**Pakistan Nuclear Weapons**

**A Brief History of Pakistan's Nuclear Program**

Pakistan's nuclear weapons program was established in 1972 by Zulfiqar Ali Bhutto, who founded the program while he was Minister for Fuel, Power and Natural Resources, and later became President and Prime Minister. Shortly after the loss of East Pakistan in the 1971 war with India, Bhutto initiated the program with a meeting of physicists and engineers at Multan in January 1972.

India's 1974 testing of a nuclear "device" gave Pakistan's nuclear program new momentum. Through the late 1970s, Pakistan's program acquired sensitive uranium enrichment technology and expertise. The 1975 arrival of Dr. Abdul Qadeer Khan considerably advanced these efforts. Dr. Khan is a German-trained metallurgist who brought with him knowledge of gas centrifuge technologies that he had acquired through his position at the classified URENCO uranium enrichment plant in the Netherlands. Dr. Khan also reportedly brought with him stolen uranium enrichment technologies from Europe. He was put in charge of building, equipping and operating Pakistan's Kahuta facility, which was established in 1976. Under Khan's direction, Pakistan employed an extensive clandestine network in order to obtain the necessary materials and technology for its developing uranium enrichment capabilities.

In 1985, Pakistan crossed the threshold of weapons-grade uranium production, and by 1986 it is thought to have produced enough fissile material for a nuclear weapon. Pakistan continued advancing its uranium enrichment program, and according to Pakistani sources, the nation acquired the ability to carry out a nuclear explosion in 1987.

 [Pakistan Nuclear Weapons - A Chronology](http://www.fas.org/nuke/guide/pakistan/nuke/chron.htm)

**Nuclear Tests**

On May 28, 1998 Pakistan announced that it had successfully conducted five nuclear tests. The Pakistani Atomic Energy Commission reported that the five nuclear tests conducted on May 28 generated a seismic signal of 5.0 on the Richter scale, with a total yield of up to 40 KT (equivalent TNT). Dr. A.Q. Khan claimed that one device was a boosted fission device and that the other four were sub-kiloton nuclear devices.

On May 30, 1998 Pakistan tested one more nuclear warhead with a reported yield of 12 kilotons. The tests were conducted at Balochistan, bringing the total number of claimed tests to six. It has also been claimed by Pakistani sources that at least one additional device, initially planned for detonation on 30 May 1998, remained emplaced underground ready for detonation.

Pakistani claims concerning the number and yields of their underground tests cannot be independently confirmed by seismic means, and several sources, such as the [Southern Arizona Seismic Observatory](http://www.geo.arizona.edu/geophysics/faculty/wallace/ind.pak/index.html) have reported lower yields than those claimed by Pakistan. Indian sources have also suggested that as few as two weapons were actually detonated, each with yields considerably lower than claimed by Pakistan. However, seismic data showed at least two and possibly a third, much smaller, test in the initial round of tests at the [Ras Koh](http://www.fas.org/nuke/guide/pakistan/facility/ras_koh.htm) range. The single test on 30 May provided a clear seismic signal.

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| --- | --- | --- | --- |
| **DEVICE** | **DATE** | **YIELD[announced]** | **YIELD[estimated]** |
| [boosted device?]  | 28 May 1998 | 25-36 kiloton | total 9-12 kiloton |
| Fission device | 28 May 1998 | 12 kiloton |
| Low-yield device | 28 May 1998 | sub-kiloton | -- |
| Low-yield device | 28 May 1998 | sub-kiloton | -- |
| Low-yield device | 28 May 1998 | sub-kiloton | -- |
| Fission device  | 30 May 1998 | 12 kiloton | 4-6 kiloton |
| Fission device  | not detonated | 12 kiloton | -- |
| This table lists the nuclear tests that Pakistan claims to have carried out in May 1998 as well as the announced yields. Other sources have reported lower yields than those claimed by Pakistan. The [Southern Arizona Seismic Observatory](http://www.geo.arizona.edu/geophysics/faculty/wallace/ind.pak/index.html) reports that the total seismic yield for the May 28th tests was 9-12 kilotons and that the yield for the May 30th tests was 4-6 kilotons. |

According to a preliminary analysis conducted at Los Alamos National Laboratory, material released into the atmosphere during an underground nuclear test by Pakistan in May 1998 contained low levels of weapons-grade plutonium. The significance of the Los Alamos finding was that Pakistan had either imported or produced plutonium undetected by the US intelligence community. But Lawrence Livermore National Laboratory and other agencies later contested the accuracy of this finding.

These tests came slightly more than two weeks after India carried out five nuclear tests of its own on May 11 and 13 and after many warnings by Pakistani officials that they would respond to India.

Pakistan's nuclear tests were followed by the February 1999 Lahore Agreements between Prime Ministers Vajpayee and Sharif. The agreements included confidence building measures such as advance notice of ballistic missile testing and a continuation of their unilateral moratoria on nuclear testing. But diplomatic advances made that year were undermined by Pakistan's incursion into Kargil. Under US diplomatic pressure, Prime Minister Sharif withdrew his troops, but lost power in October 1999 due to a military coup in which Gen. Pervez Musharraf took over.

 Satellite Imagery of Pakistan's [May 28](http://cmrweb.cmr.gov/rdss/resources/satimage/Pakistan/PakistanWest01/index.html) and [May 30](http://cmrweb.cmr.gov/rdss/resources/satimage/Pakistan/PakistanEast01/index.html) nuclear testing sites

**Nuclear Infrastructure**

Pakistan's nuclear program is based primarily on highly enriched uranium (HEU), which is produced at the A. Q. Khan research laboratory at Kahuta, a gas centrifuge uranium enrichment facility. The Kahuta facility has been in operation since the early 1980s. By the early 1990s, Kahuta had an estimated 3,000 centrifuges in operation, and Pakistan continued its pursuit of expanded uranium enrichment capabilities.

In the 1990s Pakistan began to pursue plutonium production capabilities. With Chinese assistance, Pakistan built the 40 MWt (megawatt thermal) Khusab research reactor at Joharabad, and in April 1998, Pakistan announced that the reactor was operational. According to public statements made by US officials, this unsafeguarded heavy water reactor generates an estimated 8-10 kilotons of weapons grade plutonium per year, which is enough for one to two nuclear weapons. The reactor could also produce tritium if it were loaded with lithium-6. According to J. Cirincione of Carnegie, Khusab's plutonium production capacity could allow Pakistan to develop lighter nuclear warheads that would be easier to deliver with a ballistic missile.

Plutonium separation reportedly takes place at the New Labs reprocessing plant next to Pakistan's Institute of Nuclear Science and Technology (Pinstech) in Rawalpindi and at the larger Chasma nuclear power plant, neither of which are subject to [IAEA](http://www.iaea.or.at/) inspection.

**Nuclear Arsenal**

The [Natural Resources Defense Council (NRDC)](http://www.thebulletin.org/issues/nukenotes/jf02nukenote.html) estimates that Pakistan has built 24-48 HEU-based nuclear warheads, and [Carnegie](http://www.ceip.org/files/pdf/Deadly_Arsenals_Chap12.pdf) reports that they have produced 585-800 kg of HEU, enough for 30-55 weapons. Pakistan's nuclear warheads are based on an implosion design that uses a solid core of highly enriched uranium and requires an estimated 15-20 kg of material per warhead. According to Carnegie, Pakistan has also produced a small but unknown quantity of weapons grade plutonium, which is sufficient for an estimated 3-5 nuclear weapons.

Pakistani authorities claim that their nuclear weapons are not assembled. They maintain that the fissile cores are stored separately from the non-nuclear explosives packages, and that the warheads are stored separately from the delivery systems. In a [2001 report](http://www.fas.org/irp/threat/prolif00.pdf), the Defense Department contends that "Islamabad's nuclear weapons are probably stored in component form" and that "Pakistan probably could assemble the weapons fairly quickly." However, no one has been able to ascertain the validity of Pakistan's assurances about their nuclear weapons security.

Pakistan's reliance primarily on HEU makes its fissile materials particularly vulnerable to diversion. HEU can be used in a relatively simple gun-barrel-type design, which could be within the means of non-state actors that intend to assemble a crude nuclear weapon.

The terrorist attacks on September 11th raised concerns about the security of Pakistan's nuclear arsenal. According to press reports, within two days of the attacks, Pakistan's military began relocating nuclear weapons components to six new secret locations. Shortly thereafter, Gen. Pervez Musharraf fired his intelligence chief and other officers and detained several suspected retired nuclear weapons scientists, in an attempt to root out extremist elements that posed a potential threat to Pakistan's nuclear arsenal.

Concerns have also been raised about Pakistan as a proliferant of nuclear materials and expertise. In November, 2002, shortly after North Korea admitted to pursuing a nuclear weapons program, the press reported allegations that Pakistan had provided assistance in the development of its uranium enrichment program in exchange for North Korean missile technologies.

**Foreign Assistance**

In the past, China played a major role in the development of Pakistan's nuclear infrastructure, especially when increasingly stringent export controls in western countries made it difficult for Pakistan to acquire materials and technology elsewhere. According to a [2001 Department of Defense report](http://www.fas.org/irp/threat/prolif00.pdf), China has supplied Pakistan with nuclear materials and expertise and has provided critical assistance in the construction of Pakistan's nuclear facilities.

In the 1990s, China designed and supplied the heavy water Khusab reactor, which plays a key role in Pakistan's production of plutonium. A subsidiary of the China National Nuclear Corporation also contributed to Pakistan's efforts to expand its uranium enrichment capabilities by providing 5,000 custom made ring magnets, which are a key component of the bearings that facilitate the high-speed rotation of centrifuges.

According to [Anthony Cordesman](http://www.csis.org/burke/hd/reports/threat_pak_nukes.pdf) of CSIS, China is also reported to have provided Pakistan with the design of one of its warheads, which is relatively sophisticated in design and lighter than U.S. and Soviet designed first generation warheads.

China also provided technical and material support in the completion of the [Chasma](http://www.fas.org/nuke/guide/pakistan/facility/chashma.htm) nuclear power reactor and plutonium reprocessing facility, which was built in the mid-1990s. The project had been initiated as a cooperative program with France, but Pakistan's failure to sign the NPT and unwillingness to accept IAEA safeguards on its entire nuclear program caused France to terminate assistance.

According to the [Defense Department report](http://www.fas.org/irp/threat/prolif00.pdf) cited above, Pakistan has also acquired nuclear related and dual-use and equipment and materials from the Former Soviet Union and Western Europe.

**Intermittent US Sanctions**

On several occasions, under the authority of amendments to the Foreign Assistance Act, the U.S. has imposed sanctions on Pakistan, cutting off economic and military aid as a result of its pursuit of nuclear weapons. However, the U.S. suspended sanctions each time developments in Afghanistan made Pakistan a strategically important "frontline state," such as the 1981 Soviet occupation and in the war on terrorism.

**Pakistan's Nuclear Doctrine**

Several sources, such as Jane's Intelligence Review and [Defense Department reports](http://www.fas.org/irp/threat/prolif00.pdf) maintain that Pakistan's motive for pursuing a nuclear weapons program is to counter the threat posed by its principal rival, India, which has superior conventional forces and nuclear weapons.

Pakistan has not signed the [Non-Proliferation Treaty (NPT)](http://www.fas.org/nuke/control/npt/index.html) or the [Comprehensive Test Ban Treaty (CTBT)](http://www.fas.org/nuke/control/ctbt/index.html). According to the Defense Department report cited above, "Pakistan remains steadfast in its refusal to sign the NPT, stating that it would do so only after India joined the Treaty. Consequently, not all of Pakistan's nuclear facilities are under IAEA safeguards. Pakistani officials have stated that signature of the CTBT is in Pakistan's best interest, but that Pakistan will do so only after developing a domestic consensus on the issue, and have disavowed any connection with India's decision."

Pakistan does not abide by a no-first-use doctrine, as evidenced by President Pervez Musharraf's statements in May, 2002. Musharraf said that Pakistan did not want a conflict with India but that if it came to war between the nuclear-armed rivals, he would "respond with full might." These statements were interpreted to mean that if pressed by an overwhelming conventional attack from India, which has superior conventional forces, Pakistan might use its nuclear weapons.

**Sources and Resources**

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* [ENHANCING NUCLEAR SECURITY IN THE COUNTER-TERRORISM STRUGGLE: India and Pakistan as a New Region for Cooperation](http://www.ceip.org/files/Publications/wp29.asp?from=pubtype) - by Rose Gottemoeller, Carnegie Endowment for International Peace, August 2002. This working paper explores possible cooperative programs that could enhance the security of Pakistan and India's nuclear arsenals, in order to prevent the diversion of dangerous materials into the hands of terrorists or rogue state leaders.
* ["Pakistan's Nuclear Forces, 2001"](http://www.thebulletin.org/issues/nukenotes/jf02nukenote.html) from NRDC Nuclear Notebook, Bulletin of Atomic Scientists Jan/Feb 2002. A Two-page update on the state of Pakistan's nuclear arsenal. It makes rough estimates of the number of nuclear weapons and the amount of fissile material in Pakistan's possession and touches on fissile material production capabilities. Also included is a brief discussion of delivery mechanisms such as aircraft and missiles.
* [Monterey Institute Resource Page on India and Pakistan](http://cns.miis.edu/research/india/) - last updated July 7, 2000. This page has many useful links to relevant maps, news articles and analytical pieces on India and Pakistan's nuclear programs.
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* ["Pakistan's Nuclear Dilemma"](http://www.ceip.org/files/events/Paktranscript.asp) - September 23 2001, Carnegie Endowment for International Peace. Transcripts from a Carnegie panel on developments in Pakistan in the aftermath of the September 11th attacks. The panel included three speakers -- Shirin Tahir-Kheli, George Perkovich and Rose Gottemoeller-- and was moderated by Joseph Cirincione.
* [Chapter on Pakistan, from Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998](http://www.ceip.org/files/Publications/TrackingPakistan.asp) by Rodney W. Jones, Mark G. McDonough, with Toby F. Dalton and Gregory D. Koblentz (Washington, DC: Carnegie Endowment, July 1998). This chapter documents the history of Pakistan's nuclear program and tracks the development of its nuclear infrastructure. It also covers in detail the sanctions the US imposed on Pakistan in light of these developments, as well Pakistan's missile program.
* ["U.S. Appears to be Losing Track of Pakistan's Nuclear Program" and "U.S. Now Believes Pakistan to use Khushab Plutonium in Bomb Program"](http://www.nyu.edu/globalbeat/nucwatch/nucwatch071798.html) By Mark Hibbs July, 1998. Two brief articles written in the aftermath of Paksistan's 1998 nuclear tests -- they discuss Pakistan's weapons grade uranium and plutonium production capacities and the implications for its nuclear arsenal.
* "U.S. Labs at Odds on Whether Pakistani Blast Used Plutonium," by Dana Priest Washington Post Sunday, January 17, 1999; Page A02. This article discusses the controversy over the preliminary analysis carried out by Los Alamos National Laboratory, which found that plutonium traces had been released into the atmosphere during Pakistan's May 30th underground nuclear test. Scientists at Lawrence Livermore National Labs contested the accuracy of this finding and alleged that Los Alamos had contaminated and then lost the air sample. At the time, Los Alamos' findings were highly controversial because they implied that Pakistan had obtained plutonium either though imports or indigenous production, and there was uncertainty about Pakistan's plutonium production capabilities. It is now public knowledge that Pakistan can produce and isolate plutonium at its Khusbab reactor and at the New Labs and Chasma separation facilities.
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