

## The Comprehensive Test Ban Treaty (CTBT)

[The Comprehensive Test Ban Treaty \(CTBT\)](#) is a multilateral agreement that prohibits the explosive testing of nuclear weapons. The CTBT opened for signatures on September 24, 1996, but the agreement is still in the ratification stage. The United States has signed, but has not yet ratified the treaty.

The United States conducted the world's first successful [nuclear weapons test](#) on July 16, 1945. The Soviet Union tested their first nuclear weapon on August 29, 1949. These tests jump-started a decades-long arms race between the two super powers. Over 2,000 tests have been detected on Earth or in Earth's atmosphere.

The [Limited Test Ban Treaty](#) (1963), a multilateral treaty banning all nuclear testing except for underground (atmospheric, outer space, and underwater), and the [Threshold Test Ban Treaty](#) (1974), a bilateral treaty between the United States and Soviet Union banning nuclear tests of 150 kilotons or more (ten times the size of the Hiroshima bombing), addressed concerns about the safety and environmental impact of nuclear testing, and aimed to quell rising tensions between nuclear-armed states. The Comprehensive Test Ban Treaty is the culminating step in banning all explosive nuclear testing.

Of the CTBT's 185 signatories, 170 have ratified the treaty. The CTBT requires that all 44 "nuclear capable" states (also known as "[Annex II](#)" states) [ratify](#) the treaty before it may enter into force. Eight Annex II states have yet to ratify the CTBT: the Democratic People's Republic of Korea (North Korea), India, and Pakistan have neither signed nor ratified, and the United States, China, Egypt, Iran, and Israel have signed but have yet to ratify. The United States Senate failed to ratify the CTBT in 1999 with a vote of 51-48, but the legislative body can still ratify the treaty in the future.

Russia ratified the CTBT in 2000, but in November 2023, Russian President Vladimir Putin revoked its ratification of the treaty amidst the backdrop of the war in Ukraine. Moscow cited the United States' failure to ratify the treaty as the reason for Russia's withdrawal.

The Comprehensive Test Ban Treaty Organization (CTBTO) Preparatory Commission, which was created by the treaty and ensures its partial implementation, has established verifications systems over the last 20 years to detect nuclear explosions anywhere in the world. Once the treaty enters into force, the CTBTO will be officially established.

### **Successive U.S. administrations since 1996 have urged ratification citing the following benefits**

#### *Keeps Non-Nuclear States from Developing a Nuclear Weapon*

The CTBT is in the United States' national security interests because it hinders non-nuclear states' potential paths to develop nuclear weapons technology. Without the ability to conduct tests, states that seek to develop nuclear technology are significantly [disadvantaged](#). The United States has conducted the most nuclear tests and, therefore, has the most extensive nuclear testing data and is able to maintain its arsenal without further testing. The U.S. has enforced a unilateral moratorium on nuclear weapons testing since 1992, relying on the [Stockpile Stewardship and Management Program](#) to maintain its nuclear deterrent in part by using advanced computer modeling and simulations.

#### *Keeps Nuclear States from Advancing Weapons Designs*

States that do possess nuclear weapons will not be able to develop and deploy new models in full confidence that they are operational without testing the design. While nuclear-armed states with significant scientific

capabilities are able to maintain their arsenals without testing, it would be difficult for less-advanced nuclear states to create an entirely new weapon without proving the viability of a design through testing.

### *Reduces the Likelihood of Regional Arms Races*

The CTBT contributes to the prevention of regional arms races by helping to inhibit non-nuclear states from developing nuclear technology and by helping to keep some states that do possess nuclear weapons from achieving further technological advances.

## **What the Treaty Does**

- **Zero-yield:** The CTBT prohibits states from exploding nuclear material regardless of whether the purposes are weapons-related or peaceful. The treaty does not include a technical explanation of activities that are allowed or not allowed, effectively banning all explosive nuclear activity. The treaty becomes legally binding when it enters into force – which requires all 44 “nuclear capable” states to sign and ratify the agreement.
- **The International Monitoring System (IMS):** The CTBT establishes a global system of monitors designed to detect nuclear explosions. The CTBTO is [confident](#) that “their system can detect and identify any militarily relevant nuclear test anywhere on the planet.” The IMS is explained in detail below.
- **[Environmental Impact:](#)** The explosive testing of nuclear weapons releases radioactive particles (nuclear fallout), which cause cell damage in living organisms. While the ban on atmospheric testing limited the impact of some short-lived radioactive materials, large amounts of other harmful materials were released underground. The ratification of the CTBT would provide legal protections against further damage to the environment and humanity by nuclear testing.
- **[The Comprehensive Test Ban Treaty Organization \(CTBTO\):](#)** The CTBTO Preparatory Commission is based in Vienna. The organization promotes the ratification of the treaty, and implements the verification regime (see below) so that it is fully operational when the treaty enters into force.

## **Verification**

### *The International Monitoring System*

The IMS features a network of 337 monitoring facilities and uses four types of monitoring mechanisms to detect possible nuclear explosions globally. The data collected at monitoring stations in various countries around the world is sent to the [International Data Center](#) at the CTBTO Preparatory Commission headquarters in Vienna, where it is processed and sent to member states. The IMS is [90% operational](#) today.

- **[Seismic:](#)** 50 primary and 120 auxiliary stations detect shockwaves in the earth. These stations primarily pick up data on earthquakes, but they also detect man-made explosions.
- **[Hydroacoustic:](#)** 11 stations detect sound waves in the oceans. The sound waves from nuclear detonations can travel deep under water.
- **[Infrasound:](#)** Nuclear explosions emit ultra-low frequency sound waves that are inaudible to the human ear. 60 infrasound stations detect these sound waves.
- **[Radionuclide:](#)** 80 stations detect radioactive particles in the atmosphere. 40 of these stations detect noble gases, which can better confirm whether a detonation was nuclear. There are 16 supportive radionuclide laboratories.

### *On-Site Inspections*

[On-site inspections](#) are conducted at the request of a State Party to the CTBT. The request must be approved by 30 of the Executive Council’s 51 members. The party being inspected cannot refuse access to a suspected site. The inspection team must arrive within six days of a request being filed, and a report is submitted within 25 days of the request’s approval.