Nuclear proliferation

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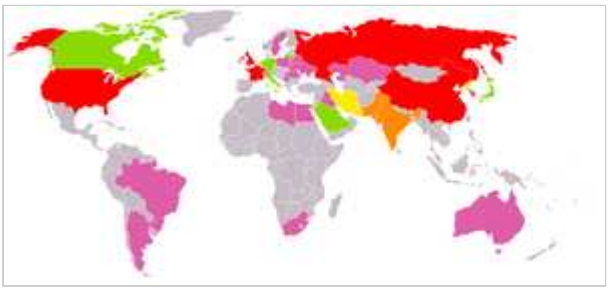

World map with nuclear weapons development status represented by color. **Red**: Five "nuclear weapons states" from the NPT (USA, Russia, UK, France, PRC). **Dark orange**: Other known nuclear powers (India, Pakistan). **Light orange**: States suspected of having possession of, or accused of being in the process of developing, nuclear weapons (Israel, North Korea, Iran). **Purple**: States which at one point had nuclear weapons and/or nuclear weapons research programs. **Green**: Other states capable of developing nuclear weapons within several years if the decision to do so were made.

Nuclear proliferation is the spread of nuclear weapons production technology and knowledge to nations that do not already have such capabilities. It has been opposed by many nations with and without nuclear weapons, who fear that more countries with nuclear weapons may increase the possibility of nuclear warfare, de-stabilize international or regional relations, or infringe upon the national sovereignty of individual nation-states. Other nations have pursued their own independent weapons development, calling into question the authority of some countries being able to specify who can or cannot have their own defensive nuclear weapons.

Earnest international efforts to promote **nuclear non-proliferation** did not begin until the late-1960s, after five nations had acquired nuclear weapons (see List of countries with nuclear weapons for more information). Since then, the primary focus of anti-proliferation efforts has been to maintain control over the specialized materials necessary to build such devices because this is the most difficult and expensive part of a nuclear weapons program. The main materials whose generation and distribution is controlled are highly enriched uranium and plutonium. Other than the acquisition of these special materials, the scientific and technical means for weapons construction to develop rudimentary, but working, nuclear devices are, although non-trivial, considered to be within the reach of most nations.

Nuclear weapons

History of nuclear weapons
Nuclear warfare
Nuclear arms race
Weapon design / testing
Nuclear explosion
Delivery systems
Nuclear espionage
Proliferation
Countries
Nuclear weapons states

US · Russia · UK · France
China · India · Pakistan · Israel

The International Atomic Energy Agency (IAEA) has been the primary international anti-proliferation organization since it was established in 1957 by the United Nations. It operates a safeguards system as specified under the Nuclear Non-Proliferation Treaty (NPT) of 1968. It has involved cooperation in developing nuclear energy while ensuring that civil uranium, plutonium, and associated plants are used only for peaceful purposes and do not contribute in any way to proliferation or nuclear weapons programs.

Most countries have renounced nuclear weapons, stating that possession of them would threaten rather than enhance national security. They have therefore embraced the NPT as a public commitment to use nuclear materials and technology only for peaceful purposes. A number of other countries, and individuals within countries, have been suspected of encouraging nuclear proliferation for either national or personal gain.

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International cooperation

Nuclear Non-Proliferation Treaty

Main article: Nuclear Non-Proliferation Treaty

At present, 189 states are party to the 1968 Nuclear Non-Proliferation Treaty. These include all five declared Nuclear Weapons States (NWSs): the People's Republic of China, France, the Russian Federation, the UK, and the USA.

Notable non-signatories to the NPT are Israel, Pakistan, and India (the latter two have since tested nuclear weapons, while Israel is considered by most to be an unacknowledged nuclear weapons state). North Korea was once a signatory but withdrew in January 2003.

The NPT's main objectives are to stop the further spread of nuclear weapons, to provide security for non-nuclear weapon states which have given up the nuclear option, to encourage international co-operation in the peaceful uses of nuclear energy, and to pursue negotiations in good faith towards nuclear disarmament leading to the eventual elimination of nuclear weapons.

International Atomic Energy Agency

Main article: International Atomic Energy Agency

The IAEA was set up by unanimous resolution of the United Nations in 1957 to help nations develop nuclear energy for peaceful purposes. Allied to this role is the administration of safeguards arrangements to provide assurance to the international community that individual countries are honouring their commitments under the treaty.

The IAEA regularly inspects civil nuclear facilities to verify the accuracy of documentation supplied to it. The agency checks inventories, and samples and analyzes materials. Safeguards are designed to deter diversion of nuclear material by increasing the risk of early detection. They are complemented by controls on the export of sensitive technology from countries such as UK and USA through voluntary bodies such as the Nuclear Suppliers Group. The main concern of the IAEA is that uranium not be enriched beyond what is necessary for commercial civil plants, and that plutonium which is produced by nuclear reactors not be refined into a form that would be suitable for bomb production.

Scope of safeguards

Traditional safeguards are arrangements to account for and control the use of nuclear materials. This verification is

a key element in the international system which ensures that uranium in particular is used only for peaceful purposes.

Parties to the NPT agree to accept technical safeguard measures applied by the IAEA. These require that operators of nuclear facilities maintain and declare detailed accounting records of all movements and transactions involving nuclear material. Over 550 facilities and several hundred other locations are subject to regular inspection, and their records and the nuclear material being audited. Inspections by the IAEA are complemented by other measures such as surveillance cameras and instrumentation.

The inspections act as an alert system providing a warning of the possible diversion of nuclear material from peaceful activities. The system relies on;

1. Material Accountability - tracking all inward and outward transfers and the flow of materials in any nuclear facility. This includes sampling and analysis of nuclear material, on-site inspections, and review and verification of operating records.
2. Physical Security - restricting access to nuclear materials at the site.
3. Containment and Surveillance - use of seals, automatic cameras and other instruments to detect unreported movement or tampering with nuclear materials, as well as spot checks on-site.

All NPT non-weapons states must accept these full-scope safeguards. In the five weapons states plus the non-NPT states (India, Pakistan and Israel), facility-specific safeguards apply. IAEA inspectors regularly visit these facilities to verify completeness and accuracy of records.

The terms of the NPT cannot be enforced by the IAEA itself, nor can nations be forced to sign the treaty. In reality, as shown in Iraq and North Korea, safeguards can be backed up by diplomatic, political and economic measures.

While traditional safeguards easily verified the correctness of formal declarations by suspect states, in the 1990s attention turned to what might not have been declared. While accepting safeguards at declared facilities, Iraq had set up elaborate equipment elsewhere in an attempt to enrich uranium to weapons grade. North Korea attempted to use research reactors (not commercial electricity-generating reactors) and a reprocessing plant to produce some weapons-grade plutonium.

The weakness of the NPT regime lay in the fact that no obvious diversion of material was involved. The uranium used as fuel probably came from indigenous sources, and the nuclear facilities were built by the countries themselves without being declared or placed under safeguards. Iraq, as an NPT party, was obliged to declare all facilities but did not do so. Nevertheless, the activities were detected and brought under control using international diplomacy. In Iraq, a military defeat assisted this process.

In North Korea, the activities concerned took place before the conclusion of its NPT safeguards agreement. With North Korea, the promised provision of commercial power reactors appeared to resolve the situation for a time, but it later withdrew from the NPT and declared it had nuclear weapons.

The greatest risk of nuclear weapons proliferation lies with countries which have not joined the NPT and which have significant unsafeguarded nuclear activities. India, Pakistan and Israel are in this category. While safeguards apply to some of their activities, others remain beyond scrutiny.

Additional Protocol

In 1993 a program was initiated to strengthen and extend the classical safeguards system, and a model protocol was agreed by the IAEA Board of Governors in 1997. The measures boosted the IAEA's ability to detect undeclared nuclear activities, including those with no connection to the civil fuel cycle.

Innovations were of two kinds. Some could be implemented on the basis of IAEA's existing legal authority through safeguards agreements and inspections. Others required further legal authority to be conferred through an Additional Protocol. This must be agreed by each non-weapons state with IAEA, as a supplement to any existing

comprehensive safeguards agreement. Weapons states have agreed to accept the principles of the model additional protocol.

Key elements of the model Additional Protocol:

- The IAEA is to be given considerably more information on nuclear and nuclear-related activities, including R & D, production of uranium and thorium (regardless of whether it is traded), and nuclear-related imports and exports.
- IAEA inspectors will have greater rights of access. This will include any suspect location, it can be at short notice (e.g., two hours), and the IAEA can deploy environmental sampling and remote monitoring techniques to detect illicit activities.
- States must streamline administrative procedures so that IAEA inspectors get automatic visa renewal and can communicate more readily with IAEA headquarters.
- Further evolution of safeguards is towards evaluation of each state, taking account of its particular situation and the kind of nuclear materials it has. This will involve greater judgement on the part of IAEA and the development of effective methodologies which reassure NPT States.

Currently 54 states have signed and 18 have ratified the Additional Protocol.

Other IAEA developments

The Zangger Committee communicated its guidelines, essentially a set of export rules, to the IAEA in 1978. These were to ensure that transfers of nuclear material or equipment would not be diverted to unsafeguarded nuclear fuel cycle or nuclear explosive activities, and formal government assurances to this effect were required from recipients. The Guidelines also recognised the need for physical protection measures in the transfer of sensitive facilities, technology and weapons-usable materials, and strengthened retransfer provisions. The group began with seven members -- the USA, the former USSR, the UK, France, Germany, Canada and Japan -- but now includes 35 countries.

In May 1995, NPT parties reaffirmed their commitment to a Fissile Materials Cut-off Treaty to prohibit the production of any further fissile material for weapons. This aims to complement the Comprehensive Test Ban Treaty of 1996 and to codify commitments made by USA, UK, France and Russia to cease production of weapons material, as well as putting a similar ban on China. This treaty will also put more pressure on Israel, India and Pakistan to agree to international verification.

On August 9, 2005 Ayatollah Ali Khamenei issued a fatwa forbidding the production, stockpiling and use of nuclear weapons. The full text of the fatwa was released in an official statement at the meeting of the International Atomic Energy Agency (IAEA) in Vienna. [1] (http://www.ww4report.com/node/929) As of February 2006 Iran formally announced that uranium enrichment within their borders has continued. Iran claims it is for peaceful purposes but England, France, Germany, and The United States claim the purpose is for nuclear weapons research and construction. [2] (http://www.cnn.com/2006/WORLD/meast/03/06/iran.nuclear/index.html)

Unsanctioned nuclear activity

Iraq

Up to the late 1980s it was generally assumed that any undeclared nuclear activities would have to be based on the diversion of nuclear material from safeguards. States acknowledged the possibility of nuclear activities entirely separate from those covered by safeguards, but it was assumed they would be detected by national intelligence activities. There was no particular effort by IAEA to attempt to detect them.

Iraq had been making efforts to secure a nuclear potential since the 1960s. In

Weapons of mass destruction	
By type	
Biological weapons Chemical weapons Nuclear weapons Radiological weapons	
By country	
Algeria	Argentina
Brazil	Australia
Canada	P.R. China

France	Germany
India	Iran
Iraq	Israel
Italy	Japan
Netherlands	North Korea
Pakistan	Poland
Russia	South Africa
ROC (Taiwan)	United Kingdom
United States	

the late 1970s a specialised plant, Osiraq, was constructed near Baghdad. The plant was attacked during the Iran-Iraq War and was destroyed by Israeli bombers in June 1981.

Not until the 1990 NPT Review Conference did some states raise the possibility of making more use of (for example) provisions for "special inspections" in existing NPT Safeguards Agreements. Special inspections can be undertaken at locations other than those where safeguards routinely apply, if there is reason to believe there may be undeclared material or activities.

After inspections in Iraq following the UN Gulf War cease-fire resolution showed the extent of Iraq's clandestine nuclear weapons programme, it became clear that the IAEA would have to broaden the scope of its activities. Iraq was an NPT Party, and had thus agreed to place all its nuclear material under IAEA safeguards. But the inspections revealed that it had been pursuing an extensive clandestine uranium enrichment programme, as well as a nuclear weapons design programme.

The main thrust of Iraq's uranium enrichment programme was the development of technology for electromagnetic isotope separation (EMIS) of indigenous uranium. This uses the same principles as a mass spectrometer (albeit on a much larger scale). Ions of uranium-238 and uranium-235 are separated because they describe arcs of different radii when they move through a magnetic field. This process was used in the Manhattan Project to make the highly enriched uranium used in the Hiroshima bomb, but was abandoned soon afterwards.

The Iraqis did the basic research work at their nuclear research establishment at Tuwaitha, near Baghdad, and were building two full-scale facilities at Tarmiya and Ash Sharqat, north of Baghdad. However, when the war broke out, only a few separators had been installed at Tarmiya, and none at Ash Sharqat.

The Iraqis were also very interested in centrifuge enrichment, and had been able to acquire some components including some carbon-fibre rotors, which they were at an early stage of testing.

They were clearly in violation of their NPT and safeguards obligations, and the IAEA Board of Governors ruled to that effect. The UN Security Council then ordered the IAEA to remove, destroy or render harmless Iraq's nuclear weapons capability. This was done by mid 1998, but Iraq then ceased all cooperation with the UN, so the IAEA withdrew from this work.

The revelations from Iraq provided the impetus for a very far-reaching reconsideration of what safeguards are intended to achieve.

See also: Iraq and weapons of mass destruction

North Korea

The Democratic People's Republic of Korea (DPRK) acceded to the NPT in 1985 as a condition for the supply of a nuclear power station by the USSR. However, it delayed concluding its NPT Safeguards Agreement with the IAEA, a process which should take only 18 months, until April 1992.

During that period, it brought into operation a small gas-cooled, graphite-moderated, natural-uranium (metal) fuelled "Experimental Power Reactor" of about 25 MWt. It exhibited all the features of a plutonium production reactor for weapons purposes and produced only about 5 MWe. North Korea also made substantial progress in the construction of two larger reactors designed on the same principles, a prototype of about 200 MWt (50 MWe), and a full-scale version of about 800 MWt (200 MWe).

In addition it completed and commissioned a reprocessing plant for the extraction of plutonium from spent reactor fuel. That plutonium, if the fuel was only irradiated to a very low burn-up, would have been in a form very suitable for weapons. Although all these facilities at Yongbyon were to be under safeguards, there was always the risk that at some stage, the DPRK would withdraw from the NPT and use the plutonium for weapons.

One of the first steps in applying NPT safeguards is for the IAEA to verify the initial stocks of uranium and plutonium to ensure that all the nuclear material in the country have been declared for safeguards purposes. While undertaking this work in 1992, IAEA inspectors found discrepancies which indicated that the reprocessing plant had been used more often than the DPRK had declared, which suggested that the DPRK could have weapons-grade plutonium which it had not declared to the IAEA. Information passed to the IAEA by a Member State (as required by the IAEA) supported that suggestion by indicating that the DPRK had two undeclared waste or other storage sites.

In February 1993 the IAEA called on the DPRK to allow special inspections of the two sites so that the initial stocks of nuclear material could be verified. The DPRK refused, and on 12 March announced its intention to withdraw from the NPT (three months' notice is required). In April 1993 the IAEA Board concluded that the DPRK was in non-compliance with its safeguards obligations and reported the matter to the UN Security Council. In June 1993 the DPRK announced that it had "suspended" its withdrawal from the NPT, but subsequently claimed a "special status" with respect to its safeguards obligations. This was rejected by IAEA.

Once the DPRK's non-compliance had been reported to the UN Security Council, the essential part of the IAEA's mission had been completed. Inspections in the DPRK continued, although inspectors were increasingly hampered in what they were permitted to do by the DPRK's claim of a "special status". However, some 8,000 corroding fuel rods associated with the experimental reactor have remained under close surveillance.

Following bilateral negotiations between DPRK and the USA, and the conclusion of the agreed framework in October 1994, the IAEA has been given additional responsibilities. The agreement requires a freeze on the operation and construction of the DPRK's plutonium production reactors and their related facilities, and the IAEA is responsible for monitoring the freeze until the facilities are eventually dismantled. The DPRK remains uncooperative with the IAEA verification work and has yet to comply with its safeguards agreement.

While Iraq was defeated in a war, allowing the UN the opportunity to seek out and destroy its nuclear weapons programme as part of the cease-fire conditions, the DPRK was not defeated, nor was it vulnerable to other measures, such as trade sanctions. It can scarcely afford to import anything, and sanctions on vital commodities, such as oil, would either be ineffective, or risk provoking war.

Ultimately, the DPRK was persuaded to stop what appeared to be its nuclear weapons programme in exchange, under the agreed framework, for about US$5 billion in energy-related assistance. This included two 1000 MWe light water nuclear power reactors based on an advanced US System-80 design.

In January 2003 the DPRK withdrew from the NPT. In response a series of discussions between the DPRK, USA, and the PRC was held in Beijing beginning in April 2004 concerning North Korea's weapons program.

On January 10 2005 North Korea declared that it was in the possession of nuclear weapons. This has yet to be independently confirmed.

South Africa

In 1991, South Africa acceded to the NPT, concluded a comprehensive safeguards agreement with the IAEA, and submitted a report on its nuclear material subject to safeguards. At the time, the state had a nuclear power programme producing nearly 10% of the country's electricity, whereas Iraq and North Korea only had research reactors.

The IAEA's initial verification task was complicated by South Africa's announcement that between 1979 and 1989 it built and then dismantled a number of nuclear weapons. South Africa asked the IAEA to verify the conclusion of its weapons programme. In 1995 the IAEA declared that it was satisfied all materials were accounted for and the weapons programme had been terminated and dismantled.

United States-NATO nuclear weapons sharing

The United States provides about 180 tactical B61 nuclear bombs for use by Belgium, Germany, Italy, the Netherlands and Turkey under a NATO nuclear weapons sharing agreement. Some countries believe this violates Articles I and II of the Nuclear Non-Proliferation Treaty, where the U.S. has committed:

> "... not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly...".

The U.S. insists its forces control the weapons and that no transfer of the nuclear bombs or control over them is intended "unless and until a decision were made to go to war, at which the [NPT] treaty would no longer be controlling", so there is no breach of the NPT. However the pilots and other staff of the "non-nuclear" NATO countries practice handling and delivering the U.S. nuclear bombs.

Threshold States

India and Pakistan (with Israel) have been "threshold" countries in terms of the international non-proliferation regime. They possess or are quickly capable of assembling one or more nuclear weapons. They have remained outside the 1970 NPT. They are thus largely excluded from trade in nuclear plant or materials, except for safety-related devices for a few safeguarded facilities.

In May 1998 India and Pakistan each exploded several nuclear devices underground. This heightened concerns regarding an arms race between them, with Pakistan involving the People's Republic of China, an acknowledged nuclear weapons state. Both countries are opposed to the NPT as it stands, and India has consistently attacked the Treaty since its inception in 1970 labeling it as lopsided treaty in favor of the nuclear powers.

Relations between the two countries are tense and hostile, and the risks of nuclear conflict between them have long been considered quite high. Kashmir is a prime cause of bilateral tension, its sovereignty being in dispute since 1948. There is persistent low level military conflict due to Pakistan backing a Muslim insurgency there.

Both engaged in a conventional arms race in the 1980s, including sophisticated technology and equipment capable of delivering nuclear weapons. In the 1990s the arms race quickened. In 1994 India reversed a four-year trend of reduced allocations for defence, and despite its much smaller economy, Pakistan was expected to push its own expenditures yet higher. Both have lost their patrons: India, the former USSR, and Pakistan, the United States.

But it is the growth and modernisation of China's nuclear arsenal and its assistance with Pakistan's nuclear power programme and, reportedly, with missile technology, which exacerbate Indian concerns. In particular, Pakistan is aided by China's People's Liberation Army, which operates somewhat autonomously within that country as an exporter of military material.

India

Nuclear power for civil use is well established in India. Its civil nuclear strategy has been directed towards complete independence in the nuclear fuel cycle, necessary because of its outspoken rejection of the NPT. This self-sufficiency extends from uranium exploration and mining through fuel fabrication, heavy water production, reactor design and construction, to reprocessing and waste management. It has a small fast breeder reactor and is planning a much larger one. It is also developing technology to utilise its abundant resources of thorium as a nuclear fuel.

India has 14 small nuclear power reactors in commercial operation, two larger ones under construction, and ten more planned. The 14 operating ones (2548 MWe total) comprise:

- two 150 MWe BWRs from USA, which started up in 1969, now use locally-enriched uranium and are under safeguards,
- two small Canadian PHWRs (1972 & 1980), also under safeguards, and
- ten local PHWRs based on Canadian designs, two of 150 and eight 200 MWe.

- two new 540 MWe and two 700 MWe plants are tarapore (known as TAPP :Tarapore Atomic Power Project)

The two under construction and two of the planned ones are 450 MWe versions of these 200 MWe domestic products. Construction has been seriously delayed by financial and technical problems. In 2001 a final agreement was signed with Russia for the country's first large nuclear power plant, comprising two VVER-1000 reactors, under a Russian-financed US$3 billion contract. The first unit is due to be commissioned in 2007. A further two Russian units are under consideration for the site.

Nuclear power supplied 3.1% of India's electricity in 2000 and this is expected to reach 10% by 2005. Its industry is largely without IAEA safeguards, though a few plants (see above) are under facility-specific safeguards. As a result India's nuclear power programme proceeds largely without fuel or technological assistance from other countries. Its power reactors used to be among the worst-performing in the world, reflecting the technical difficulties of the country's isolation. However recently - since 1999 - the performance of Indian nuclear power reactors has been among the very best in world.

Its weapons material appears to come from a Canadian-designed 40MW "research" reactor which started up in 1960, well before the NPT, and a 100MW indigenous unit in operation since 1985. Both use local uranium, as India does not import any nuclear fuel. It is estimated that India may have built up enough weapons-grade plutonium for a hundred nuclear warheads.

The country has at least three other research reactors including the tiny one which is exploring the use of thorium as a nuclear fuel, by breeding fissile U-233. In addition, an advanced heavy-water thorium cycle is under development.

India exploded a nuclear device in 1974, the so-called Smiling Buddha test, which it has consistently claimed was for peaceful purposes. Others saw it as a response to China's nuclear weapons capability. It was then universally perceived, notwithstanding official denials, to possess, or to be able to quickly assemble, nuclear weapons. In 1997 it deployed its own medium-range missile and is now developing a long-range missile capable of reaching targets in China's industrial heartland.

In 1995 the USA quietly intervened to head off a proposed nuclear test. However, in 1998 there were five more tests in Operation Shakti. These were unambiguously military, including one claimed to be of a sophisticated thermonuclear device, and their declared purpose was "to help in the design of nuclear weapons of different yields and different delivery systems".

Indian security policies are driven by:

- its determination to be recognised as the dominant power in the region
- its increasing concern with China's expanding nuclear weapons and missile delivery programmes
- its concern with Pakistan's capability to deliver nuclear weapons deep into India

It perceives nuclear weapons as a cost-effective political counter to China's nuclear and conventional weaponry, and the effects of its nuclear weapons policy in provoking Pakistan is, by some accounts, considered incidental. India has had an unhappy relationship with China. Soundly defeated by China in the 1962 war, relations were frozen until 1998. Since then a degree of high-level contact has been established and a few elementary confidence-building measures put in place. China still occupies some territory claimed by India, and India still occupies some territory claimed by China. Its nuclear weapon and missile support for Pakistan is a major bone of contention.

Recently, George Bush met with India to discuss India's involvement with nuclear weapons. The two countries agreed that the United States would give nuclear power assistance to India. India would also be allowed to produce more nuclear weapons.

Pakistan

In Pakistan, nuclear power supplies only 1.7% of the country's electricity. It has one small (125 MWe) Canadian PHWR nuclear power reactor from 1971 which is under international safeguards, and a 300 MWe PWR supplied by China under safeguards, which started up in May 2000. A third one, a Chinese PWR, is planned. Enriched fuel for the PWRs will be imported from China.

It also has a 9 MW research reactor of 1965 vintage, and there are persistent reports of another "multipurpose" reactor, a 50 MW PHWR near Khushab, which is presumed to have potential for producing weapons plutonium.

Pakistan's concentration is on weapons technology, particularly the production of highly enriched uranium suitable for nuclear weapons, utilising indigenous uranium. It has at least one small centrifuge enrichment plant. In 1990 the US Administration cut off aid because it was unable to certify that Pakistan was not pursuing a policy of manufacturing nuclear weapons. This was relaxed late in 2001. In 1996 USA froze export loans to China because it was allegedly supplying centrifuge enrichment technology to Pakistan. Indian opinion is in no doubt about Pakistan's nuclear weapons capability.

Pakistan has made it clear since early 1996 that it had done the basic development work, and that if India staged a nuclear test, Pakistan would immediately start assembling its own nuclear explosive device. It is assumed to now have enough highly-enriched uranium for up to forty nuclear warheads.

In April 1998 Pakistan test fired a long-range missile capable of reaching Madras in southern India, pushing home the point by naming it after a 12th century Muslim conqueror. This development removed India's main military advantage over Pakistan.

Pakistan's security concerns derive from India's possession of a nuclear weapons capability, its development of short and intermediate-range missiles and, since their partition in 1947, its defeat by India in three of three wars, notably in East Bengal, now Bangladesh.

In May 1998 Pakistan announced that they had conducted six underground tests in the Chagai Hills, five on the 28th and one on the 30th of that month. Seismic events consistent with these claims were recorded.

Pakistan-North Korea Nuclear Proliferation and Missile Cooperation

Pakistan and North Korea's efforts to acquire nuclear weapons have had some similarities. Both countries first attempted the plutonium route to acquire such weapons and when this was thwarted turned towards uranium enrichment.

Pakistan

In 1970s it first focused on the plutonium route with the fissile material expected to come from diversion from a reprocessing plant to be sourced from France. However under the US pressure this attempt could not take off. Thereafter Pakistan redoubled its efforts to obtain uranium enrichment technology. The main efforts towards this direction were done under Dr. Abdul Qadeer Khan, who had earlier worked with Fysisch Dynamisch Onderzoekslaboratorium (FDO), a subsidiary of the Dutch firm VMF-Stork based in Amsterdam. From 1972-1975 he had access to classified data used to enrich ordinary uranium to weapons grade concentrations. FDO was working on the development of ultra high-speed centrifuges for Urenco. In 1974 while he was on secondment for 16 days as a translator to the Urenco plant in Almelo, he obtained photographs and documents of the plant. Dr. A. Q. Khan returned to Pakistan in 1976 and initiated the Uranium enrichment programme on the basis of the technology he had stolen from his previous employer. In this programme, Pakistan received significant help from China.

His efforts made Dr. Khan into a national hero. In 1981, as a tribute, the president of Pakistan, General Muhammad Zia-ul-Haq, renamed the enrichment plant the A. Q. Khan Research Laboratories.

In 2003, IAEA unearthed a nuclear blackmarket with close ties to Pakistan. It was widely believed to have direct

involvement of the government of Pakistan. This claim could not be verified due to the refusal of the government of Pakistan to allow IAEA to inteview the alleged head of the nuclear blackmarket, who happened to be no other than Dr. Khan. Dr. Khan later confessed to his crimes on the national television, bailing out the government by taking full responsibility. He confessed to nuclear proliferation from Pakistan to Iran and North Korea. He was immediately given presidential immunity. Exact nature of the involvement at the governmental level is still unclear, but the manner in which the government acted cast doubt on the sincerity of Pakistan.

North Korea

North Korea joined the NPT in 1985 and had subsequently signed a safeguards agreement with the IAEA. However it was believed that North Korea was diverting plutonium extracted from the fuel of its reactor at Yongbyon, for use in nuclear weapons. The subsequent confrontation with IAEA on the issue of inspections and suspected violations, resulted in North Korea threatening to withdraw from the NPT in 1993. This led to negotiations with the US resulting in the Agreed Framework of 1994, which provided for IAEA safeguards being applied to its reactors and spent fuel rods. These spent fuel rods were sealed in canisters by US to prevent North Korea from extracting plutonium from them. North Korea had to therefore freeze its plutonium programme.

During this period Pakistan-North Korea cooperation in missile technology transfer was being established. A high level Pakistani military delegation visited North Korea in August-September 1992, reportedly to discuss the supply Scud missile technology to Pakistan. In 1993, PM Benazir Bhutto travelled to China and North Korea. The visits are believed to be related to the subsequent acquisition of Ghauri (North Korean No-dong) missiles by Pakistan. During the period 1992-1994, A.Q. Khan was reported to have visited North Korea thirteen times. The missile cooperation programme with North Korea was under Dr. A. Q. Khan's Kahuta Research Laboratories. At this time China was under US pressure not to supply the M series of missiles to Pakistan. This forced the latter (possibly with Chinese connivance) to approach North Korea for missile transfers. Reports indicate that North Korea was willing to supply missile sub-systems including rocket motors, inertial guidance systems, control and testing equipment of Scud SSMs for US$ 50 million.

It is not clear what North Korea got in return. Joseph S. Bermudez Jr. in Jane's Defence Weekly (27 November 2002) reports that Western analysts had begun to question what North Korea received in payment for the missiles; many suspected it was nuclear technology and components. Khan's KRL was in charge of both Pakistan's uranium enrichment programme and also of the missile programme with North Korea. It is therefore likely during this period that cooperation in nuclear technology between Pakistan and North Korea was initiated. Western intelligence agencies began to notice exchange of personnel, technology and components between KRL and entities of the North Korean 2nd Economic Committee (responsible for weapons production).

A New York Times report on October 18, 2002 quoted US intelligence officials having stated that Pakistan was a major supplier of critical equipment to North Korea. The report added that equipment such as gas centrifuges appeared to have been "part of a barter deal" in which North Korea supplied Pakistan with missiles. Separate reports indicate (Washington Times, November 22, 2002) that U.S. intelligence had as early as 1999 picked up signs that North Korea was continuing to develop nuclear arms. Other reports also indicate that North Korea had been working covertly to develop an enrichment capability for nuclear weapons for at least five years and had used technology obtained from Pakistan (Washington Times, October 18, 2002).

Nuclear arms control in the region

The public stance of the two states on non-proliferation differs markedly. Pakistan appears to have dominated a continuing propaganda debate.

Pakistan has initiated a series of regional security proposals. It has repeatedly proposed a nuclear free zone in South Asia and has proclaimed its willingness to engage in nuclear disarmament and to sign the Non-Proliferation Treaty if India would do so. It has endorsed a United States proposal for a regional five power conference to consider non-proliferation in South Asia.

India has taken the view that solutions to regional security issues should be found at the international rather than

the regional level, since its chief concern is with China. It therefore rejects Pakistan's proposals.

Instead, the 'Gandhi Plan', put forward in 1988, proposed the revision of the Non-Proliferation Treaty, which it regards as inherently discriminatory in favor of the nuclear-weapon States, and a timetable for complete nuclear weapons disarmament. It endorsed early proposals for a Comprehensive Test Ban Treaty and for an international convention to ban the production of highly enriched uranium and plutonium for weapons purposes, known as the 'cut-off' convention.

The United States for some years, especially under the Clinton administration, pursued a variety of initiatives to persuade India and Pakistan to abandon their nuclear weapons programs and to accept comprehensive international safeguards on all their nuclear activities. To this end, the Clinton administration proposed a conference of the five nuclear-weapon states, Japan, Germany, India and Pakistan.

India refused this and similar previous proposals, and countered with demands that other potential weapons states, such as Iran and North Korea, should be invited, and that regional limitations would only be acceptable if they were accepted equally by China. The USA would not accept the participation of Iran and North Korea and these initiatives have lapsed.

Another, more recent approach, centers on 'capping' the production of fissile material for weapons purposes, which would hopefully be followed by 'roll back'. To this end, India and the United States jointly sponsored a UN General Assembly resolution in 1993 calling for negotiations for a 'cut-off' convention. Should India and Pakistan join such a convention, they would have to agree to halt the production of fissile materials for weapons and to accept international verification on their relevant nuclear facilities (enrichment and reprocessing plants). It appears that India is now prepared to join negotiations regarding such a Cut-off Treaty, under the UN Conference on Disarmament.

Bilateral confidence-building measures between India and Pakistan to reduce the prospects of confrontation have been limited. In 1990 each side ratified a treaty not to attack the other's nuclear installations, and at the end of 1991 they provided one another with a list showing the location of all their nuclear plants, even though the respective lists were regarded as not being wholly accurate. Early in 1994 India proposed a bilateral agreement for a 'no first use' of nuclear weapons and an extension of the 'no attack' treaty to cover civilian and industrial targets as well as nuclear installations.

Having promoted the Comprehensive Test Ban Treaty since 1954, India dropped its support in 1995 and in 1996 attempted to block the Treaty. Following the 1998 tests the question has been reopened and both Pakistan and India have indicated their intention to sign the CTBT. Indian ratification may be conditional upon the five weapons states agreeing to specific reductions in nuclear arsenals. The UN Conference on Disarmament has also called upon both countries "to accede without delay to the Non-Proliferation Treaty", presumably as non-weapons states.

Israel

Israel is also thought to possess an arsenal of potentially up to several hundred nuclear warheads and associated delivery systems, but this has never been openly confirmed or denied.

An Israeli nuclear installation is located about ten kilometers to the south of Dimona, the Negev Nuclear Research Center. Its construction commmenced in 1958, with French assistance. The official reason given by the Israeli and French governments was to build a nuclear reactor to power a "desalination plant", in order to "green the Negev". The purpose of the Dimona plant is widely assumed to be the manufacturing of nuclear weapons, and the majority of defence experts have concluded that it does in fact do that. However, the Israeli government refuses to confirm or deny this publicly, a policy it refers to as "ambiguity".

Norway sold 20 tonnes of heavy water needed for the reactor to Israel in 1959 and 1960 in a secret deal. There were no "safeguards" required in this deal to prevent usage of the heavy water for non-peaceful purposes. The British newspaper *Daily Express* accused Israel of working on a bomb in 1960. [3] (http://news.bbc.co.uk/2/hi/programmes/newsnight/4743493.stm) When the United States intelligence community

discovered the purpose of the Dimona plant in the early 1960s, it demanded that Israel agree to international inspections. Israel agreed, but on a condition that US, rather than IAEA, inspectors were used, and that Israel would receive advanced notice of all inspections.

Some claim that because Israel knew the schedule of the inspectors' visits, it was able to hide the alleged purpose of the site from the inspectors by installing temporary false walls and other devices before each inspection. The inspectors eventually informed the U.S. government that their inspections were useless due to Israeli restrictions on what areas of the facility they could inspect. In 1969, the United States terminated the inspections.

In 1986, Mordechai Vanunu, a former technican at the Dimona plant, revealed to the media some evidence of Israel's nuclear programme. Israeli agents kidnapped him from Italy, drugged him and transported him to Israel, and an Israeli court then tried him in secret on charges of treason and espionage, and sentenced him to eighteen years imprisonment. He was freed on April 21st, 2004, but was severely limited by the Israeli government. He was arrested again on November 11, 2004, though formal charges were not immediately filed.

See also: Israel and weapons of mass destruction

See also

- Dominique Lorentz, French investigative journalist on nuclear proliferation and the Eurodif dispute between Iran and France
- Iran's nuclear program
- Global Nuclear Energy Partnership announced February, 2006
- Nuclear disarmament
- Nuclear weapon
- Nuclear reactor
- Dual-use technology
- Nuclear warfare
- International Atomic Energy Agency
- Comprehensive Test Ban Treaty
- Nuclear Non-Proliferation Treaty
- Chemical weapon proliferation

External links and references

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Nuclear proliferation

- The Wrath of Khan (http://www.theatlantic.com/doc/200511/aq-khan) from The Atlantic Monthly
- *Preventing Catastrophic Nuclear Terrorism* (http://www.cfr.org/publication/10067/), a Council on Foreign Relations Special Report by Senior Fellow Charles Ferguson
- The Uranium Information Centre (http://www.uic.com.au/) provided much of the original material in this article.
- The IAEA official website: http://www.iaea.org/worldatom
- The Non-Proliferation Project website: http://www.carnegieendowment.org/npp/
- Proliferation of Weapons of Mass Destruction: Assessing the Risks (http://www.anthrax.osd.mil/documents/library/proliferation.pdf) - U.S. Congress, Office of Techchnology Assessment (OTA-ISC-559, August 1993)
- Nuclear Threat Initiative (http://nti.org/)
- Monterey Institute of International Studies, Center for Nonproliferation Studies (http://cns.miis.edu/)
- Nuclear Proliferation (http://www.pakistan-facts.com/index.php?topic=wmd-proliferation)
- Federation of American Scientists (http://fas.org/)
- Bulletin of the Atomic Scientists (http://www.thebulletin.org/) - A non-technical public policy and global security magazine that has reported on nuclear proliferation issues since 1945.
- "A Tale of Nuclear Proliferation: How Pakistani Built His Network" (http://www.nytimes.com/2004/02/12/international/asia/12NUKE.html?hp)
- Annotated bibliography on nuclear proliferation from the Alsos Digital Library

(http://alsos.wlu.edu/qsearch.aspx?browse=issues/Proliferation)
- Opinion essay arguing for a totally "nuclear-free" world (http://fletcher.tufts.edu/news/2004/02/najam.shtml) by Prof. Adil Najam in USA Today.
- Nuclear Files.org (http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/proliferation/index.htm) Comprehensive information regarding nuclear proliferation, including case studies.
- Nuclear Files.org (http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/terrorism/director-general-threat-of-nuclear-terrorism.html) Nuclear Proliferation and the Potential Threat of Nuclear Terrorism

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