IRAN FACT FILE

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Fact Sheet

Iran's Uranium Enrichment Program and Facilities

Over the past two decades, Iran has developed an extensive network of uranium mining, processing and enrichment facilities. As a result of these efforts, including direct assistance from Pakistan and the A.Q. Khan-led black market network, Iran has reached the point where it can enrich uranium in large amounts. Iran's alleged past efforts to pursue nuclear weapon-related technology makes the development of these facilities and capabilities a major international security concern, and Iran's non-compliance with its International Atomic Energy Agency (IAEA) inspection agreements has led to the imposition of broad international sanctions against Tehran. Iran is now engaged with the five permanent members of the UN Security Council, Germany and the European Union (also known as the P5+1) on ways to end the sanctions regime and restore international trust in its non-nuclear status.

Uranium and Enrichment

Natural uranium contains several isotopes of the uranium atom, including Uranium-238 (U-238) that is not directly usable in a nuclear weapon, and Uranium-235 (U-235) that can be used in nuclear weapons if concentrated. U-235 makes up less than 1% of the uranium found in nature, and this isotope must be mechanically concentrated to levels close to 90% to be efficiently used in a nuclear weapon. States have developed a variety of means to enrich uranium including by using magnets (electromagnetic isotope separation), semi-porous barriers (gaseous diffusion) and rapidly spinning cylinders known as centrifuges.

Iran has invested heavily in the use of centrifuges, although it has also experimented with alternative enrichment technologies. Iran's reliance on centrifuges stems from its past access to the nuclear black market network run by Pakistan's A.Q. Khan. Iran heavily relies on designs of Pakistani centrifuges, although it continues to modify the original Pakistani designs to make the units more efficient. Iran now has the ability to domestically produce large numbers of centrifuges and other critical components, and the production of centrifuges is no longer a constraint on Iran's enrichment capacity.

Iran's Key Uranium Facilities

Natanz is Iran's primary enrichment facility and houses both the commercial Fuel Enrichment Plant (FEP) and the Pilot Fuel Enrichment Plant (PFEP). The facility consists of three underground buildings, two of which are designed to hold fifty thousand centrifuges, and six buildings built above ground. The nuclear material and enrichment equipment located at the FEP and PFEP are now under IAEA safeguards.

A video map and animated tour of the Natanz facility is available here.

The PFEP houses 692 centrifuges and is designed to test the development and operation of centrifuge assemblies. It is not a major site of uranium enrichment. The FEP now houses some 16,000 centrifuge units and is Iran's largest uranium enrichment plant. It's stated purpose is to produce enriched uranium for use in both the Tehran Research Reactor (requiring 19.75% U-235 content) and fuel for the Bushehr nuclear power plant (BNPP) (requiring 3.5% U-235 content). The Natanz facility is not large enough to produce enough 3.5% enriched material for the BNPP, which has a lifetime supply agreement with the Russian Federation who completed construction of the facility.

Under the terms of the Joint Plan of Action (JPOA) Iran has agreed not to enrich any material beyond 5% and to disconnect the inter-linkages between cascades that could produce higher enrichment levels. Iran has also agreed not to make any "further advances" at the Natanz enrichment site, including not to install any new centrifuge units except to replace failed units.

The **Fordow** Enrichment Plant is a large underground industrial facility located near the city of Qom. The site includes two underground halls each able to hold 1,500 centrifuges. The site current holds 2,700 centrifuges and remains under IAEA safeguards. Under the terms of the JPOA, no material is being enriched beyond 5% U-235 content and no further advances are being made to the site. In addition, no new centrifuges can be installed except to replace units that fail.

A video map and animated tour of the Fordow plant is available here.

Iran claims that the stated purpose of the Fordow site is to enrich uranium up to 20% U-235 for use in the TRR and at lower levels for the BNPP. However, there is concern that the site was intended to take 20% U-235 enriched material from Natanz and rapidly enrich it to higher levels for use in a nuclear weapon. The International Atomic Energy Agency is investigating these allegations. For more information on the past military dimensions of Iran's nuclear program, see the Iran Fact File Fact Sheet on this subject.

Iran failed to disclose the existence of the Fordow facility until it was revealed publicly by western governments in 2009. This failure to disclose such a significant facility has added to international mistrust of Iran's long-term nuclear intentions.

Uranium Mining and Conversion

To support the operation of these facilities, Iran has developed uranium mining and conversion facilities to provide enough UF6 for the enrichment plants. Iran does not have large domestic sources of uranium ore and relies largely on 531 tons of uranium oxide (U_3O_8), also known as yellowcake, purchased from South Africa in 1982[1]. Iran does operate 2 mines, the Saghand mine and Gchine mine, that provide some uranium for its enrichment program, but these have low concentrations of uranium (0.055% and 0.2% uranium ore respectively). The Gchine mine extracts uranium by open pit mining and converts the uranium ore to yellowcake at the Bandar Abbas Uranium Production Plant (UPP). The Saghand mine extracts uranium through underground mining and has a milling facility 75 km west of Saghand known as the Ardakan mill to produce yellowcake from the ore[2]. The throughputs of the UPP and the Ardakan mill are reported to be 21 tons and 50 tons respectively. Iran reports to have uranium reserves equivalent to 1,527 tons but claims to have recently discovered a new deposit extending this quantity to 4,400 tons uranium[3]. In addition, to these potential sources of uranium, there is evidence that Iran has also been experimenting with obtaining uranium from secondary sources, such as extracting uranium from phosphoric acid.

Iran's lack of access to high purity and large amounts of uranium ore could pose a significant constraint on its nuclear program.

Once uranium ore is converted into yellowcake at milling facilities, it needs to be further purified and converted to UF6. Iran has constructed a dedicated facility for this purpose known as the Uranium Conversion Facility (UCF) near Isfahan and according to the IAEA has produced 550 tons of UF6. It is not clear whether the source of the material used is yellowcake from South Africa or UF6 that has been indigenously produced. The UCF plant can also convert UF6 into UO2, a step Iran has pursued for the production of fuel for the Tehran Research Reactor and the still incomplete IR-40 research reactor at Arak. UO2 cannot be directly used for enrichment and has to be reconverted back to UF6 to increase the enrichment level.

Iran Fact File is a project of the James Martin Center for Nonproliferation Studies.

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[1] http://www.world-nuclear.org/info/Country-Profiles/Countries-G-N/Iran/.

[2] https://web.archive.org/web/20060505003926/http://www.aeoi.org.ir/NewWeb/department.asp?id=41

[3] http://www.irna.ir/en/News/80556197/Politic/New_uranium_resources_indentified_in_Iran,_report