

Nuclear Latency (NL) Dataset  
Country Coding Sheets

**PAKISTAN**

**COW COUNTRY CODE: 770**

List of Country's Enrichment and Reprocessing (ENR) Facilities

1. Chaklala
2. Chashma Reprocessing Facility
3. Golra
4. Gadwal
5. Kahuta- KRL (A.Q. Khan Research Laboratories)
6. Experimental Reprocessing Plant at Pakistan Institute of Nuclear Science and Technology (PINSTECH)
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Detailed Facility-Specific Information and Sources

**1. Chaklala**

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Uranium enrichment, centrifuge.

- b. *Facility size (laboratory, pilot, commercial).*

Pilot.

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

Construction started in 1974 and the facility was completed in 1976. The facility began operating around 1980 and may continue to operate.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

Yes, the facility was covert from 1976. It was known by 2005, if not earlier

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No, the facility is not under IAEA safeguards.

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

g. *Did the facility have a military purpose?*

Yes, the facility is designed to produce HEU for the weapons program.

h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No. Research and development at Chakala was lead by Pakistani scientists. Work on centrifuges began before AQ Khan returned to Pakistan with stolen designs. Centrifuges had already been indigenously produced before Khan joined the project in 1976.

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## 2. Chashma Reprocessing Facility

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Reprocessing.

- b. *Facility size (laboratory, pilot, commercial).*

Pilot.<sup>1</sup>

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

The IAEA accepted the application for the facility in 1976 and IPFM states work on the reprocessing plant started in 1974 when Pakistan signed a contract with a French firm. Work on the plant stalled, however, and Pakistan shifted its attention to a smaller reprocessing plant at PINSTECH (see below). In 2015, about 40 years after work began, the International Panel on Fissile Materials reported the reprocessing plant may be finished.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

No.

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

Yes, if only briefly. Under pressure from the United States and France, Pakistan agreed that the facility should be under international safeguards. One inspection occurred in 1976. Safeguards seem to apply to this facility, even if they were not in force.

- f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

- g. *Did the facility have a military purpose?*

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<sup>1</sup> The facility size is debatable. Albright and Brannan (2007) claim the original size and construction suggests a pilot scale facility. Construction at the site is ongoing at the time of the coding.

Yes, the facility was likely intended to serve military purposes. Pakistan has no civilian plutonium program.

- h. *Was the facility multinational? If so, identify the other countries that were involved.*

No, though France supplied the original reprocessing facility in the 1970s, the facility is owned and operated by Pakistan.

- i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

Yes. This facility benefitted from both French and Chinese assistance. The project began in the 1970s with assistance from France, principally the French firm Saint Gobain. By the time French aid was terminated in 1978, some technical information had already been transferred to Pakistan. Khaz notes that by 1978, 95% of the engineering designs for a reprocessing facility had already been transferred from SGN to the PAEC. French engineers continued working on the construction of the facility even once the contract had been terminated, not leaving until June of 1979. China helped to complete this facility after France withdrew. The Zhongyuan Engineering Corporation, a subsidiary of China's National Nuclear Corporation, was apparently the most influential Chinese entity involved in the project.

- j. *Sources:*

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### 3. Golra

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Uranium enrichment, centrifuge.

- b. *Facility size (laboratory, pilot, commercial).*

Pilot.

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

Construction of the facility began in 1987<sup>2</sup> and the operational status is unknown.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

Yes, the facility was developed covertly. Pakistani officials initially denied that the site was being constructed. However, the facility was first publically reported in 1987, which minimizes the years the location could have remained secret.

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No, the facility is not under IAEA safeguards as of 2005.

- f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

- g. *Did the facility have a military purpose?*

Yes, the facility is part of the military complex designed to produce HEU.

- h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

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<sup>2</sup> The construction date is from NTI, though Fitzpatrick confirms.

- i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No. While it is suspected Pakistan built this facility with clandestinely acquired Western equipment, insufficient evidence was found to justify coding the facility as being built with foreign assistance. Specifically, firms in Canada, the UK, Switzerland, and the US may have illicitly provided equipment and technology. Additionally, the purchase of Chinese cobalt ring magnets may have been intended for this site. Global Security posits that the facility may have been built with Chinese assistance.

- j. *Sources:*

Ciricione, Joseph, Jon B. Wolfsthal, and Miriam Rajkumar. 2005. *Deadly Arsenals: Nuclear, Biological, and Chemical Threats*. Washington D.C.: Carnegie Endowment for International Peace.

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Willingham, Chuck and Peggy Riechers. "Country Nuclear Facilities Maps." Pacific Northwest National Laboratory. Unclassified Version.

#### **4. Gadwal**

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Uranium enrichment, centrifuge.

- b. *Facility size (laboratory, pilot, commercial).*

Pilot.

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

Construction on the facility began in the late 1990s. The US designated the facility an enrichment plant in 1998 and this is the date used for start of operations.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

The international community now knows about the facility. However, it is likely that Pakistan attempted to conceal this plant. To be sure, there is very little information about it in the public record.

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No, the facility is not under IAEA safeguards as of 2005.

- f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

- g. *Did the facility have a military purpose?*

Yes, the facility is designed to produce HEU for the weapons program.

- h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

- i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No definitive evidence about this site could be found. Global Security notes there may have been Chinese assistance but there is no firm evidence of this.

- j. *Sources:*

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Nuclear Threat Initiative. "Gadwal Uranium Enrichment Plant."  
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## 5. Kahuta- KRL (A.Q. Khan Research Laboratories)

a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Uranium enrichment, centrifuge.

b. *Facility size (laboratory, pilot, commercial).*

Commercial.

c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

Construction on the facility began in 1974.<sup>3</sup> The facility has been in operation since 1984.<sup>4</sup> This facility was upgraded in 1990s, potentially replacing the original enrichment halls.

d. *Was the facility developed covertly? If so, identify years that facility was covert.*

Yes, Pakistan worked hard to keep this facility secret.

e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No, the facility is not under IAEA safeguards as of 2005.

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

g. *Did the facility have a military purpose?*

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<sup>3</sup> Zentner and ORNL list 1974. Pakistan acquired Urenco centrifuges in 1975.

<sup>4</sup> AQ Khan claims that HEU was produced as early as 1983. The IAEA date for start of operation is 1984 is used. Global Security reports that HEU was first produced in 1986.

Yes, the facility is part of the nuclear weapons structure of Pakistan.

h. Was the facility multinational? If so, identify the other countries that were involved.

No.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

Early on, the facility was indigenously designed. Construction of the facility was approved in 1975, a year before AQ Khan returned to Pakistan with stolen designs. Much of the plant was based on these stolen AQ Khan designs. There was Chinese technical assistance however and Chinese scientists helped to set up the plant. In 1986 Chinese scientists apparently began working at the facility to assist in enrichment and in 1989 Pakistan purchased magnets from China. In 1994 and 1995 China apparently provided five thousand ring magnets to the facility. In 1995 the CIA informed the State Department that China's National Nuclear Corporation supplied specialized ring magnets for gas centrifuges. US officials acknowledged this transfer could have gone through without the knowledge of the Chinese government.

The Kahuta plant was part of the secret Pakistani project 706. The centrifuge uranium enrichment project was initiated in 1974 by the PAEC. The plan was to act on the project in three phases, with the third phase being the installation of cascades at Kahuta. Khan notes there may have been Italian assistance in this project, but it is unclear the degree of this assistance, and it was likely not state sanctioned.

j. *Sources:*

Ahmed, Samina. "Pakistan's Nuclear Weapons Program." *International Security*. 23(4): 186.

Albright, David and Mark Hibbs. 1992. "Pakistan's Bomb: Out of the Closet." *Bulletin of the Atomic Scientists*. 48(6): 38-43.

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## 6. Experimental Reprocessing Plant at Pakistan Institute of Nuclear Science and Technology (PINSTECH)

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Reprocessing.

- b. *Facility size (laboratory, pilot, commercial).*

Laboratory.

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

There is some confusion about whether this plant might be the same as the "New Labs" (facility #7 below). It appears that British Nuclear Fuel Limited (BNFL) sold Pakistan a small hot cell before work began on the larger facility at PINSTECH.

Khan (2012, 134) states, however, that the facility was designed by BNFL but never purchased by Pakistan. We include this hot cell in the dataset because more than one source that we judge to be reliable claims that it existed. It is nonetheless possible that references to this lab-scale facility are, in fact, the pilot plant described below. Construction of the facility began in 1971 and finished 1973. The operational history of the hot cell is unclear, but we assume that it is still in operation.

d. *Was the facility developed covertly? If so, identify years that facility was covert.*

The facility may have been publicly known due to British involvement. Given the likely ties to the weapons program, however, and the absence of full transparency on the part of Pakistan, we code this as a covert facility.

e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

In light of British involvement, it seems likely that the facility would have been safeguarded. We found no evidence, however, of safeguards being in effect here.

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

g. *Did the facility have a military purpose?*

The facility was part of Pakistan's clandestine nuclear program.

h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

Yes. British Nuclear Fuels Limited (BNFL) sold an experimental reprocessing facility to Pakistan in 1971. When the UK refused to supply a larger plant, Pakistan turned to Belgonucleaire. Pakistan apparently preferred the Belgian design as it would allow more room for expansion of the facility and would be subject to less stringent safeguards.

j. *Sources:*

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## 7. New Labs at PINSTECH

a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Reprocessing.

b. *Facility size (laboratory, pilot, commercial).*

Pilot.<sup>5</sup>

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

The NTI says construction occurred between 1980 and 1982.<sup>6</sup> State department documents state that the facility was several years away from producing enough material for a weapon in 1983. Hot tests were carried out in 1987, according to Ferroz Khan (2012, 200). Initial renovations in the 1990s and production of plutonium probably began during that period. Recent renovations in 2002 and 2006 have been observed, including an expansion of the facility. A second plutonium facility at PINSTECH is being built to augment the additional plutonium production capacity from new military production reactors. The purpose of the expansion is assumed to be increased capacity but this has yet to be determined with certainty. Operational capacity of the facility is unknown.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

The facility was part of Pakistan's clandestine nuclear program.

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No, the facility is not and has not been under IAEA safeguards.

- f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

- g. *Did the facility have a military purpose?*

Yes, the facility, if and when operational, is part of the military complex. Pakistan has no civilian plutonium program. The new reprocessing facilities are being built in anticipation of extra radiated fuel from three near production reactors at the site.

- h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

- i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

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<sup>5</sup> There is disagreement about the size of the initial facility by this name. During the 1980s, open source information suggested the facility was a hot-cell only able to produce gram quantities of plutonium. However, once the Khushab reactors started operating, US government officials stated the facility was a pilot scale plant in 2000.

<sup>6</sup> Federation of American Scientists and Spector list the start date as 1982.

Yes. The New Labs benefitted from French and Belgian assistance. It is thought that Pakistanis constructed the facility, while the design and procurement of equipment was left to the French firm SGN and Belgian firm Belgonucleaire. SGN was in charge of the engineering of the reprocessing facility and Belgonucleaire in charge of the building design and the construction of the fuel fabrication laboratory, though the Belgian assistance was not under a formal cooperation agreement. The New Labs also benefitted from the SGN contract at Chasma by increasing Pakistani exposure to European firms.

SGN offered Pakistan a universal machining unit for the new labs, and PAEC took advantage of the French relationship by pursuing technology and equipment even as the French nuclear deal looked set to collapse. Pakistan received blueprints for the facility from France before the deal fell apart, and may have received other assistance as well. Pakistan also worked with German and Belgian firms on the New Labs. In 1973 three Pakistanis visited Belgium to negotiate and receive training from Belgonucleaire. One of the Pakistanis, Abdul Majeed Chaudrhy, later became the head of the New Labs Project. In 1981 a Belgonucleaire employee is thought to have visited Pakistan in connection with a shipment of hot-cell related equipment.

*j. Sources:*

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## 8. Sihala

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Uranium enrichment, centrifuge.

- b. *Facility size (laboratory, pilot, commercial).*

Pilot.

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

Construction of the facility began in 1976. The facility was completed in 1979<sup>7</sup> and it reportedly still operates.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

This facility was part of Pakistan's secret program to produce HEU.

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No, the facility is not under IAEA safeguards as of 2005.

- f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

- g. *Did the facility have a military purpose?*

Yes, the facility is part of the nuclear weapons program for the production of HEU.

- h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

- i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No, there is circumstantial evidence that foreign assistance was provided, but the evidence is not definitive. There are reports of China supporting the enrichment process in Pakistan. Sihala was part of the secret Pakistani enrichment project 706. In 1974 the PAEC planned to establish an experimental test bed for prototype centrifuges at Sihala. There may have been Italian assistance in this project, but if there was it was likely without the approval of the Italian government. The Sihala facility relied on equipment and technology clandestinely acquired from Western sources. AQ Khan's stolen blueprints for example were crucial in the construction of both Sihala and Kahuta. The Sihala facility may have also benefitted from the sale of the 5,000 Chinese ring magnets, though it is unclear if these were used at Sihala or only at Kahuta.

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<sup>7</sup> The 1979 date is from Zentner et al. (2005) while the NTI lists 1978 as operational start date.

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*Additional Notes:*

The Chasma facility may have expanded to a commercial size as of 2007, though other sources have not determined whether this facility is operating.