Iran's Nuclear Program:

Lessons from Pakistan

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Brief Analysis

Public anxiety about Iran's nuclear intentions is focused on the Natanz uranium enrichment plant, which in many respects -- in both the public debate and the policy discussion -- resembles the situation in the 1980s when there was growing concern about Pakistan's Kahuta enrichment plant. The lessons that can be draw from that experience are not encouraging. The comparison is particularly appropriate because Iran uses the same high-speed centrifuge technology to enrich uranium as does Pakistan. Photos of Iranian centrifuges show some of them as identical to Pakistani designs developed by the disgraced A.Q. Khan. Iran also claims to be operating more advanced centrifuges using its own modifications.

Uranium and Its Isotopes

The uranium isotope U-235 is a fissile material; under the right conditions, it undergoes a chain reaction. If controlled, the chain reaction produces heat that can be used to generate power in a nuclear power plant. When uncontrolled, the chain reaction is explosive. Uranium-235, however, only occurs in 0.7 percent of natural uranium (uranium-238 is the more common isotope), so to increase the proportion of fissile material, the uranium must be enriched

Enriched between 3 and 5 percent, uranium-235 can be used as a fuel in nuclear reactors. The International Atomic Energy Agency (IAEA) classifies anything enriched at 20 percent or more as highly enriched. This uranium is used in specialized nuclear reactors, such as those used in some submarines. Nuclear explosive devices typically use uranium enriched to 90 percent or more, although the percentage can be less, as in the atomic bomb dropped on Hiroshima in 1945.

The other material used in nuclear explosives is plutonium, as in the bomb dropped on Nagasaki. Plutonium does not occur naturally; it is a byproduct of uranium used in nuclear power or research reactors and, when separated or reprocessed from other waste products, is a more powerful explosive than uranium-235. Iran is currently building a plutonium-producing reactor at Arak, where it refuses to provide access to the IAEA.

The Pakistani Experience

In the 1970s and 80s, Pakistan's denials of nuclear military intent and claims of the solely peaceful nature of its Kahuta plant were as strong as Iran's current protests. Former U.S. officials personally witnessed dramatic protestations of innocence by then military dictator Gen. Muhammad Zia al-Haq despite ironclad intelligence information to the contrary. (Pakistan's overseas purchasing network had been thoroughly penetrated by the early 1980s, and the design specifications of its intended nuclear device extrapolated from components ordered in Britain.) In 1989, the late Pakistani prime minister Benazir Bhutto claimed in a speech to the U.S. Congress that "we do not possess nor do we intend to make a nuclear device." Unfortunately, neither aspect of this statement was true. By this time, nine years before it actually tested two nuclear devices, Pakistan already had a workable design, based on drawings supplied by China, and had built a small nuclear arsenal.

The extent to which Pakistan, an ally of the United States, deliberately took an approach contemptuous of Washington is astonishing. General Zia, while restricted by U.S. congressional determination to impede Pakistan's development of nuclear weapons, artfully took advantage of the Reagan administration's need for Pakistan's help in undermining the Soviet army in Afghanistan. In 1984, Zia publicly agreed to a U.S. demand that Pakistan would not enrich beyond 5 percent, yet told his scientists to ignore any such restriction. Without inspection of Kahuta, which was not and still is not subject to international safeguards, it was impossible to confirm what Pakistan was doing. At least one attempt at clandestine monitoring was thwarted when Pakistan discovered a high-tech device, disguised as a boulder, on a nearby hillside. Historical accounts suggest that U.S. officials were also undermined by a verbal agreement between Zia and President Reagan that Pakistan would not embarrass the United States by actually testing a nuclear device. (The U.S. media had already reported that American satellites had discovered Pakistan's proposed test site in the Baluchistan desert and the construction of support facilities.)

The United States failed in the effort to deter Pakistan despite relatively cordial diplomatic ties and a shared strategic goal in Afghanistan. Perhaps the only American success was to delay the Pakistani nuclear test until 1998 (when India tested for the second time).

The Iranian Dilemma

Iran, which has the world's second-largest oil reserves after Saudi Arabia and the second-largest natural gas reserves after Russia, claims implausibly that it needs nuclear power for its energy needs. Iran also asserts that it plans to sell low-enriched uranium from Natanz worldwide and to use it in future reactors built with Iranian technology. Meanwhile, Iran acknowledges it has no current capability to make its low-enriched uranium into the fuel rods for a reactor, nor does it claim to be working at developing such a capability. In fact, Iran's only nuclear reactor, under construction at Bushehr, on the Persian Gulf coast, will use fuel supplied by Russian manufacturers.

The technical obstacles for Iran to pursue nuclear weapons, however, appear residual. The country seems to have all the access to the raw material, technology, and expertise that it needs. The challenge is to persuade Iran diplomatically that it should confine itself to a nonnuclear-weapons route.

In the face of Iranian technical advances, its denial of military intent, and its determination to master all aspects of the nuclear fuel cycle, one option that some have advocated is to accept the Iranian enrichment program so long as its scope is capped. Variations on this idea include securing an Iranian commitment to not enrich beyond a certain level, establishing better international supervision of Iranian enrichment capacity, or building an internationally owned plant operated by Iran, either inside or outside the country.

The Pakistan experience suggests the considerable problems involved in going down this route. Apart from the challenge of persuading Iran that it does not need nuclear weapons or the capability to make them, there is little reason for confidence that Iran would be honest in declaring all its facilities. Even if Iran showed willingness to take a diplomatic route toward resolving doubts about its program, the standards imposed by the United States would

probably be stricter than those of other members of the international community. Iran's stance, seen by some countries as a stalling tactic and others as important clarification of detail, is likely to stay the same. Ultimately, Tehran can always say it should be allowed the same facilities and capabilities as neighboring Pakistan.

Centrifuge cascades provide an example of just how difficult it is to gather the necessary information to discern Iran's real intent. Enriching uranium in centrifuges is not just a question of putting the hexafluoride feedstock into a cascade and then leaving it to spin until, in the case of what is needed for an atomic bomb, it is enriched beyond 90 percent. Rather, it is a step process where one group of centrifuges (a cascade) enriches to a certain level, and then another cascade, sometimes with a different number of centrifuges, taking it further. Pakistan's cascades operate in four steps, using as many as 164 centrifuges in each cascade in the initial stages and far fewer in the final stage.

In 2007, the IAEA reported that Iran was using a 164-centrifuge cascade. Mastering the use of such a cascade is, infuriatingly for analysts, consistent with seeking both low-enriched and highly enriched uranium. The most recent IAEA reports do not specify how many centrifuges Iran has in each cascade, apart from several small experimental cascades. A greater concern is Iran's plans to have tens of thousands of centrifuges at Natanz. Pakistan's estimated eleven thousand centrifuges at Kahuta provide it with the capability to make enough highly enriched uranium each year for six to ten atomic bombs.

The Iranian nuclear challenge facing the international community today bears a haunting similarity to that faced by the United States twenty years ago with Pakistan -- a sobering thought when considering the prospects for engagement with Iran.

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