are recognized as nuclear-weapon states by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which states "For the purposes of this treaty, a nuclear-weapon state is a state that has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to January 1, 1967". The other four states (India, Pakistan, Israel, North Korea) have nuclear weapons, but for the purposes of the NPT they are not recognized as nuclear-weapon states. For the practical purposes of this paper, the nine states are collectively referred to as states possessing nuclear weapons.

[2] The approximate numbers of nuclear weapons per state are: Russia, 6 260; United States, 5 550; China, 350; France, 290; United Kingdom, 225; Pakistan, 165; India, 160; Israel, 90; North Korea, 40 (Recna Nuclear Warhead Data Monitoring Team, 2021).

adjacent border city. Holding the HINW conferences helped lead the United Nations General Assembly adopt in 2017 the Treaty on the Prohibition of Nuclear Weapons (TPNW). The TPNW, in its preamble, considers the concern that the consequences of nuclear weapons transcend national borders and cause impacts on humanity and the global environment.

This paper proposes the protection of border regions that can contribute to disarmament and peace. The proposal to protect border regions between states possessing nuclear weapons and non-nuclear-weapon states considers the two general positions on disarmament. The first position is on the step-by-step disarmament policies of the permanent member states of the UN Security Council and their allies in this matter. The second position is that of states seeking disarmament—immediate and total elimination of nuclear weapons. It also considers the relationship of the issue to states possessing nuclear weapons outside the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The proposal explores a diplomatic strategy that benefits both approaches with a balance point for consensus. This analysis seeks to contribute to peace and security, generate stability that reduces geopolitical dangers, avoid the risk of humanitarian impact, and help safeguard the environment and global development. The protection of border regions would limit the use of nuclear weapons, a further justification for their non-existence in the future, thus reducing military expenditure and international tensions.

This paper is divided into three parts. The first presents a quantitative review of the borders of each of the nine states possessing nuclear weapons. It also identifies the cities in the border regions and the population size. Finally, this section presents a comparative analysis between the number of population found in the border regions and the population covered by the treaties of nuclear-weapon-free zones and the treaties of nuclear-weapon-free geographical regions. The second part analyzes the consequences of a nuclear detonation in a region involving two border cities by comparing two simulators, one in Mexico and the other in the United States (the Tijuana-San Diego case), and their geopolitical implications for international security. The third part presents a proposal to explore and analyze the protection of border regions and cities between states possessing nuclear weapons and non-nuclear-weapon states.

Boundaries between states possessing nuclear weapons and non-nuclear-weapon states

A review of the borders of the nine states possessing nuclear weapons reveals a considerable number of cities and populations on both sides of their geographic boundaries. It also identifies each non-nuclear-weapon state that shares a border with the states possessing nuclear weapons.

The study verified the population of each city located at a maximum distance of 100 miles from the border on both sides, either of the state possessing nuclear weapons or the non-nuclear-weapon state. It considered the 100-mile distance based on the immediate effects of nuclear weapons in their detonation ranges according to kiloton and megaton capacities. This study also compares the quantity of the population in the border regions between states possessing nuclear weapons and non-nuclear-weapon

states with the population that is covered ("protected") by regional nuclear-weapon-free zone treaties.

Nuclear weapons have different energy capacities measured in kilotons and megatons; one kiloton is equivalent to 1 000 tons of trinitrotoluene (TNT), and one megaton is equivalent to one million tons of TNT (Siracusa, 2015). An example of kilotons is the two warheads used in the cities of Hiroshima and Nagasaki, which ranged between 15 and 21 kilotons (Malik, 1985). Nuclear technological development from 1945 to 2021 made it possible to create and test nuclear warheads with a capacity of 1 to 50 megatons. The immediate effects of a nuclear detonation of 1 to 50 megatons can be within a range of 100 miles or 160.93 kilometers away, depending on various conditions where the detonation takes place, such as height above the ground, atmospheric pressure, or weather, among others (Glasstone & Dolan, 1977). The effects of radiation can go to a distance greater than 300 miles without limits, depending on the wind direction, among other environmental conditions (Glasstone & Dolan, 1977).

Table 1. States that share borders with states possessing nuclear weapons

	State possessing nuclear weapons	Border with	Subtotal	Total
1	United States	Canada, Mexico	2	2
2	United Kingdom	Ireland	1	1
3	France	Germany, Andorra, Belgium, Spain, Italy, Luxembourg, Switzerland, Monaco, the Netherlands* *The Netherlands does not share a land border with France, but it is within a distance of 50 to 100 miles.	9	9
4	Russia	China, North Korea, Estonia, Finland, Kazakhstan, Mongolia, Norway, Ukraine, Azerbaijan, Latvia, Belarus, Georgia	12	10
5	China	Mongolia, Russia, Myanmar, India, Kazakhstan, North Korea, Vietnam, Nepal, Kyrgyzstan, Pakistan, Bhutan, Laos, Tajikistan, Afghanistan	14	10
6	India	Bangladesh, China, Nepal, Pakistan, Bhutan, Myanmar	6	4
7	Pakistan	India, Afghanistan, China, Iran	4	2
8	Israel	Lebanon, Syria, Jordan, Palestine, Egypt	5	5
9	North Korea	China, South Korea, Russia	3	1
		Total	56-6: 50	44-6: 38

Source: created by the author based on maps from United Nations Geospatial, location information for a better world (n. d.) and Google (n. d.)

The subtotal in Table 1 is an overall margin of all countries whose borders adjoin the nine states possessing nuclear weapons, a sum that represents a total of 50. It should be noted that some states overlap with more than one state possessing nuclear weapons,

so a second count was performed to remove states that border more than one and to remove nuclear-armed countries. The objective is to determine how many non-nuclear-weapon states border the nine states possessing nuclear weapons. There are a total of 38 non-nuclear-weapon states bordering nuclear armed states (Table 2).

Table 2. Border breakdown

Subtotal of states	50
Sum of states possessing nuclear weapons bordering other nuclear armed states	6
Sum of non-nuclear-weapon states bordering two states possessing nuclear weapons	6
Total number of non-nuclear-weapon states that have a land border with any of the nine states possessing nuclear weapons	38

Source: created by the author based on maps from the United Nations Geospatial, location information for a better world (n. d.) and Google (n. d.)

Table 3. Borders between states possessing nuclear weapons

States possessing nuclear weapons	Shares a border with
China	Russia, India, North Korea, and Pakistan
North Korea	Russia and tChina
Russia	China and North Korea
India	China and Pakistan
Pakistan	China and India

Source: created by the author based on maps from the United Nations Geospatial, location information for a better world (n. d.) and Google (n. d.)

Table 4. Non-nuclear-weapon states sharing borders with two states possessing nuclear weapons

Non-nuclear-weapon states	Shares a border with
Mongolia	Russia and China
Kazakhstan	Russia and China
Nepal	China and India
Bhutan	China and India
Myanmar	China and India
Afghanistan	China and Pakistan

Source: created by the author based on maps from the United Nations Geospatial, location information for a better world (n. d.) and Google (n. d.)

Table 3 presents the states possessing nuclear weapons that border other nuclear armed states. Table 4 presents each of the six non-nuclear-weapon states that border two states possessing nuclear weapons.

Population and cities in the border regions between states possessing nuclear weapons and non-nuclear-weapon states

The information in this study (see Table 5) presents a total of 2 453 cities[3] within 100 miles of the border. The number of cities in non-nuclear-weapon states is 1 246. In the case of states possessing nuclear weapons, the total number of cities is 1 207. The total population of these cities located in the border regions is 254 194 347. There are 38 cities with more than one million inhabitants.

Table 5. Population and cities in the border regions between states possessing nuclear weapons and non-nuclear-weapon states

Total number of cities	2 453
Cities in non-nuclear-weapon states	1 246
Cities in states possessing nuclear weapons	1 207
Number of cities with more than one million inhabitants	38
Total population	**254 194 347**

Source: created by the author with data obtained through the identification of each city and the review of the population in official censuses

The total population living in cities in the border regions between states possessing nuclear weapons and non-nuclear-weapon states is equivalent to 254 194 347 people. This number is important from the human perspective because each person's life is significant. The lives of the populations in the border regions between non-nuclear-weapon states and states possessing nuclear weapons are vulnerable, some more than others, depending on the region in which they are located. Such regions and populations are not protected or included in a legal instrument compared to other regions or areas. The zones considered by treaties are Nuclear-Weapon-Free Zones (NWFZ) and certain geographic areas-regions. The concept NWFZ appears in the United Nations General Assembly resolution 3472B (1975):

> A "Nuclear-Weapon-Free Zone" shall, as a general rule, mean any zone recognized as such by the General Assembly of the United Nations, which any group of States, in the free exercises of their sovereignty, has established by virtue of a treaty or convention whereby:
>
> *a*) The statute of total absence of nuclear weapons to which the zone shall be subject, including the procedure for the delimitation of the zone, is defined;

[3] The data in Table 5 were obtained by identifying each city and reviewing its population size. For this study, an extensive database was created that includes state, city, distance to border, population, and census year, which generated a series of data categories. The sources of the database are official censuses of states and their cities, and the population statistics website City Population which references and links official state censuses. The database exceeds the page limit of this article so it is not included, but it can be requested from the author for consultation.

b) An international system of verification and control is established to guarantee compliance with the obligations deriving from that statute. (G. A. RES 3472B, p. 15, December 11, 1975)

The Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Treaty of Tlatelolco), adopted in 1967, is the first regional treaty prohibiting the manufacture, possession, and use of nuclear weapons in a populated region. The Treaty of Tlatelolco served as an example for five other regions that opted to join NWFZ: the 1985 Treaty of Rarotonga in the South Pacific; Bangkok in 1995 in Southeast Asia; Pelindaba in 1996 in Africa; Semipalatinsk in 2006 in Central Asia; and, finally, the territory of Mongolia, which declared itself a nuclear-weapon-free state in 2000 (Organismo para la Proscripción de las Armas Nucleares [OPANAL], n. d.; United Nations Office for Disarmament Affairs [UNODA], n. d.-c). The Middle East region[4] does not have a NWFZ treaty, although it initiated consultations in 2019. Table 6 presents the regional NWFZ treaties, identifying the number of states and the population of each zone.

Table 6. Nuclear-Weapon-Free Zone treaties and population

Treaty	Official name of the treaty	States	Population
Treaty of Tlatelolco	Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean	33	653 million (2019)
Treaty of Rarotonga	South Pacific Nuclear Free Zone Treaty	13	41.9 million (2020)
Treaty of Bangkok	Treaty on the Southeast Asia Nuclear Weapon-Free Zone	10	661 million (2019)
Treaty of Pelindaba	African Nuclear-Weapon-Free Zone Treaty	51	1 276.7 million (2019)
Treaty of Semipalatinsk	Treaty on a Nuclear-Weapon-Free Zone in Central Asia	5	72.8 million (2019)
Resolutions on status-conditional recognition of Mongolia	UN General Assembly Resolutions 53/77D and 55/33S on international security and Mongolia's Nuclear-Weapon-Free status	1	3.2 million (2019)

Source: created by the author with population data by country from the United Nations Population Fund (UNFPA, n. d.) and UNODA (n. d.-b)

Table 6 shows that the 254 million people in the border regions exceed the population covered by the Rarotonga, Semipalatinsk treaties and Mongolia. The border regions have slightly less than half the population covered by the Tlatelolco and Bangkok treaties. Finally, the population of the border regions represents one-fifth of

[4] The United Nations General Assembly, with resolution A/73/546, initiated, since 2019, a series of conferences to consult on the possibility of establishing in the Middle East a zone free of nuclear weapons and other weapons of mass destruction. It was attended by 22 states with a total population of 513.7 million. Israel did not participate and has a population of 8.8 million (UNFPA, n. d.; UNODA, n. d.-a).

the population covered by the Treaty of Pelindaba. Table 7 presents other treaties that preclude the presence of nuclear weapons in certain geographic areas-regions.

Table 7. Nuclear-Weapon-Free Geographical Regions treaties and population

Treaty	Official name	States	Population covered by the treaty
Antarctic Treaty	Antarctic Treaty (1959)	52 signatory states (29 consultative and 23 non-consultative parties)	1 000 to 5 000 people live there temporarily. The number of people varies in each period of the year
Outer Space Treaty	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967)	107 States Parties and 89 signatories	6 astronauts (on the International Space Station. The countries to which they belong are the United States, Canada, and Russia)
Sea-bed Treaty	Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil Thereof (1971)	94 States Parties and 84 signatories	Data not available
Moon Agreement	Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979)	18 States Parties and 11 signatories	0

Source: created by the author based on data from the Instituto Antártico Chileno (2019), NASA (n. d.-b) and UNODA (n. d.-b)

Article I of the Antarctic Treaty stipulates that "(...) Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measure of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons". (Antarctic Treaty, 1959). Article V refers to the prohibition of nuclear explosions and the presence of radioactive waste in the region. The treaty permits scientific research by military personnel or equipment for peaceful purposes. In Antarctica, 29 countries carry out various scientific research activities, sending personnel at different times of the year. During that time, the population can vary from 1 000 to 5 000 people. In the case of the Outer Space Treaty, Article IV stipulates:

> States Parties to the treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner. (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, January 27, 1967, https://www.unoosa.org/pdf/publications/STSPACE11S.pdf)

The article also refers to other celestial bodies as well as the Moon. Their use for peaceful purposes prohibits the establishment of military bases, installations, and fortifications, and the testing of any weapons. There is also a specific UN agreement for the Moon: Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, dated 1979. This Moon Agreement provides that nuclear weapons must not be deployed or used. The population of the Moon is registered as zero, and the population of outer space can be interpreted as the six people registered on the International Space Station in 2019. This population is maintained temporarily. Historically, the maximum number of people in outer space before 2019 was 13 (NASA, n. d.-b). Accordingly, based on the way the Moon is considered, the planet Mars will also require a legal instrument that includes the issue of nuclear weapons and their non-deployment and non-use on Martian territory. The governmental and private technological trend is for humans to inhabit Mars, and there will be few inhabitants at first. The regulatory background of outer space will make it possible to contemplate the international community attending to the nuclear issue of Mars with little or no population.

The analysis of the territory covered by the Antarctic Treaty revealed a population of up to 5 000 people. Regarding the Outer Space Treaty, according to the expeditions recorded by NASA from 2000 to 2019 (n. d.-a), the population has fluctuated between two and thirteen. The two treaties are important for humanity and cover a lower population than the rest of the NWFZ treaties and the population found in the border regions.

The analysis of the comparisons between the number of populations covered by each of the treaties and the number of populations located in the border regions between states possessing nuclear weapons and non-nuclear-weapon states leads to concern about the humanitarian consequences of the use of nuclear weapons and their effects on the environment, the economy, food security, human life and health, and vulnerable groups, among others.[5] The aforementioned justifies a review and analysis of the possibility of new agreements, treaties, or legal applications to protect the population in border regions.

Consequences of a hypothetical nuclear detonation in a border region, Tijuana-San Diego case

This part of the study aims to analyze the consequences of a possible nuclear detonation in a city of a state possessing nuclear weapons bordering a city of a non-nuclear-weapon state. According to military policies and perceptions in selecting attack targets, cities of states possessing nuclear weapons may be strategic points of nuclear attack by state adversaries. Since a nuclear detonation does not recognize borders, the impact and consequences can affect nations outside the conflicts. Hence, this study argues that cities bordering states possessing nuclear weapons are vulnerable due to the absence of international policies and norms to prevent nuclear attacks.

[5] The argument is based on information from the HINW conferences, which confirm in their results that there is no organization or state capacity to effectively address the consequences of a nuclear detonation in a populated area (Europe Integration Foreign Affairs, 2014).

The methodology of this study is quantitative, qualitative, and comparative, integrated with an analysis of international security and the application of two simulation models of a nuclear detonation. It presents the detonation simulation in a border region in order to analyze its consequences with statistical data. The cities chosen for this study are San Diego, California, in the United States, and Tijuana, Baja California, in Mexico.

The border between the United States and Mexico runs for 3 175 kilometers (Comisión Internacional de Límites y Aguas entre México y los Estados Unidos [CILA], 2017). It has high migration and commercial flow. Mexico's foreign policy is pacifist and has prestige at the international level in conflict mediation, peaceful settlement of disputes, and the historical conclusion of treaties. Mexico led the creation of the Treaty of Tlatelolco, which served as an example for other NWFZ treaties. The Mexican diplomat Alfonso García Robles received the Nobel Peace Prize in 1982 for his work on disarmament (Instituto Matías Romero & Secretaría de Relaciones Exteriores, 2008). Mexico, as a non-nuclear-weapon state, has been active since the beginning of the Conference on Disarmament in Geneva and its permanent mission to the United Nations First Committee Disarmament and International Security.

Mexican diplomat María Antonieta Jáquez shows that Mexico contributed with nuclear disarmament principles in the NPT negotiations that supported Article VI, which makes possible future treaties on disarmament, the initiatives of the Global Campaign for Disarmament, the UN study on disarmament, and the UN study on disarmament and non-proliferation education (Jáquez Huacuja, 2015). Mexico was a key organizer in the HINW conferences and the initiative of the negotiations for the TPNW.

On the other hand, US foreign policy on international security issues has been involved in various conflicts and tensions, such as the satellite conflicts of the Cold War, the Iraq wars, tensions with Russia in the cases of Syria and Ukraine, and tensions with North Korea and Iran. It is also important to note that the United States has a diplomatic, political, and academic current that has contributed to disarmament and non-proliferation. For example, this US current is reflected in its participation as negotiator and depositary of the NPT in concluding the Strategic Arms Reduction Treaties (Start) with Russia on strategic arms reduction; it has even ratified the protocol of the Treaty of Tlatelolco, among other agreements. However, the United States is a pioneer of the nuclear arms race and the military policy of nuclear deterrence[6] (the latter can fail with its state adversaries).

[6] The concept of deterrence is that one of the parties threatens to harm the other, to prevent it from performing an action that the first party does not want (Morgan, 2003; Quackenbush, 2011). Accordingly, deterrence is the persuasion of the opponent to understand that acting in a certain way will have costs or risks contrary to its interests so that it will refrain (George & Smoke, 1974; Roehrig, 2017). Deterrence theory assumes that governments, leaders, or decision makers are rational with sufficient information, options, and cost and benefit calculations, but in practice, due to information margin of error or for other reasons, they do not act with perfect rationality (Roehrig, 2017).

The states possessing nuclear weapons have doctrines based on deterrence theories[7] to deter their enemies. However, more and more studies[8] are questioning the theory of nuclear deterrence originating from the Cold War and arguing that it has limitations in the current era. On the other hand, the thesis of realism theorists is that the United States and the Soviet Union did not have a direct confrontation because of the balance of power and deterrence. They argue that both states acted rationally because they had sufficient arsenals for mutually assured destruction (Mingst & Arreguín-Toft, 2018). During the Cold War, two states were responsible for the risk of using nuclear weapons; however, in the current era, there are more states possessing nuclear weapons, which increases the likelihood that deterrence can fail.

The Second Conference on the Humanitarian Impact of Nuclear Weapons concludes that the more states deploy nuclear weapons, the greater the risk of accidents, errors, or intentional use (México, Gobierno de la República, 2014). Similarly, the conclusion of the Vienna HINW Conference reinforces the argument that deterrence does not rule out intentional or accidental use and that the security doctrines of states possessing nuclear weapons are limited to the circumstances of international conflicts and tensions (Europe Integration Foreign Affairs, 2014).

The different theories and positions of the scientific community may influence the visions, strategies, and policies adopted by states. Considering that nuclear deterrence doctrines may fail, the scientific community has developed studies on states' possible nuclear strike targets.

The three basic levels of nuclear strike targets, according to Table 8, present the characteristics considered for a target to be prioritized for an attack in a conflict. Hans Kristensen and Matthew Mckinzie (2014) presented the three basic levels of nuclear strike targets at the Vienna HINW Conference in a paper entitled "Nuclear deterrence, nuclear war planning, and nuclear conflict scenarios".

[7] The theory of realism in the study of international relations explains, from one perspective, the behavior of states and their armament strategies. This theory argues that the state acts according to its national interest with a high perception of insecurity, and seeks to accumulate power to protect itself (Mingst & Arreguín-Toft, 2018). Accordingly, the theory of realism includes deterrence as a state approach to the control of insecurity, where it assumes that warlike confrontations can be avoided by threatening to use force (Mingst, 2007). On the other hand, there are other lines of study and theories that consider nuclear deterrence theory ineffective.

[8] For a better understanding consult studies such as: B. Unal, Y. Afina & P. Lewis (Eds.), (2020). Perspectives on nuclear deterrence in the 21st Century, Chatham House; K. Berry, P. Lewis, B. Pélopidas, N. Sokov & W. Wilson (2010). Delegitimizing nuclear weapons. Examining the validity of nuclear deterrence, Monterrey Institute of International Studies.

Table 8. Three basic levels of nuclear attack targets

Level	Nuclear attack targets
Level 1 Targets of countries among themselves Non-strategic targets	Troop formations Military garrisons Conventional missiles Air bases Conventional naval bases Missile defense systems Nuclear weapons production facilities Tactical nuclear weapons sites
Level 2 Targets of countries among themselves Strategic nuclear deterrent weapons	Nuclear weapons Command, control, and communications
Level 3 Cities	Direct target cities

Source: Kristensen and Mckinzie, 2014

Table 8 makes it possible to consider the city of San Diego, CA, for this hypothetical case because it meets the three basic levels of nuclear attack target and is located in a border region. The city is an important geographic point for the US military and has several military bases, most of them naval. It has the Pacific Fleet's main port, making it a Tier 1 target with conventional naval bases. Regarding Tier 2, the city is not characterized as having nuclear silos or nuclear weapons stockpile, but it does have a submarine base. The United States has submarines loaded with intercontinental nuclear missiles, with a high probability that they will be stationed in different submarine bases; from this perspective, it complies with level 2.

Finally, level 3, San Diego is a cosmopolitan city with significant infrastructure and population, and is considered one of the most important cities in the United States. Hence a considerable amount of the population of Tijuana, Mexico, crosses the border to the north, and the inhabitants of San Diego, United States, to the south, every day, for work, economic activities, tourism, services, and shopping.

Table 9 presents data on the number of people (women, men, and children), hospitals, schools, and inhabited houses in each city in this border region that are vulnerable in the hypothetical case of a nuclear detonation. A nuclear attack on the city of San Diego by an adversary state of the United States would have humanitarian consequences[9] that would affect Mexico.

[9] The data broken down below provide a clearer picture of vulnerable groups in the face of a nuclear contingency. According to the Inegi (2021b), Tijuana has 265 728 girls and 276 560 boys. The child population from 0 to 4 years old is 136 586, with 67 561 girls and 69 025 boys. The adult population over 60 years of age is 169 282 people, of whom 90 199 are women and 79 083 are men. According to the United States Census Bureau (n. d.), the child population from 0 to 4 years old in the city of San Diego is 80 442, and the number of adults over 65 years old is 184 461. The United States Census Bureau (n. d.) indicates that San Diego County has a child population from 0 to 4 years old of 201 216, and 478 301 adults over 65 years old.

Table 9. Data for the border region of Tijuana, B. C. (Mexico) and San Diego, CA (USA)

	Tijuana	City of San Diego	San Diego County	Year
Total population Women Men Children (age 0-17)*	1 922 523 953 783 968 740 542 297	1 386 932 686 531 700 401 271 838	3 298 634 1 639 421 1 659 213 705 907	2020
Inhabited houses	576 708	556 735	1 233 923	2020-Tijuana 2019-San Diego
Hospitals	107	310 (254 in service)		2020-Tijuana 2021-San Diego
Schools	2 034	1 022		2020-Tijuana 2021-San Diego

Source: created by the author with data from Inegi (2021a, 2021b), United States Census Bureau (2019a, 2019b, n. d.), California Health and Human Services Open Data (n. d.), Dirección General de Planeación, Programación y Estadística Educativa (n. d.), California Department of Education (n. d.)
* Article 1 of the Convention on the Rights of the Child (1989) indicates that a child is any human being under 18 years of age

According to the HINW (2014) and the TPNW (2017) conferences, women and children are part of the most vulnerable groups to the humanitarian consequences of the disproportionate effects of nuclear weapons. Studies on the humanitarian impact of nuclear weapons from a gender perspective present evidence that women and girls are more vulnerable to ionizing radiation. The biological characteristics of women make them more vulnerable than men to the effects of radiation and susceptible to a higher probability of diseases, such as cancer or complications during pregnancy (Borrie, Dimmen et al., 2016; Dimmen, 2014). Women from different cultural backgrounds suffer more social, psychological, and discriminatory effects and displacement, among others (Borrie, Dimmen et al., 2016; Dimmen, 2014).

Table 10 presents different distance points between the cities of Tijuana and San Diego. The distance measurements are expressed in the metric and imperial systems of units. The range of a nuclear detonation in different megaton measurements can cover the distances presented.

Table 10. Distance between San Diego, CA (USA) and Tijuana, B. C. (Mexico)

Point to point	Km/miles
Tijuana (TJ)-San Diego (SD)	16.10 km (10.0 miles) Range of 20.28 to 31.50 km (19.62 miles)
SD-Customs border checkpoint (USA)	22.06 km/13.71 miles
Downtown SD-Customs border checkpoint (Mexico-TJ)	22.63 km/14.06 miles
Downtown SD-Downtown TJ (Zona Río)	25.65 km/15.94 miles
SD-Eastern Edge of TJ (La Presa)	39.82 km/24.75 miles

Source: created by the author based on distance measurements using Google (n. d.)

The nuclear simulation models[10] where the data for this study are held are computerized: the city, exact location where the simulation is to be performed, number of kilotons or megatons of warheads, wind direction, and the option of detonation in the air or on the ground, among others. After entering the data, the program generates the estimated detonation results, such as the impact radius and the number of people affected, killed, and injured.

Table 11 presents the results of the first simulation of the impact of a nuclear detonation in the city of San Diego, CA. The selection and registration of the different quantities of five to 35 megatons in the simulator generate a data series that make it possible to estimate the number of deaths and injuries. The simulator also makes it possible to view the different radii (distances of humanitarian and structural effects). According to the different variables, such as atmospheric conditions, height, or ground level of the detonation, the numbers of the data presented can be increased or decreased. The simulation for the detonation data was in standard conditions without extremes in the different conditions. The humanitarian impact is 545 780 to 1 216 460 deaths and 1 154 250 to 1 784 790 injured, and the detonation coverages cause wide radii in kilometers.

[10] The first nuclear simulation model used in this study is the Nukemap created since 2012 and updated until 2021 by Alex Wellerstein (doctorate in history of science from Harvard University), based on a study by Philip J. Dolan and Samuel Glasstone: *The Effects of Nuclear Weapons*, 3rd ed., 1977, published by the Department of Defense. It is also based on the research report by E. Royce Fletcher, Ray W. Albright, Robert F.D. Perret, Mary E. Franklin, I. Gerald Bowen, and Clayton S. White, "Nuclear bomb effects computer" (Including slide-rule design and curve fits for weapons effects), (CEX-62.2) U.S. Atomic Energy Commission Civil Effects Test Operations, 1963. The simulator is sponsored by The College of Arts and Letters Stevens Institute of Technology and is also on the site of the Federation of American Scientists. The second nuclear weapons effects simulator model is created by Jean M. Bele, Physics Dept. Laboratory for Nuclear *Science, Massachusetts Institute of Technology (*MIT) Nuclear Weapons Education Project.

Table 11. Impact of a nuclear detonation on the city of San Diego, CA. Humanitarian and structural effects (simulation 1)

Megatons	Deaths	Injured	Fireball radius	Moderate damage radius	Thermal radiation radius (third-degree burns)	Last stage damage radius
5	545 780	1 154 250	1.84 km (10.6 km²) 1.1 mi	12 km (454 km²) 7.4 mi	24.5 km (1 880 km²) 15.2 mi	33.8 km (3 590 km²) 15.2 mi
10	736 240	1 429 790	2.43 km (18.5 km²) 1.5 mi	15.1 km (721 km²) 9.3 mi	32.9 km (3 400 km²) 20.4 mi	42.6 km (5 700 km²) 26.4 mi
15	861 570	1 604 230	2.85 km (25.6 km²) 1.7 mi	17.3 km (944 km²) 10.7 mi	39.1 km (4 800 km²) 24.3 mi	48.8 km (7 470 km²) 30.3 mi
20	968 640	1 695 900	3.2 km (32.2 km²) 1.9 mi	19.1 km (1,140 km²) 11.8 mi	44.1 km (6 120 km²) 27.4 mi	53.7 km (9 050 km²) 33.3 mi
35	1 216 460	1 784 790	4.01 km (50.4 km²) 2.4 mi	23 km (1,660 km²) 14.2 mi	52.7 km (8 710 km²) 32.7 mi	64.7 km (13 140 km²) 40.2 mi

Source: created by the author based on Alex Wellerstein's Nukemap simulator (https://nuclearsecrecy.com/nukemap/). For this article, the data originated in the simulator in March 2021

The second simulation (Table 12) presents general ranges of distances of humanitarian and structural effects, provides the distance of radioactive contamination with a wind speed of 30 mph, and indicates the thermal radiation radius that causes third and first-degree burns. From 5 megatons, the range of the detonations varies from 27.6 km to 52.4 km from the point of detonation, according to the number of megatons used. This figure can be increased with other conditions or with a higher number of megatons. The amount of 5 megatons exceeds 256 km of radioactive contamination in approximately 7 hours, and the distances increase the greater the amount of energy released by the explosion. The thermal radiation radius caused by the detonation of 35 megatons, which causes third and first-degree burns, has a range of 48.9 km and 64.0 km, which indicates that under other conditions, it can exceed 50 km and 70 km.

Table 12. Impact of a nuclear detonation (Simulation 2)

Megatons	Distance of humanitarian and structural impacts	Distance of radioactive contamination with 30 mph wind	Thermal radiation radius (third and first degree burns)
5	27.6 km (17.1 mi)	256 km (159 mi) in 471 minutes (7.85 hours)	22.0 km-30.5 km (13.6 mi-18.9 mi)
10	34.7 km (21.5 mi)	351 km (218 mi) in 660 minutes (11 hours)	29.2 km-39.7 km (18.1 mi-24.6 mi)
15	39.6 km (24.6 mi)	421 km (261 mi) in 800.4 minutes (13.34 hours)	34.5 km-46.4 km (21.4 mi-28.8 mi)
20	43.6 km (27.0 mi)	479 km (297 mi) in 916.8 minutes (15.28 hours)	39.9 km-51.7 km (24.7 mi-32.1)
35	52.4 km (32.5 mi)	616 km (382 mi) in 1191.4 minutes (19.85 hours)	48.9 km-64.0 km (30.3 mi-39.7 mi)

Source: created by the author based on the nuclear weapons effects simulator by Jean M. Bele, Nuclear Weapons Education Project (Laboratory for Nuclear Science, Massachusetts Institute of Technology [MIT]) https://nuclearweaponsedproj.mit.edu/Node/104

Note: This article's data originated from the simulator in March 2021

The two simulators present similar data in the distances of the effects. The radii of the first simulation are in an approximate range to the distances of the second simulation, and the effects caused by third-degree burns have a different range of 11.8 km to 15.8 km in each detonation capacity for each simulator. The distances of the last phase effects of the first simulator, when compared to the humanitarian and structural effects of the second simulator, present a range of difference of 6.2 km to 12.3 km.

In the academia and defense sectors of the United States, studies and reports on strategic nuclear strike points have evaluated strategic cities at risk of attack, including calculating counterattacks as a response to an adversary's first strike. Among the hypothetical cases of strategic attack points, the city of San Diego, CA, is one of them (Daugherty et al., 1986; Duffield & Von Hippel, 1984; Federal Emergency Management Agency [FEMA], 1987; Kristensen et al., 2006).

Since the Cold War, reports and assessments have been made regarding a possible confrontation between the United States and the Soviet Union. More recently, North Korea has caused great uncertainty about its main targets if it decides to launch a nuclear attack against the United States. North Korea is developing intercontinental ballistic missile technology with ranges of up to 13 000 km (Missile Defense Project, 2018b); its capability to attack the United States may be credible, according to the Department of Defense's Missile Defense Review report (US Department of Defense, 2019); it has also developed the missile capability to attack South Korea and the islands of Japan.

Berkowitz et al. (2017) argue that the points of attack that North Korea has contemplated can be observed from its propaganda, where maps appear with indications that may be US facilities, lines that begin in Asia and end in US territory, the lines of what appear to be military targets reach Hawaii where Joint Base Pearl Harbor-Hickam (Pacific Fleet barracks) is located; then, in order of distance, are the

city of San Diego, California, which has Naval Base San Diego; Barksdale Air Force Base in Louisiana; Air Force Global Strike Command headquarters; and Washington DC, where the Department of Defense is located.

If North Korea launches an intercontinental missile against the United States, the only system to intercept it is the ground-based midcourse defense (GMD), which is integrated with 44 GBI (ground-based interceptors), 40 in Alaska and four in California (Missile Defense Project, 2018a). The system was tested once against an intercontinental missile; since 1999, there have been 18 intercept tests with missiles of different ranges of coverage, 10 tests were successful, but the system has never been used to intercept multiple launches (Whiteaker et al., 2017).

Kristensen and McKinzie (2012) carried out the research "Reducing alert rates of nuclear weapons", published by the United Nations Institute for Disarmament Research (Unidir). In an internal event prior to the Nuclear Non-Proliferation Treaty Review Conference, the authors presented a paper in Geneva, Switzerland, in which they studied the alleged behavior of countries in their intercontinental missile alerts, referring to the fact that having high alerts means having nuclear warheads ready to be launched in a short time. They mentioned that in a hypothetical confrontation between the United States and Russia, whoever received the first attack would have the capacity to respond; likewise, on a map of the United States, they illustrated, on a computer, hypothetical impacts where the region of San Diego, CA, is observed, and how the knock-on effects cross the Mexican border.

Proposal and analysis for the protection of border regions

This proposal is for exploratory analysis in the academic and state scenario, non-governmental organizations, and international-regional organizations. It arises after studying the consequences of a possible nuclear detonation in a city in a border region between a state possessing nuclear weapons and a non-nuclear-weapon state.

The argument is that cities bordering states possessing nuclear weapons are vulnerable due to the absence of preventive international policies and norms. Cities in states possessing nuclear weapons can be strategic points of nuclear attack by state adversaries. The proposal puts forward for consideration an initiative for the protection of border areas or regions between states possessing nuclear weapons and non-nuclear-weapon states.

This initiative proposes creating norms so that states possessing nuclear weapons do not attack border regions or cities that affect other nations that are not involved in the conflicts. It is suggested to include elements oriented towards making states remove from their nuclear attack manuals or plans the targets in geographic border points and include the prohibition of attacks in border areas and cities. The proposal aims to prove how unnecessary it is to have nuclear weapons and promote abstention from their use in border regions, which would avoid risks, accidents, and humanitarian consequences.

This proposal analyzes hard law legal instruments or other mechanisms to achieve a new treaty or agreement in particular, as provided for and permitted by Articles VI and VII of the NPT. The proposal is based on the principles of the NPT, the Nuclear-Weapon-Free Zone treaties, and the Treaty on the Prohibition of Nuclear Weapons.

Article VI of the NPT makes it possible to negotiate effective measures relating to nuclear disarmament, the termination of the arms race, and a general disarmament treaty. It reads as follows:

> Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control. (NPT, July 1, 1968, https://www.un.org/es/conf/npt/2010/npttext.shtml)

Article VII of the NPT makes possible the ratification of regional treaties, stating: "Nothing in this Treaty affects the right of any group of States to conclude regional treaties in order to assure the total absence of nuclear weapons in their respective territories" (NPT, July 1, 1968, https://www.un.org/es/conf/npt/2010/npttext.shtml).

The current proposal can be a reference for an amendment to the NPT as permitted by Article VIII:

> Any Party to the Treaty may propose amendments to this Treaty. The text of any proposed amendment shall be submitted to the Depositary Governments which shall circulate it to all Parties to the Treaty. Thereupon, if requested to do so by one-third or more of the Parties to the Treaty, the Depositary Governments shall convene a conference, to which they shall invite all the Parties to the Treaty, to consider such an amendment. (NPT, July 1, 1968, https://www.un.org/es/conf/npt/2010/npttext.shtml)

This initiative to safeguard the security of states and promote disarmament to limit the use of nuclear weapons could be a major step forward in disarmament, control, and nuclear non-proliferation. In addition to having the common good and cooperation as objectives, the proposal also considers the interests of the states because the humanitarian consequences and the risk to life caused by nuclear weapons put the state's survival at risk.

The proposal is compatible with: the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), Nuclear-Weapon-Free Zone (NWFZ) treaties, and the new Treaty on the Prohibition of Nuclear Weapons (TPNW). The TPNW addresses the concern about the humanitarian consequences and risks of any nuclear detonation in its preamble. Concerning borders, it considers the conclusions of the conferences on the humanitarian impact of nuclear weapons held in Norway, Mexico, and Austria between 2013 to 2014:

> Cognizant that the catastrophic consequences of nuclear weapons cannot be adequately addressed, transcend national borders, pose grave implications for human survival, the environment, socioeconomic development, the global economy, food security and the health of current and future generations, and have a disproportionate impact on women and girls, including as a result of ionizing radiation (TPNW, July 7, 2017, https://treaties.un.org/doc/Treaties/2017/07/20170707%2003-42%20PM/Ch_XXVI_9.pdf)

Article 10 of the TPNW also makes amendments possible, "At any time after the entry into force of this Treaty, any State Party may propose amendments to the Treaty [...]" (TPNW, July 7, 2017, https://treaties.un.org/doc/Treaties/2017/07/20170707%20

03-42%20PM/Ch_XXVI_9.pdf). The feasibility of the proposal[11] on protecting the population of border regions and cities from nuclear attack through some legal instrument or commitment lies in the facts that:

1. It is compatible with Article VI of the NPT on negotiating effective measures relating to cessation of the arms race and disarmament because it has the same purpose.

2. Article VII of the NPT makes possible the conclusion of regional treaties and can be applied to border regions because they meet regional criteria, such as unique areas with a high population, and the number of states involved exceeds the number of States Parties to several treaties.

3. Article VIII of the NPT and Article 10 of the TPNW make possible the creation of amendments based on considering border regions. Although the TPNW considers that the consequences of nuclear weapons transcend national borders, it does not include border regions. States Parties to the TPNW have the possibility to consider border regions in their future meetings.

4. The proposal is compatible and may be integrated with the NWFZ regional treaties.

5. The proposal aims to contribute to achieving the same humanitarian goals for a peaceful world as those included in the conferences on the humanitarian impact of nuclear weapons and the TPNW.

The analysis and reflections of the proposal can be carried out at the conferences of the state's parties to the TPNW. There is a precedent in that the general idea presented here was mentioned in the negotiations of the United Nations General Assembly during the creation of the TPNW. The proposal can also be addressed by the review conferences of the NPT States Parties and the conferences of the States Parties to the NWFZ. It can also be addressed by other forums, international or regional bodies linked to the UN, and bilaterally or in groups between states. The participation of academia and civil society is essential to the states presenting a consolidated proposal.

The nuclear arms race of the Cold War left a legacy of risk to the world that continues to hold a considerable number of arsenals. The nine states possessing nuclear weapons and their deterrence policies do not guarantee international security since the existence of the weapons creates the possibility of their intentional or accidental use.

The proposal for the analysis and protection of border regions or cities presents a basis for other strategies in favor of prevention, disarmament, and peace. The process of cooperation and the step-by-step approach are included. The basis of the proposal is intended for future academic studies and for analysis by the states so that, with its help, they can have a basis on which to form agreements.

[11] The general essence of the proposal was first mentioned by the author of this study (with preliminary data) at the UN, with two contributions during the General Assembly negotiations for the creation of a legally binding instrument prohibiting nuclear weapons and leading to their total elimination, negotiations that created the TPNW in 2017. The contributions occurred during March and June in formal sessions of the General Assembly. Videos of the contributions are on the UN's UnWebTV website, titled "United Nations Conference to negotiate a legally binding instrument to prohibit nuclear weapons, leading toward their total elimination", 18th meeting at https://media.un.org/en/asset/k1q/k1qrut3yii and 6th meeting at https://media.un.org/en/asset/k17/k17mg1z1z4. A summary of the preliminary study can be found in the extension of the eighth biennial report of the Secretary-General on disarmament and non-proliferation education: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N18/206/59/pdf/N1820659.pdf?OpenElement.

Negative security assurances, step-by-step approach, immediate disarmament: considerations and opportunities

States should consider the opportunity to create negative security assurances (NSAs) that protect border regions-cities between states possessing nuclear weapons and non-nuclear-weapon states. The NSA option can be agreed upon between states through different multilateral and bilateral legal ways.

There are two categories of security assurances, positive and negative. NSAs are commitments by a nuclear-weapon state not to threaten to use or use weapons against non-nuclear-weapon states. On the other hand, positive security assurances are commitments by nuclear-weapon states to assist a state in case it is the victim of a threat or an act of aggression with nuclear weapons (Gómez Robledo, 2008; Tertrais, 2012; Valle Fonrouge, 2003).

Security assurances were first mentioned in the 1960s; during the NPT negotiations, the non-nuclear-weapon states expressed their concerns about certain states' nuclear weapons. Accordingly, the United States, United Kingdom, and the Soviet Union committed to pursuing the issue, and Security Council Resolution 255 emerged, recognizing the purpose of creating positive assurances (Kierulf, 2017; Valle Fonrouge, 2003). After positive assurances were achieved, a group of non-nuclear-weapon states expressed their preference for negative assurances to prevent nuclear weapons from being used by nuclear-weapon states against non-nuclear-weapon states (Valle Fonrouge, 2003). Accordingly, the first NSAs appeared in the NWFZ agreements. The Treaty of Tlatelolco includes the first NSAs through its protocols, the only NWFZ treaty whose assurances are ratified by the nuclear-weapon states recognized by the NPT.

Negative security assurances exist in various forms.[12] They can be presented in unilateral declarations or multilateral documents; these assurances can be for a specific state, a certain area, or a group of states (Tertrais, 2012). Security assurances where NPT states parties participate are perceived to have greater legitimacy, although there are different scenarios where the effectiveness and legitimacy can be questioned. There is the dilemma of recognition and the paradox in security cooperation when a non-NPT nuclear-weapon state seeks to provide negative security assurances to non-nuclear-weapon states. On the one hand, non-nuclear-weapon states need greater security, but accepting these assurances offered by non-NPT members means a perception of legitimizing states possessing nuclear weapons that are not recognized as nuclear-weapon states and to which most of the international community proposes their disarmament-denuclearization.

Security Council Resolution 984 (1995) recognizes the unilateral statements, listed from 261 to 265 by the General Assembly, on NSAs against the use or threat of use of nuclear weapons made by each nuclear-weapon state on the conclusion of effective

[12] Tertrais (2012) makes a classification of agreements and commitments where negative assurances are considered. First, negative assurances from nuclear-weapon states to non-nuclear weapon states on the non-use of nuclear weapons. Second, mutual commitments by members of treaties where they consider non-aggression and non-deployment. Third, agreements by nuclear-weapon states with members of regional NWFZ treaties that include non-use and non-deployment. Fourth, non-use and non-aggression agreements of the nuclear-weapon states with states that have renounced their weapons of mass destruction. Fifth, non-deployment commitments between NATO and Russia, between South Korea and North Korea. There are also agreements between non-member states of the NPT with states that have nuclear weapons, as in the case of India and Pakistan.

international arrangements to provide assurances to non-nuclear-weapon states. Statements perceived as promises (such as many security assurances) leave a group of states unsatisfied, especially the non-nuclear-weapon states that have repeatedly proposed a legally binding instrument on security assurances.

In the different types of security assurances granted or considered in different scenarios and strategies of the foreign policy of states, there is no negative security assurance with specific characteristics and objectives to protect border regions, their cities, and their populations. NSAs in the NPT regime were created for non-nuclear-weapon states. However, consideration should also be given to states recognized as nuclear-weapon states and those with nuclear weapons but not recognized as nuclear-weapon states by the NPT. The states possessing nuclear weapons can be threatened and attacked in their border cities; the damage from these attacks would also directly affect non-nuclear-weapon states and other nuclear armed states. A review of the different NSA formulas indicates that none consider border regions; there are no assurances to protect these areas.

NSAs depend on the positions or approaches of states to carry out the disarmament process in the short, medium, or long term; different groups of states are inclined toward certain strategies. The step-by-step approach is a gradual process for disarmament, and it makes it possible for states that cannot move forward on total weapons elimination because of security conditions or policies to move forward on other issues that contribute when conditions change to complete disarmament (Brixey-Williams, 2019). The step-by-step approach makes it possible for states to negotiate measures that include NSAs, among other measures, such as banning nuclear testing, halting production of fissile material, and concluding verifiable arms reduction agreements (Borrie, Caughley et al., 2016). States have had different routes and strategies to achieve nuclear disarmament. Two general strategies stand out: states seeking immediate disarmament and those leaning toward a gradual process, but this approach has several options, so a study by Borrie, Caughley et al. (2016) argues that the practicalities of the approach are not clearly articulated.

A key question is how, among the different positions of states, border regions can be protected through a legally binding assurance of preference or some other option that generates the norm. Protecting border regions is an opportunity for diplomacy, prestige, reputation, and cooperation between states. The states' agendas have several important goals to specify and ratify legally binding agreements that the world requires to advance with disarmament, non-proliferation, and control. However, some are slow, and others are not supported by the states possessing nuclear weapons and a group of allies that do not have such weapons. The conditions—security doctrines—do not make it possible for the moment, but protecting border regions can be viable. It would also achieve a meeting point of the different strategies.

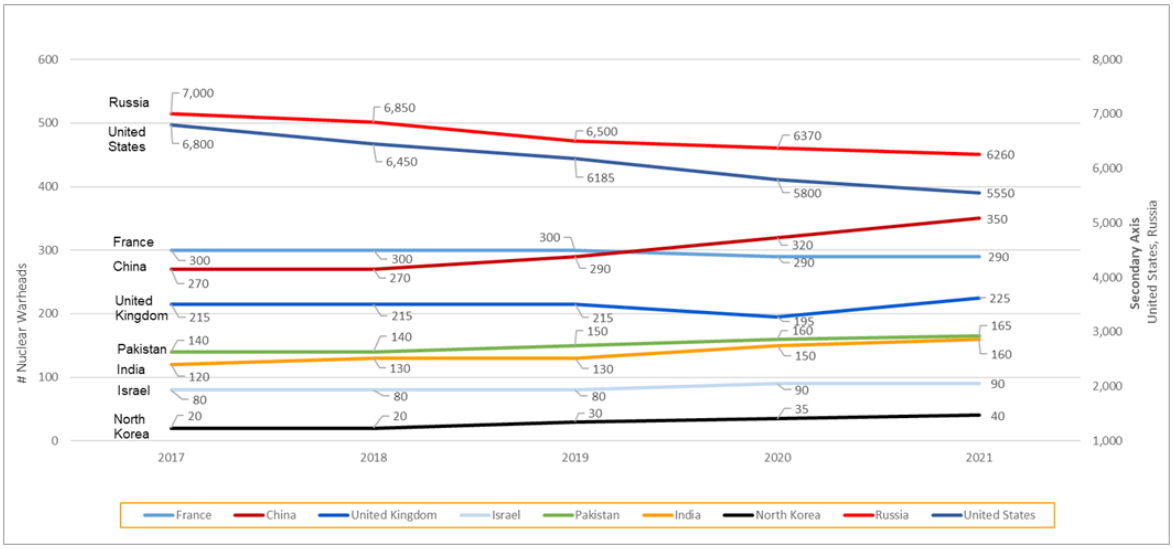
During the ceremony of the 40th anniversary of the Treaty of Tlatelolco, the Mexican Ambassador Juan Manuel Gómez Robledo deduced the following:

> Therefore, we have to become as creative as were the founders of the Treaty of Tlatelolco in order to determine how we can renew the discussion about the negative security assurances with, of course, the active support of civil society and the relevant NGOs. (Gómez Robledo, 2008, p. 127)

This paragraph by the ambassador is significant because, although he was referring to the NSAs, it also contributes to thinking about proposals for new norms that are sufficiently studied, feasible, and creative to provide the perfect opportunity for new agreements between states.

Article 1 section *a*) of the TPNW prohibits states from developing, testing, producing, manufacturing, acquiring, possessing, and stockpiling nuclear weapons; and *d*) prohibits using or threatening to use nuclear weapons (TPNW, July 7, 2017, https://treaties.un.org/doc/Treaties/2017/07/20170707%2003-42%20PM/Ch_XXVI_9.pdf). The TPNW delegitimizes deterrence and the status of the nuclear-weapons states, and this states are not considering signing the treaty in the short or medium term. However, the existence of the TPNW contributes to awareness in the states (Torres Sandoval, 2021) of the advancement and creation of step-by-step agreements in various forms, such as variants of NSAs, among others, in order to advance disarmament and achieve, in the future, the main objective of the TPNW.

Figure 1. Nuclear weapons period 2017-2021



Source: created by the author with data from the Nuclear Warheads Data Monitoring Team of the Research Center for Nuclear Weapons Abolition, Nagasaki University, years 2017 to 2021

The TPNW was adopted in 2017, and the fiftieth ratification entered into force in 2021. The numerical behavior of arsenals during the period 2017-2021 (see Figure 1) was as follows: Russia decreased its nuclear warheads from 7 000 to 6 260; the United States from 6 800 to 5 550; France from 300 to 290; and the United Kingdom from 215 to 195, only to then increase to 225. China significantly increased from 270 to 350, and it has no reduction agreements. India and Pakistan have had a series of conflicts and have maintained the Kashmir region dispute with a militarized border. These two countries practice deterrence that can fail at any time. During the 2017-2021 period, India increased from 120 to 160, and Pakistan increased from 120 to 165. Israel has stayed in the 80-90 range and has constant conflicts with other Middle Eastern states. North and South Korea have a militarized border; North Korea has conducted a series

of missile and nuclear weapons tests that have generated tensions with South Korea; the United States and Japan, among others, are calling for the denuclearization of the Korean peninsula. North Korea has increased from 20 to 40. The states tend to increase their arsenals; those that have significantly decreased their arsenals still maintain high numbers of weapons, budget projections, and high technology.

Conclusion

This research studies the border regions between states possessing nuclear weapons and non-nuclear-weapon states and their vulnerability due to the absence of norms to prevent a nuclear attack. Accordingly, the study analyzes the feasibility of creating new legal provisions and instruments to address the problem.

This study identified 38 non-nuclear-weapon states that share borders with states possessing nuclear weapons. A total of 2 704 cities were identified in the border regions, and a population of 254 194 347 people was counted. The total population living in the border regions exceeds those involved in the Rarotonga, Semipalatinsk, Mongolia, Antarctic, and Outer Space treaties. The population in the border regions is balanced in proportion to the population found in the NWFZs. This justifies the feasibility of creating an international legal instruments to protect border regions. The humanitarian consequences of nuclear detonation in a border region are devastating. The effects of explosions and radiation cross borders, affecting life, ecosystems, and economic and urban sectors.

The absence of an international protection norm to prevent a nuclear attack in border regions-cities between states possessing nuclear weapons and non-nuclear-weapon states poses a humanitarian risk, as border cities of nuclear armed states can be strategic points of nuclear attack. International norms of border region protection between the nuclear-weapon states and non-nuclear-weapon states are consistent with the NPT, nuclear-weapon-free zone treaties, and the TPNW. The proposal for a new treaty, agreement, or compromise offers convenient circumstances for state diplomacy to strengthen international law and advance the disarmament process.

The historical and legal review of the nuclear weapons issue indicates no specific considerations to protect border regions and no negative security assurances or norms on the subject. States have the opportunity to explore and consider new legal instruments or assurances to protect these regions.

Humanity needs new agreements to reduce and eradicate the risks of nuclear weapons. These multilateral-bilateral agreements or treaties must be compatible with the NPT, TPNW, and NWFZ. The treaties' regulatory structure and strategic techniques must have the power to achieve advances in international security, elements that consider the two general disarmament positions of the States to achieve a point of consensus in the negotiations and that justify the abolition of nuclear weapons.

Non-nuclear-weapon states may sign different types of bilateral or multilateral agreements with states possessing nuclear weapons, including NSAs in border regions. One option is for the proposal to be put forward by non-nuclear-weapon states with the collaboration of academia and civil society. This first option may be considered the most natural because non-nuclear-weapon states have built a considerable part of international law for disarmament and associated issues. Another natural option is

that the proposal can be addressed from the outset with initiatives by the non-nuclear-weapon states and the nuclear-weapon states. On the other hand, the options do not exclude consideration of agreements between nuclear-weapons states because they can be attacked. The impact can include other nuclear armed states or non-nuclear-weapon states not directly involved in the conflict other than by their close geographic location on the border. Accordingly, to protect border regions, states can analyze and offer different formulas for participation.

The existence of nuclear weapons in the possession of nine states does not guarantee international security, the guarantee of deterrence policies is insufficient, and there is a margin of error that makes an intentional or accidental nuclear attack possible. The results of presentations and discussions at the HINW conferences, the NPT review conferences, the TPNW negotiations, and the activities of the NWFZ conferences lead to the conclusion that targeted objectives for immediate disarmament are essential for the synergy of step-by-step policies.

This study of the protection of border regions between states possessing nuclear weapons and non-nuclear-weapon states is the first of its kind; the topic had not been examined in previous research. This article presented the case of the border between Tijuana and San Diego; however, it also considered the geopolitical and security situation of other regions that are not presented in detail here for reasons of length so that, for future studies, other similar cases that contribute to the topic can be discussed. Accordingly, the quantitative methodology of this work can contribute to the development of future qualitative analyses of existing tensions and conflicts derived from political issues, territorial disputes, and other factors that involve the vulnerability of border regions. It is also possible to consider the designs and structures of what could be the content of bilateral and multilateral agreements to protect border regions between states possessing nuclear weapons and non-nuclear-weapon states. Another aspect to observe for this research is the data provided by the population censuses that countries carry out in different years, so the focus was kept in the range of the last 10 years to have a better approximation and a minimal margin in the difference of the figures.

This article aims to contribute to peace from a rational perspective for life, human, and state security and to promote humanitarian intelligence and work for peace as a universal mission.

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