

The time bomb frozen in the ice: Novaya Zemlya

If you look at the map today, **Novaya Zemlya** (Russian for *New Earth*) appears as a vast, crescent-shaped white patch between the Arctic Ocean and the Kara Sea. At first glance, it seems like a barren, dreary no-man's-land where frost and wind reign supreme. In reality, however, this archipelago is one of the world's most strictly guarded, **closed military zones**, where the Cold War never ended. Indeed, in recent years it has shifted into higher gear than ever before.

If, for some mysterious reason, you were to decide to hire a sailing boat and moor on the northern part of the island, it wouldn't be seals that would greet you. Within minutes, Russian warships, MiG-31 interceptors or the radars of S-400 air defence systems would lock onto your coordinates. Novaya Zemlya is not only a graveyard of the nuclear past (it was here that the infamous 50-megaton Tsar Bomba was detonated), but also the most important bastion of modern Russian geopolitics in the Arctic.

Entry is permitted only with FSB authorisation

There are only two permanent settlements on the archipelago: **Belusya Guba** and **Rogachovo**. Civilians are not permitted to set foot here unless they work for the military or hold a permit issued by the Russian secret service (**FSB**), which is practically impossible for ordinary people to obtain.

The local population – soldiers, officers and their families – live in a completely isolated microcosm. Rogachovo military airfield is on high alert 24 hours a day; it is the departure point for patrols that monitor the northern shipping routes. This is where hypersonic weapons and new-generation nuclear-powered missiles (such as the **Burevestnik**). For this reason, Western spy satellites monitor the area 24 hours a day using infrared and radar (**SAR**) sensors. The Russians are not bothered by this surveillance: visibility has become part of the deterrent.



Barents Sea (Willem Barents's grave; 76°27'N 68°42'E)

When cutting-edge technology meets nature

Although the bases are equipped with the very latest technology, everyday life is shaped by the harsh reality of the Arctic. A few years ago, the residents of Belusya Guba were forced to declare a state of emergency, not because of hostile sabotage, but because of **hungry polar bears** .

Due to climate change and the shrinking ice cover, the animals have taken to raiding the military bases' rubbish bins. There was a period when dozens of polar bears were roaming amongst the prefabricated blocks of flats, venturing into the stairwells of residential buildings, and soldiers had to travel to work in armoured vehicles. Not even warning shots or sirens could scare the wild animals away.

But in this region, polar bears are the least of the problems. For there is something left on the island from the past that has slowly begun to thaw...

The Tsar Bomba

The Tsar Bomba (officially known as **AN602** or **RDSZ-220**) took place at 11.32 am on 30 October 1961 over Novaya Zemlya. It was a gigantic, 27-tonne monster, so large (8 metres long and 2 metres in diameter) that the **Tupolev Tu-95V** had to have its bomb bay doors and some of the fuel tanks built into its wings removed, as it simply would not fit. The bomber dropped the weapon from an altitude of 10,500 metres.



The explosion of the Tsar Bomba, image: Rosatom State Atomic Energy Corporation

A huge 800-kilogram parachute system was fitted to the bomb. This deliberately slowed its descent so that the pilot of the Tu-95, **Andrei Durnovtsev**, and the escort aircraft exactly 188 seconds (just under 3 minutes) to escape from the scene.

The force of the gigantic explosion was estimated at between fifty and sixty megatons, which is approximately ten times the combined force of all the explosives used during the Second World War.

At the moment of the explosion, the aircraft were already about 45 kilometres away, but the shockwave still caught up with them: the bomber began to plummet uncontrollably for a while, and it took some time before the pilot was able to regain control of the aircraft.

The weapon was detonated by barometric and radar sensors at an altitude of exactly 4,000 metres. The flash was visible within a radius of 1,000 kilometres, the mushroom cloud reached an altitude of 64 kilometres (penetrating the mesosphere), and its cap spread out to a width of nearly 100 kilometres.

The Tsar Bomba was a so-called three-stage thermonuclear weapon, based on the classic *Teller-Ulam principle*. Its operating principle consisted of the following stages:

1. **First stage (Fission):** At the core of the weapon was a conventional, plutonium-based classical implosion atomic bomb. Its detonation generated the extreme heat (several million degrees) and intense X-ray radiation that were essential for triggering the next stage.
2. **Second stage (Fusion):** The energy from the first atomic bomb compressed and ignited the second stage, which was a hydrogen bomb fuelled by lithium deuteride.
3. **Third stage (superfusion):** What made the Tsar Bomba unique was that the energy from the

second stage was used to ignite an even larger, third fusion stage.

The 'disabled' fourth stage

According to the original plans, there was to have been a fourth stage involving the fission of uranium-238, but Andrei Sakharov and his team replaced it with lead practically at the last minute before the test.

Had the physicists (led by Andrei Sakharov) not replaced the uranium casing with lead, they would have activated the weapon's fourth stage (nuclear fission), unleashing the full **100 megatonne** explosive force. Had this phase also been carried out, history would not have recorded it as a '*record-breaking experiment*', but as a global catastrophe:

The Tsar Bomba **50-megaton** was the '*cleanest*' nuclear weapon ever tested: 97 per cent of its energy came from pure nuclear fusion, leaving hardly any radioactive waste. However, had the fourth stage been activated, the neutrons produced during fusion would have fissioned the atoms in the uranium casing. This stage alone would have released a brutal amount of deadly radioactive waste (caesium, strontium, iodine).

This single explosion would have increased the total amount of radioactive contamination released into the atmosphere by humankind since 1945 by 25 per cent. As the seismic and atmospheric waves circled the planet several times, this gigantic radioactive cloud would have blanketed Scandinavia, Northern Europe, Canada and the populated areas of the Soviet Union within a few days, carried by global air currents. Agricultural land would have been rendered unusable for decades, and millions would have developed cancer as a result of radioactive fallout.

The Sakharovs took these simulations fully into account in their calculations. They pointed out to Party General Secretary Nikita Khrushchev that the 100-megaton test would not be a demonstration of political strength, but an act of suicide that would also pose a direct threat to the Soviet Union. Khrushchev therefore authorised, in the final weeks, that Phase 4 be *to be 'deactivated'* from the bomb and replace the heavy uranium with lead.

Traces of the Tsar Bomba and the real nuclear graveyard

We are justified in asking: what lies there now, where history's most destructive weapon was detonated above Cape Sukhoi Nos?

The answer is surprising: **the epicentre is (presumably) radiation-free today**. As the Tsar Bomba was detonated at an altitude of 4,000 metres, the fireball did not reach the ground, and the radioactive particles rose into the stratosphere. Although the surface of the rocks at the site of the explosion was melted smooth, direct radiation levels today barely exceed the background radiation levels found in a major city.



Cape Zhelaniya (the northernmost point of Severnyy; 76°57' N, 68°35' N)

The real danger lies not at the site of the Tsar Bomba test, but in the underwater nuclear graveyard **underwater nuclear graveyard**. For decades, the Soviet Navy literally used the eastern shores of Novaya Zemlya as a rubbish tip. Instead of properly decommissioning the obsolete nuclear devices, they simply dumped them into the sea.

The following arsenal is currently rotting on the seabed:

- The **K-27 nuclear submarine** in its entirety, with its reactor welded shut, containing **90 kg of highly enriched uranium**.
- **14 dismantled ship reactors** (five of which remain full of nuclear fuel to this day), including the damaged reactor compartment of the nuclear icebreaker Lenin.
- **19 wrecks packed with radioactive waste and deliberately sunk**.
- Approximately **17,000 containers of** solid nuclear waste.

The most astonishing aspect of it all is the depth of this underwater graveyard. Whilst international recommendations state that such hazardous wrecks should be sunk to a depth of at least 3,000 metres to isolate them from the biosphere, the Soviets dumped them in the shallow bays of Novaya Zemlya, at depths of 30–50 metres. In practice, with the right diving equipment, one could dive down to the world's most dangerous nuclear wrecks – if the Russian Navy did not immediately open fire on anything approaching the island.

To make matters worse, radioactive dust from 130 atmospheric tests carried out in the 1950s and 1960s has become frozen into the island's northern glaciers. As the ice melts due to climate change, the water is now washing concentrated caesium and strontium directly into the Barents Sea.

Moreover, Novaya Zemlya marks the physical boundary, the '*iron gate*' on the Northern Sea Route (north-eastern passage). The archipelago separates the Barents Sea from the Kara Sea. To ensure

that Soviet ships could sail safely past Novaya Zemlya, unmanned 'automatic' *strontium-90*-fuelled RTG generators, which I have previously written about in this post: [Az abandoned Soviet nuclear lighthouses](#).

Whilst the RTGs in Europe and the Baltic have largely been decommissioned as part of international programmes, those in the strictly restricted military zones around Novaya Zemlya remain to this day as abandoned, unattended nuclear beacons, from which strontium may leak just as it does in Navarino Bay, due to frost and erosion.



The terminus of the Inostrantsev Glacier (76°28'N 66°5'E)

Poligon vs Novaya Zemlya

We've already mentioned the [a Polygon](#), the former Soviet Union's largest nuclear test site. With the collapse of the Soviet dream, the area fell outside Russian jurisdiction, and an impending humanitarian disaster was averted thanks to an international decontamination programme. It is worth summarising the differences between the two test sites in a quick table:

Criterion	The Polygon (Kazakhstan)	Novaya Zemlya (Arctic)
Number of tests	456 nuclear detonations	130 nuclear detonations
Nature of detonations	Surface (ground) and atmospheric detonations (25 directly on the ground).	Mainly high-altitude, atmospheric tests, barely affecting the ground.
Soil contamination	Extremely high. Due to the explosions carried out at the ground-based towers, the soil was burnt to dust, turned into radioactive glass (trinitite) and remained in situ.	Locally lower. Fireballs rarely reached the ground; the contamination was carried away by the wind into the stratosphere.

Criterion	The Poligon (Kazakhstan)	Novaya Zemlya (Arctic)
Human catastrophe	Appalling. Hundreds of thousands of people lived around the Polygon in the middle of the steppe, and they were exposed to radiation (cancer, mutations).	Minimal. Before the tests, the local indigenous Nenets people were forcibly resettled, so the area was uninhabited.
The main danger today	The open, unfenced areas where locals graze their livestock and collect scrap metal in the restricted zones.	Radiation leaking from melting glaciers and from nuclear submarines sunk in the bays.

The reindeer of Novaya Zemlya

In the case of Novaya Zemlya, no one can count on a decontamination operation organised through international cooperation. As the most dangerous nuclear waste in history lies off the coast of the archipelago, and with weapons tests still taking place on the mainland today in accordance with the latest Russian doctrine, the poison frozen in the ice will remain in the shadow of geopolitical manoeuvres and Russian radars for a very long time to come.

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Sources and recommended reading

International reports and nuclear waste

- **The Yablokov Report (1993):** [Facts and Problems Related to Radioactive Waste Disposal in Seas Adjacent to the Territory of the Russian Federation](#). An official report by the Russian government, led by Alexei Yablokov, an adviser to the President, which first revealed the precise list of reactors sunk in the Kara Sea and the bays of Novaya Zemlya, as well as the K-27 submarine.
- **Bellona Foundation:** [The Arctic Nuclear Burial Ground](#). Decades of research and ongoing reports by the Norwegian environmental and nuclear safety foundation on the condition of the nuclear fleet rotting in shallow bays, with particular regard to plans to salvage the K-27 wreck.
- **International Atomic Energy Agency (IAEA):** [International Arctic Seas Assessment Project \(IASAP\)](#). The agency's comprehensive radiological study on the environmental impact of solid and liquid Soviet radioactive waste dumped in the Kara Sea.

The Tsar Bomba and weapons tests

- **CTBTO (Comprehensive Nuclear-Test-Ban Treaty Organisation):** [The Tsar Bomba Test – 30 October 1961](#). A historical overview of the global monitoring network, covering the physical parameters of the detonation, the propagation of seismic waves and the political processes leading to the ban on atmospheric testing.
- **Atomic Heritage Foundation:** [Tsar Bomba](#). A detailed technical description by a foundation researching the history of nuclear armament of the three-phase implementation of the Teller-Ulam principle and Andrei Sakharov's role in halting the fourth phase (the uranium mantle).

Arctic environmental pollution and the present day

- **AMAP (Arctic Monitoring and Assessment Programme):** [Radioactivity in the Arctic](#). Regular measurements by the Arctic Council's working group on how glacier melt caused by climate change is washing radioactive dust from atmospheric tests carried out in the 1950s and 1960s (caesium-137 and strontium-90) from atmospheric tests carried out in the 1950s and 1960s into the Barents Sea.
- **The Barents Observer:** [Arctic Military Infrastructure Updates](#). Satellite radar (SAR) and optical observation reports on the modernisation of Russian military infrastructure around the Matochkin Shar Strait and the Severny research station.

Technical assistant: I also used Gemini AI to help write this post.

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