LEARN ABOUT NUCLEAR WEAPONS

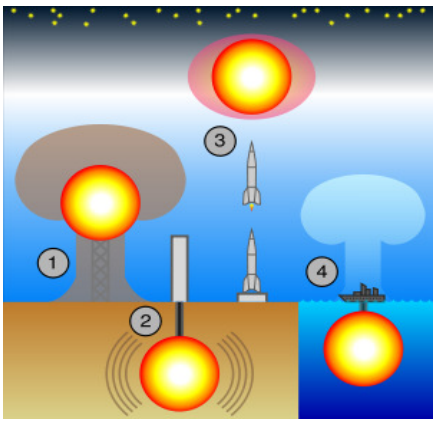
Nuclear testing – why?

Nuclear testing is conducted to document function, yield and effects of nuclear weapons during their development. When manufacturing a new nuclear weapon – or upgrading an existing one – it is important to know that everything works as planned, e.g. that it has the assumed yield. The warheads also have to be maximally secure, e.g. insensitive to fire and impossible to use unauthorised. At the same time, they have to be reliable, meaning they must function as intended if triggered in the right way.

During the 20th century, most states developing nuclear weapons have conducted nuclear tests. By testing, states have been able to find out how the weapons work, how they act in different environments, e.g. under water, and how different environments react to nuclear weapons. In addition, nuclear testing has been a means to show off scientific and military strength to the world. Nuclear tests have, in that sense, had an obvious political aspect – a number of states possessing nuclear weapons have announced their nuclear possession through nuclear testing.

Who did what?

More than 2000 nuclear tests have been conducted since the first American test, Trinity, in 1945. More than 500 tests have been done in the atmosphere, under water or in space. The rest have been tested underground. The US is responsible for around 1000 of these tests, the Soviet Union conducted about 700, France 180, China 35 and the UK about 30 tests. India has conducted six tests, Pakistan five and North Korea one nuclear test.[1]



1. atmospheric testing
2. underground testing
3. exo-atmospheric testing (more than 120 km in the atmosphere)
4. under water testing

Atmospheric nuclear tests
Atmospheric testing has often been done by detonating nuclear devices from high towers, balloons, barges or islands, or by dropping nuclear bombs from aeroplanes. Occasionally, nuclear devices have been fired from rockets at a very high altitude.

During the 1950's and 60's, most nuclear testing was done in the atmosphere. Atmospheric testing is the easiest and cheapest method to conduct and evaluate. However, it involved relatively large amounts of radioactive particles that spread around the globe with the wind, fell and rained to the ground and created a radioactive coating that released radiation. These environmental consequences got people worrying about the health effects of nuclear testing. Will I fall ill? Will my children and grand children be hurt? Can we farm the land and drink the water close to the test sites? Around the world, a strong opinion grew against nuclear testing in general and atmospheric testing in particular. Indian Prime Minister Nehru brought the world opinion to the UN in 1954, by proposing a world wide nuclear test ban.

Underwater nuclear tests
Underwater testing entails nuclear devices being detonated underwater, usually moored to a ship or a barge. These tests have usually been conducted to evaluate the effects of nuclear weapons against naval vessels, or to evaluate potential sea-based nuclear weapons like submarines or underwater torpedoes. Underwater tests close to the surface can disperse large amounts of radioactive water and steam, contaminating nearby ships or structures.

Underground nuclear tests
Underground testing refers to nuclear tests, which are conducted under the surface of the earth, at varying depths. Underground nuclear testing made up the majority of nuclear tests by the United States and the Soviet Union during the Cold War; other forms of nuclear testing were banned by the Partial Test Ban Treaty in 1963. When the explosion is fully contained, underground nuclear testing emits a negligible amount of fallout. However, underground nuclear tests can "vent" to the surface, producing considerable amounts of radioactive debris. Underground testing can result in seismic activity depending on the yield of the nuclear device and the composition of the medium it is detonated in, and generally result in the creation of subsidence craters.

Nuclear testing in the Pacific
After World War II, the US, France and the UK conducted extensive nuclear test over islands in the Pacific. For decades, the paradisical islands were contaminated with radioactive fallout, first through atmospheric testing, followed by underground testing. Between 1966 and 1990, France conducted no less than 167 nuclear tests at the islands of Mururoa and Fangataufa.[2] Between 1946 and 1962, the US used the Marshall Islands, Christmas Island and Johnston atoll for atmospheric nuclear tests.[3]

Partial Test Ban Treaty

As early as 1958 attempts were made to negotiate a treaty regulating nuclear testing. Initially the US and the UK declared a one-year moratorium on nuclear testing. The Soviet Union joined just a few days later. This first attempt was abandoned in 1961 due to political tensions and military developments. The Soviet Union resumed nuclear testing, quickly followed by the US.[4] Around the globe, people began to see the risks posed by radioactive contamination resulting from the nuclear tests and the pressure increased on nuclear weapon states to solve the problem. Indian Prime Minister Nehru brought the issue to the UN when calling for a global ban on nuclear testing in 1954. In 1963 the Soviet Union, the US and the UK negotiated the Partial Test Ban Treaty (PTBT) that prohibited nuclear testing in the atmosphere, under water and in outer space. France and China did not join the treaty.

A problem with the PTBT was the failure to prohibit underground nuclear testing and the development of new types of nuclear weapons. Underground testing can also cause radioactive fallout, as the explosions often burst through the surface and release radioactive particles. The PTBT also failed to regulate increases in existing nuclear stockpiles. In fact, nuclear weapon states increased the amount of nuclear testing after 1963 and the nuclear arsenals doubled between 1963 and 1970.[5]

Comprehensive Test Ban Treaty

To come to terms with the nuclear weapons states' development of new nuclear weapons, to prevent proliferation of nuclear weapons to new states and to ban all forms of nuclear testing, a stronger treaty was necessary. In 1996 the Comprehensive Test Ban Treaty (CTBT) was adopted by the UN, after lengthy negotiations in the Geneva-based Conference on Disarmament (CD). The CTBT prohibits all forms of nuclear testing, including peaceful tests. However, the treaty allows for so called subcritical nuclear tests where no actual nuclear explosion occurs. An International Monitoring System (IMS) will make sure no nuclear testing takes place.[6] The CTBT also allows for short-notice on-site inspections of nuclear facilities.

In order to enter into force and become part of international law the CTBT must be signed and ratified by the 44 states in the world with nuclear capacity, i.e. states with nuclear power or research facilities. Today (March 2008) three of these states: India, Pakistan and North Korea have not even signed the treaty. Nine others (China, Egypt, Indonesia, Iran, Israel and the US) have not ratified. A total of 178 of the world's 195 states have signed the CTBT and 144 have ratified.[7]

Sign	When an international treaty is being negotiated, government representatives from each state normally attend the negotiations. Usually officials from Foreign ministries deal with treaty details, supported by experts. The head of government or ministers from each state then signs the treaty, to mark the end of

	negotiations and the reaching of an agreement. Usually, however, a government is only mandated to negotiate for its state, not to make the final approval of a treaty.
Ratify	The right of final approval is normally held by the parliament in each state. The parliamentary approval signals the state's ratification of a treaty. Since the elected parliaments are seen as "superior" to governments, parliaments are not forced to ratify a treaty that has been negotiated and signed by the government. This is why some states have signed treaties but not ratified.

Box: What is the meaning of signatures and ratification?

It seems hard to convince the remaining nine states whose ratification is needed for the CTBT to enter into force. But even if the CTBT will not enter into force in the near future, there still seems to be an understanding among states about the termination of nuclear testing. The declared test moratoria of nuclear weapon states is a sign of a common understanding.

At the 2000 NPT RevCon a decision was made that no nuclear testing may be done until the entry into force of the CTBT – a principle that also India and Pakistan seem to adhere to. After the nuclear testing of India and Pakistan in May 1998 these two states declared themselves nuclear weapon states. The 2000 NPT RevCon, however, made clear that nuclear testing by no means entitles the states the status of nuclear weapons states or any other unique position. The two states, as well as the third Threshold State were encouraged to immediately and unconditionally join the NPT as non-nuclear weapon states.

Even if all states were to declare nuclear testing moratoria, the entry into force of the CTBT is still of utmost importance. Under the treaty, the undertaking not to test nuclear weapons becomes legally binding to all states, rather than today's indefinite decision by nuclear weapons states not to test. The CTBT is considered a necessary step towards nuclear disarmament and non-proliferation, as the treaty basically prevents development of new nuclear weapons. The treaty also attempts to hinder the qualitative arms race, where nuclear weapon states do not increase the numbers of their nuclear warheads, but the capacity and details of their nuclear systems. The CTBT does not prohibit nuclear research, but it is difficult to develop new nuclear weapons without testing.

The US is one of the states that have to ratify the CTBT before it can enter into force. Former President Bill Clinton signed the treaty in 1996, but the American Senate voted against the treaty in 1999. President George W. Bush has expressed a wish to withdraw the US signature from the treaty, but should according to Senate

regulations not do so without the Senate's permission. The signature therefore remains.[8] A review of the US nuclear policy in 2002 – the Nuclear Posture Review (NPR) – recommended that the US should not ratify the CTBT but stick to the nuclear test moratorium. In this way, the US can decide for itself whether to resume nuclear testing or not. The NPR also recommended the time it takes to prepare a nuclear test to be shortened from 2-3 years to a maximum of 12 months.[9] A new review with recommendations on the most suitable nuclear strategy will be submitted to Congress and the administration in December 2008.[10]

Comprehensive Test Ban Treaty Organization (CTBTO)

To verify member states' compliance to the CTBT, it establishes an organization: the Comprehensive Test Ban Treaty Organization (CTBTO). A preparatory commission for the CTBTO is now working to facilitate an early entry into force of the treaty, and to assure smooth operation of the IMS as soon as the treaty enters into force. The preparatory commission dedicates 80 % of its time to creating an efficient verification system for the CTBT. The verification system consists of the IMS, short-notice on-site inspections and confidence building measures between states.

The International Monitoring System (IMS) comprises a network of 321 monitoring stations and 16 radionuclide laboratories that monitor the earth for evidence of nuclear explosions. The system uses four verification methods, utilising the most modern technology available. Seismic, hydroacoustic and infrasound stations are employed to monitor the underground, underwater and atmosphere environments, respectively. Radionuclide stations can detect radioactive debris from atmospheric explosions or vented by underground or underwater nuclear explosions. Today, even before the entry into force of the CTBT, the IMS has more then 200 active monitoring stations that submit important information to detect seismic activities (earthquakes, tsunamis etc.) and determine whether these are nuclear explosions.[11]

Subcritical testing

Even though the CTBT has not yet entered into force, the states signing it have formally undertaken to follow the provisions of the treaty. Hence, no parties to the treaty have conducted any nuclear test since the signing of the treaty. The US, Russia, the UK and France have, to get away from this, conducted other forms of nuclear tests, i.e. Computer simulations, fusion experiments and so called subcritical testing. China, too, is suspected of having conducted at least one subcritical test.

A subcritical test implies testing of fissile materials that can be used for nuclear weapons in amounts that do not reach a critical mass. This means the nuclear reaction can not sustain itself, and the explosion fails. One way to conduct subcritical tests is by using smaller amounts of fissile materials, e.g. a kilo or so of weapon grade uranium or plutonium. The fissile material is compressed by conventional explosive material in a construction at least in some ways resembling the real nuclear weapon, the construction and material of which is to be tested.

The idea with subcritical testing is for nuclear weapon states to be able to continue the development and upgrading of nuclear weapons, while still abiding to the principles of the CTBT.

1Nuclear Files http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/testing/introduction.htm
2 IPPNW and IEER "*Environmental Effects of French Nuclear Testing*" in Radioactive Heaven and Earth: the health and environmental effects of nuclear weapons testing, in, on, and above the earth. New York, Apex Press, 1991.
3 Nuclear Weapon Archive http://nuclearweaponarchive.org/Usa/Tests/index.html
4 Federation of American Scientists http://www.fas.org/nuke/control/ctbt/chron1.htm
5Nuclear Files http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/testing/introduction.htm
6 Ibid
7 Comprehensive Test Ban Treaty Organisation http://www.ctbto.org/
8 Roberg, Jeffrey L. "*The Importance of International Treaties. Is Ratification Necessary*". World Affairs, Spring 2007, Vol. 169 Issue 4, s 184.
9 Global Security http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm
10 Scully, Megan. CongressDaily, 11/8/2007, p6
11Comprehensive Test Ban Treaty Organisation http://www.ctbto.org/