Novateur Publications
International Journal of Innovations in Engineering Research and Technology [IJIERT]
ISSN: 2394-3696 Website: ijiert.org
Volume 12, Issue 6, June– 2025

THE HISTORY OF THE CREATION OF NUCLEAR WEAPONS, THE SCALE OF LOSSES CAUSED BY THE USE OF NUCLEAR WEAPONS IN AN ARMED CONFLICT BETWEEN NUCLEAR-WEAPON COUNTRIES, AS WELL AS BETWEEN INDIA AND PAKISTAN

Kobilov Javlon Sultonovich
Colonel, Teacher at the Department of Combat Support, Chief of NBC Defense,
The Academy of Armed Forces, Republic of Uzbekistan

Khafizov Turgun Bahriddinovich
Senior Lecturer of the RCB Protection Cycle of the Department of Combat
Support of the OKF Academy of the Armed Forces of the Republic of Uzbekistan

Zyadullayev Abdukakhkhar Shamsiyevich
Professor of the RCB Protection Cycle of the Department of Combat Support of the
OKF Academy of the Armed Forces of the Republic of Uzbekistan

Maxmudov Maksud Ibroximovich
Head of the Engineering Support Cycle of the Coombat Support Deprtment,
Academy of the Armed Forcers of the Republic of Uzbekistan

Article History: Received on:31/03/2025
Accepted on: 13/06/2025

DOI: https://doi.org/10.26662/ijiert.v12i6.pp28-39

Abstract:
This article tells about the history of the creation of nuclear weapons, the countries possessing nuclear weapons, India, Pakistan, Iran, the Republic of Uzbekistan, the Wind Rose, as well as how far a cloud of radioactive dust can reach the wind direction when using nuclear weapons in an armed conflict between India and Pakistan.

Keywords: The history of the creation of nuclear weapons, the Wind Rose, the range of a radioactive dust cloud.

Introduction

Nuclear weapons are undoubtedly the most dangerous and destructive weapons ever invented by humans.

But where did such a devastating weapon originate? Who invented it, and is it possible to defend against it? These are the questions we will explore in this article.

When and how did nuclear weapons appear?

At the beginning of the 20th century, the world was changing rapidly. It seemed as if humanity had already conquered nature, and there was nothing left that resisted human control. Scientists then turned their attention to what was happening inside matter itself. The Curies discovered radioactive elements such as polonium and radium. Atomic theory and quantum mechanics emerged—sciences that described the fundamental components of everything in the universe, the smallest particles of matter.

Scientists faced new mysteries. Since the micro-world operated under laws that classical physics could not fully explain, new ideas and perspectives were needed. For several decades, the greatest physicists in history tried to understand the structure of this new world. Albert Einstein, Niels Bohr, Werner Heisenberg, Erwin Schrödinger, and others helped create this new science. It became clear that atoms contained an energy that had never before been observed. But the question remained: how could it be controlled?

In 1938, German physicists Otto Hahn and Fritz Strassmann discovered nuclear fission. Work on developing a nuclear bomb began immediately in Germany, leading to the establishment of the Uranium Project. The Germans built the world's first nuclear reactor, but it turned out to be ineffective because the scientists had taken the wrong approach. Nevertheless, they were only one step away from developing a nuclear bomb.

Figure 1. German scientists Otto Hahn and Fritz Strassmann, who were the first to lay the foundation

In 1943, Norwegian saboteurs sent by Great Britain succeeded in destroying the heavy water production plant in Norway, which was a key component of Germany's nuclear reactor. Eventually, due to insufficient funding and lack of resources, the project was completely abandoned. Fortunately for all of humanity, the Third Reich failed to create the most destructive weapon in history, although they came very close.

In the United States, in 1939, Albert Einstein—at the request of émigré physicists Leo Szilard, Eugene Wigner, and Edward Teller—sent a letter to U.S. President Franklin Delano Roosevelt. In it, he described the German scientists' progress in developing an unprecedentedly powerful weapon and urged the U.S. to launch its own research. Roosevelt immediately ordered the project to begin. Large amounts of funding were allocated, and the best working conditions were provided for scientists.

After Japan attacked Pearl Harbor and the United States entered World War II, the research accelerated significantly. Intelligence obtained information about Germany's atomic project, which greatly

influenced the urgency of development. Once physicists confirmed that it was possible to build a bomb small enough to be carried by aircraft, the Manhattan Project was launched.

The project was led by the renowned physicist Robert Oppenheimer. Tens of thousands of people worked on the atomic bomb, but the entire development process was carried out under strict secrecy. Only the project leadership knew the true purpose of their work; ordinary workers were unaware they were contributing to the creation of the most powerful weapon in history.

This story is powerfully depicted in the 2023 film *Oppenheimer*.

Figure 2. A scene from the 2023 film "Oppenheimer."

Leading scientists from various parts of the United States were involved in the project. Perhaps none of them at the time suspected the global impact their work would have. On July 16, 1945, the world's first nuclear bomb was detonated at the test site. Later, when Oppenheimer witnessed the blinding flash of the explosion, he recalled words from ancient Indian texts: "Now I am become Death, the destroyer of worlds." Within a few months, the United States used nuclear bombs against an enemy for the first and only time in history. The cities of Hiroshima and Nagasaki were wiped off the face of the earth. Why was nuclear weaponry used at the final stage of the war? This question remains a topic of much debate. Detonating bombs over peaceful cities is undoubtedly considered one of the most horrific war crimes. Having realized the evil brought to the world, Oppenheimer later became one of the most passionate advocates for disarmament and opposed nuclear weapons.

The USSR could not remain on the sidelines. Americans expected the Soviets to develop a bomb only by the mid-1950s, but in 1949 the first Soviet nuclear bomb was successfully tested. After that, the arms race began, and both sides increased their nuclear capabilities. There were so many nuclear missiles that they could easily destroy all of humanity.

The world stood on the brink of disaster several times. The most famous event was the Cuban Missile Crisis. After the U.S. placed missiles in Turkey, the USSR sent weapons to Cuba. The threat of a real nuclear war was imminent. Only long and painful negotiations managed to ease the situation and improve relations between the two superpowers. More and more countries joined the nuclear club: Great Britain, France, China. Stronger weapons continued to emerge.

Figure 3. Fidel Castro and N.S. Khrushchev

In 1961, the Soviet Union tested the Tsar Bomba on Novaya Zemlya. It was the most powerful nuclear charge in history. The blast wave traveled around the world three times, the flash was seen a thousand kilometers away from Norway and Alaska, and windows shattered in a village on Dikson Island. In fact, the power of the explosion was now without limits; it became possible to create a bomb capable of destroying entire cities from the surface of the earth.

Something had to be done about this. In 1968, the Treaty on the Non-Proliferation of Nuclear Weapons was drafted. However, some countries decided not to sign it and continued to develop their programs. Thus, India, Pakistan, North Korea, and Israel acquired nuclear weapons.

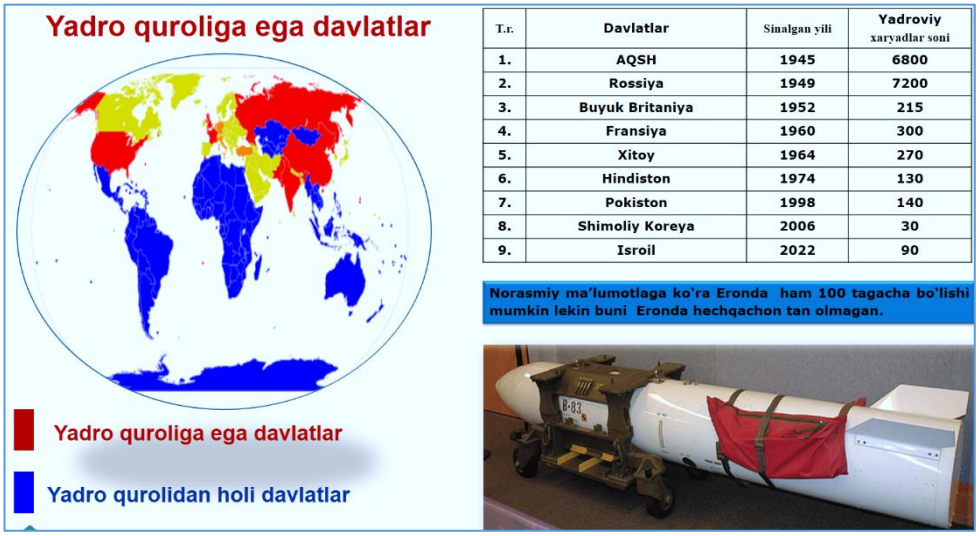
Figure 4. Brezhnev-Nixon Summit

Several attempts have been made to achieve nuclear disarmament and reduction of nuclear weapons to resolve the conflicts between the USSR and the USA. After the Cold War ended, the world's nuclear potential sharply decreased. It seemed that the world was forever freed from the fear of nuclear war. However, unfortunately, the possibility of mutual destruction is still far from zero. Therefore, we must never forget that the use of nuclear weapons is unacceptable.

In the Republic of Pakistan, the prevailing directions of the wind are as follows:

- In January, the strongest storms mostly blow at speeds of 20.8 to 24.4 m/s from directions 295°, 250°, and 230°-225°;
- In February, the strongest storms mostly blow at speeds of 24.5 to 28.4 m/s from directions 270°, 220°, and 230°, from the west and southwest;

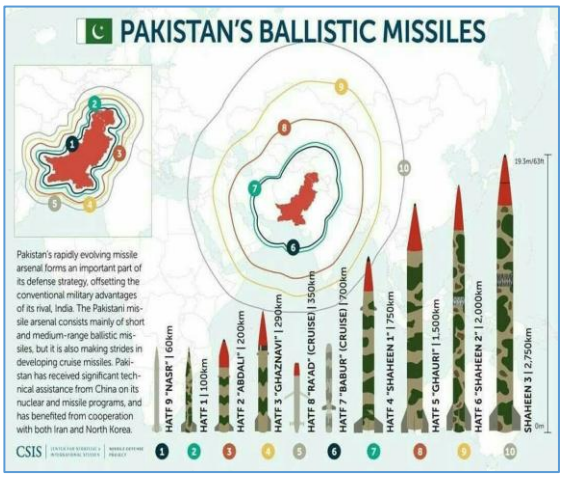
- In March, the strongest storms mostly blow at speeds of 24.5 to 28.4 m/s from directions 220°-230°, from the southwest.



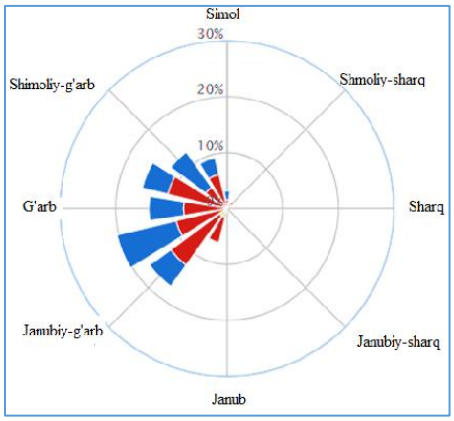
T.r.	Davlatlar	Sinalgan yili	Yadroviy xaryadlar soni
1.	AQSH	1945	6800
2.	Rossiya	1949	7200
3.	Buyuk Britaniya	1952	215
4.	Fransiya	1960	300
5.	Xitoy	1964	270
6.	Hindiston	1974	130
7.	Pokiston	1998	140
8.	Shimoliy Koreya	2006	30
9.	Isroil	2022	90

Norasmiy ma'lumotlaga ko'ra Eronda ham 100 tagacha bo'lishi mumkin lekin buni Eronda hechqachon tan olmagan.

5th figure. Countries Possessing Nuclear Weapons



6th figure. High-precision destructive weapons and armaments present in the countries of Pakistan and India



7th figure. Wind vane in the Republic of Pakistan

In April, the strongest winds mostly blow at speeds of 24.5 to 28.4 m/s from directions between 230° and 235°, coming from the west and southwest.
In May, the most severe winds reach speeds of 28.5 to 32.6 m/s, blowing from 230° direction, mainly from the southwest.
In June, the strongest winds blow at speeds of 24.5 to 28.4 m/s from directions between 210° and 195°, coming from the south.
In July, the strongest winds blow at speeds of 24.5 to 28.4 m/s from 180°, coming from the south.
In August, the strongest winds blow at speeds of 24.5 to 28.4 m/s from directions between 180° and 210°, coming from the southwest and south.
In September, the strongest winds blow at speeds of 24.5 to 28.4 m/s from directions between 180° and 200°, and at 210°, coming from the southwest and south.
In October, the strongest winds blow at speeds of 24.5 to 28.4 m/s from directions between 200° and 210°, coming from the southwest and south.
In November, the strongest winds blow at speeds of 24.5 to 28.4 m/s from directions between 230° and 210°, coming from the southwest and south.
In December, the strongest winds blow at speeds of 24.5 to 28.4 m/s from directions between 245° and 220°, coming from the southwest.
In the Islamic Republic of Iran, the wind rose throughout the year shows:

- Light winds at speeds between 1.6 and 3.3 m/s (41.67% of the time),
- Moderate winds at speeds between 5.5 and 7.7 m/s,
- Storm winds reaching speeds up to 32.7 m/s, blowing from 310° (northwest).

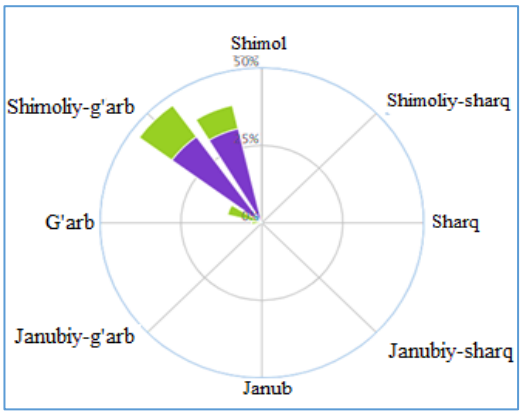


Figure 8. Wind Rose of the Islamic Republic of Iran

When nuclear weapons (NW) with a yield of 10 kilotons are used by Indian forces in the territory of Pakistan, with a wind speed of 24 m/s, the total affected area is 377 km², distributed as follows:

- Area A: 306 km²
- Area B: 47 km²
- Area V: 20 km²
- Area G: 4.1 km²

When NW with a yield of 20 kilotons are used, with a wind speed of 25 m/s, the total affected area increases to 540 km², distributed as follows:

- Area A: 445 km²
- Area B: 60 km²
- Area V: 28 km²
- Area G: 7.2 km²

Figure 9. Potential Damage Zones in Pakistan Territory in the Event of a Nuclear Strike

At a nuclear weapon yield of 50 kilotons and a wind speed of 25 m/s, the total damage area is 1121 km². The affected zones are as follows: Zone A — 913 km², Zone B — 128 km², Zone V — 59 km², and Zone G — 21 km².

At a nuclear weapon yield of 100 kilotons and a wind speed of 25 m/s, the total damage area is 1960 km². The affected zones are: Zone A — 1583 km², Zone B — 231 km², Zone V — 104 km², and Zone G — 42 km². Since the wind predominantly blows from the southwest over the territory of Pakistan, on average, about 1000 km² of the northeastern direction, extending up to the southern provinces of Afghanistan, could be contaminated with radioactive materials.

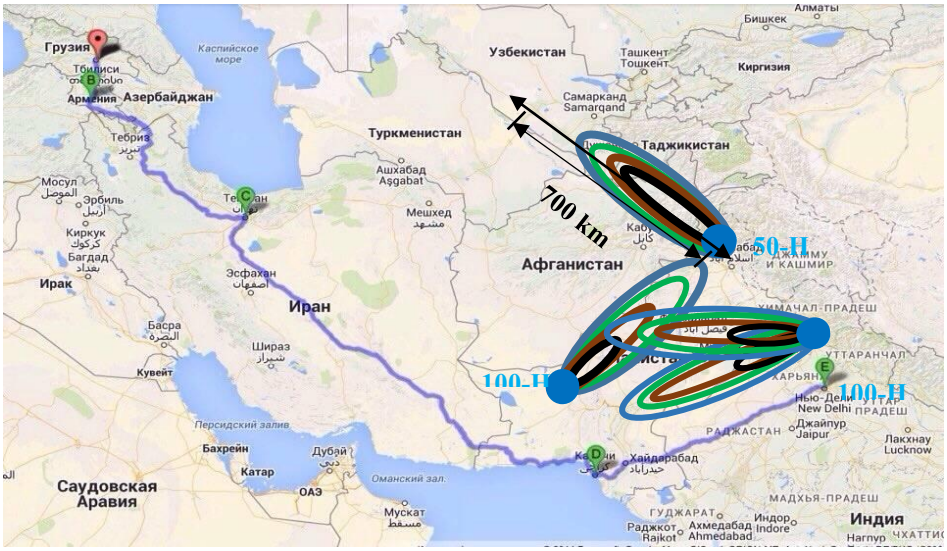


Figure 10. Areas potentially affected by nuclear weapon strikes from the armed forces of the Republics of India and Pakistan

At different times, military personnel located in open, unprotected areas at the outer boundaries of the affected region may receive the following radiation dose rates:

- After 30 minutes:
  - In zone A: 10 rad/s
  - In zone B: 180 rad/s
  - In zone V: 540 rad/s
  - In zone G: 1800 rad/s
- After 1 hour:
  - In zone A: 8 rad/s
  - In zone B: 80 rad/s
  - In zone V: 240 rad/s
  - In zone G: 800 rad/s

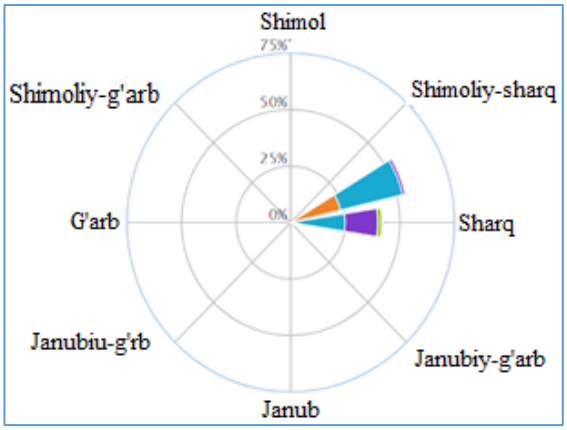


Figure 11. Wind Rose of the Republic of India

Radiation Dose Rate for Unprotected Military Personnel Located in Open Areas at the Outer Boundaries of the Contaminated Zones at Various Time Intervals:

- **After 1.5 hours**:
  - Zone A: 5 rad/s
  - Zone B: 50 rad/s
  - Zone C: 150 rad/s
  - Zone D: 500 rad/s
- **After 2 hours**:
  - Zone A: 3.5 rad/s
  - Zone B: 35 rad/s
  - Zone C: 100 rad/s
  - Zone D: 350 rad/s
- **After 3 hours**:
  - Zone A: 2.1 rad/s
  - Zone B: 21 rad/s
  - Zone C: 63 rad/s

- Zone D: 210 rad/s

"Based on the received dose rates, military personnel of the Pakistan Army may be rendered combat ineffective."

For example:

- Military personnel exposed to a dose of 125 rad/s over 4 days may experience 5% incapacitation after 30 days.
- Military personnel exposed to 150 rad/s over 4 days may experience 15% incapacitation after 30 days.
- Military personnel receiving a dose of 175 rad/s over 30 minutes within 4 days may experience 1% incapacitation after 3 hours, 3% between 6 hours and 14 days, and 32% after 30 days.
- Military personnel exposed to 200 rad/s for 20 minutes within 4 days may experience 3% incapacitation after 3 hours, 5% between 6 hours and 14 days, and 50% incapacitation after 30 days, with some cases resulting in death.

When Pakistan's forces launch a nuclear strike on Indian territory:

- At a nuclear yield of 10 kilotons and wind speed of 25 m/s, the total affected area is 377 km²:
  - Zone A: 306 km²
  - Zone B: 47 km²
  - Zone C: 20 km²
  - Zone D: 4.1 km²
- At a yield of 20 kilotons with the same wind speed, the affected area increases to 540 km²:
  - Zone A: 445 km²
  - Zone B: 60 km²
  - Zone C: 28 km²
  - Zone D: 7.2 km²
- At 50 kilotons, the total affected area is 1121 km²:
  - Zone A: 913 km²
  - Zone B: 128 km²
  - Zone C: 59 km²
  - Zone D: 21 km²
- At 100 kilotons, the total contaminated area reaches 1960 km²:
  - Zone A: 1583 km²
  - Zone B: 231 km²
  - Zone C: 104 km²
  - Zone D: 42 km²

Since the wind in Indian territory predominantly blows from the northeast, about 1000 km² in the southwest direction may be contaminated with radioactive substances.

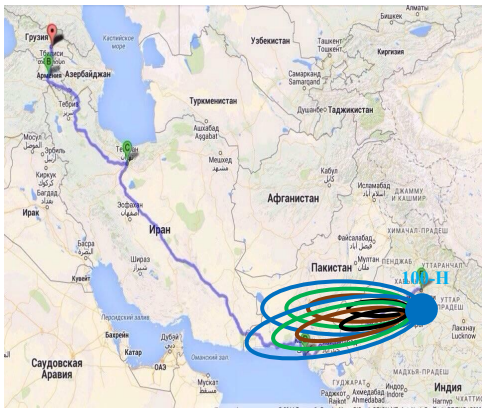


Figure 12. The area that may be affected in the event of a nuclear strike on Indian territory.

"Based on the received radiation dose rates, Indian Army personnel may be incapacitated."
When unprotected military personnel (or civilians) are exposed in open areas:

- If they receive a dose of **125 rad over 4 days**, **5%** of them will be incapacitated **within 30 days**.
- If the dose is **150 rad over 4 days**, **15%** will be incapacitated **within 30 days**.
- If they receive **175 rad over 4 days for 30 minutes**, the effects are as follows:
  - **1% incapacitation after 3 hours**,
  - **3% incapacitation from 6 hours to 14 days**,
  - **32% incapacitation within 30 days**.

According to the explanation provided in **Table 4**, the **inner boundary** of the **contaminated Zone A** is **multiplied by a coefficient of 3.2**, while the **outer boundary** is **divided by a coefficient of 3.2**.
For example:
30 minutes after the explosion, the radiation level at the inner boundary of Zone A was 43 R/h.
43 × 3.2 = 137.6 ≈ 138 R,
43 ÷ 3.2 = 13.43 R.
According to the explanation in Table 4, the inner boundary of the contaminated Zone B is multiplied by a coefficient of 1.7, and the outer boundary is divided by the same coefficient.
30 minutes after the explosion, the radiation level at the inner boundary of Zone B was 242 R/h:
242 × 1.7 = 411.4 R,
242 ÷ 1.7 = 142.35 R.
According to the explanation in Table 4, the inner boundary of Zone C is multiplied by a coefficient of 1.8, and the outer boundary is divided by the same coefficient.
30 minutes after the explosion, the radiation level at the inner boundary of Zone C was 760 R/h:
760 × 1.8 = 1368 R,
760 ÷ 1.8 = 422.22 R.
According to the explanation in Table 4, the inner boundary of Zone D is also multiplied by a coefficient of 1.8, and the outer boundary is divided by the same coefficient.
30 minutes after the explosion, the radiation level at the inner boundary of Zone D was 2420 R/h:

2420 × 1.8 = 4356 R,
2420 ÷ 1.8 = 1344.44 R.

The distance from Pakistan's capital Islamabad to Termez, the nearest territory of Uzbekistan, is approximately 700 km. If the Indian Armed Forces use a 50-kiloton nuclear weapon and the wind blows towards Uzbekistan at a speed of 25 m/s in the direction of 130°, then, based on calculations, the radioactive cloud will not reach the territory of the Republic of Uzbekistan.

Figure 13. Potentially Affected Area in the Event of a Nuclear Strike on the Territory of

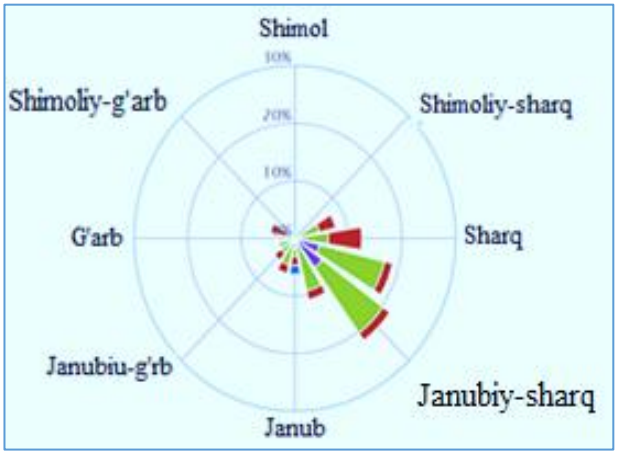


Figure 14. Wind Rose of the Republic of Uzbekistan

"However, when a humid or hot air stream formed over the Islamic Republic of Iran moves toward Uzbekistan, clouds contaminated with radioactive substances may enter the southern regions of our Republic."

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