Overview of Iran’s nuclear fuel cycle

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The nuclear fuel cycle: stages and processes

- In general—in a full (closed) nuclear fuel cycle, nuclear material moves through the following stages:
  - Mining
  - Milling
  - Conversion
  - Enrichment
  - Fuel fabrication
  - Reactors
  - Reprocessing

- Iran currently has some of which processes and does not have any fuel reprocessing facilities so, Iran's fuel cycle is open.
Nuclear fuel cycle sites & facilities in Iran

- Nuclear fuel cycle sites & facilities in Iran are principally for:
  - conversion of uranium from one form into another,
  - fuel fabrication using various forms of uranium,
  - uranium enrichment

- These facilities are most critical to Iran’s nuclear program. Because without a conversion capability, Iran could not turn uranium ‘yellowcake’ (U3O8), into uranium hexafluoride gas for enrichment. Enrichment, for its part, provides Iran with a means of generating fissile material in a form that can be made into enriched uranium reactor fuel in fuel fabrication plant.
Mining and milling

- Iran have two uranium mines:
  - Gchine in the south of the country; Uranium mined at Gchine is sent for processing at the Bandar Abbas Uranium Production Plant
  - Saghand in the center of the country; Uranium mined at Saghand is sent for processing at the Ardakan Uranium production plant
Uranium conversion

- Uranium conversion activities in Iran take place at the Uranium Conversion Facility (UCF), located at Iran’s Esfahan nuclear complex in the center of the country.
- Several conversion processes took place at the UCF, before implementation of JCPOA, including:
  - Conversion of U3O8 into natural UF6
  - Conversion UF6 into low-enriched UO2 (producing fuel rod for Arak heavy water Research Reactor)
  - Re-conversion of UF6 enriched up to 20% into U3O8 and the manufacture of fuel assemblies made of fuel plates containing U3O8 (producing fuel plate for Teheran Research Reactor)
Uranium enrichment

- Iran had three enrichment plants **before implementation of JCPOA**:
  - Natanz Fuel Enrichment Plant (FEP): used for the production of uranium enriched up to five percent.
  - Natanz Pilot Fuel Enrichment Plant (PFEP): It is used both for the production of low-enriched uranium (LEU) and for R&D.
  - Fordow Fuel Enrichment Plant (FFEP): five percent enriched UF6 fed from the FEP to Fordow, and 20 percent enriched material.
Fuel fabrication

Fuel fabrication in Iran occurs mainly at the Esfahan Fuel Manufacturing Plant, here Iran conducts several kinds of fuel manufacture involving a variety of nuclear materials:

- Natural UO2
- low-enriched UO2
- Fuel Plate U3O8

In June 2012, Iran started using one fuel assembly made of 19 fuel plates containing U3O8 enriched up to 20 percent of the TRR.

In August 2012 Iran began using a control fuel assembly consisting of 14 fuel plates of U3O8 enriched up to 20 percent in the TRR core.

In August Iran was also using a fuel assembly containing 12 rods of UO2 enriched up to 3.34 percent as one of the TRR’s control assemblies.
Reactors

There are several nuclear reactors in Iran both operating and under construction. Principally, these are situated at Bushehr, in Tehran and at Arak.

- **Bushehr Unit1**: VVER-1000 pressurized water reactor, It is located 17 kilometers southeast of the city of Bushehr, It was constructed with Russian assistance.

- **Bushehr Unit2**: Construction and installation work at the site of unit 2 of the Bushehr nuclear power plant in Iran.
- **Tehran Research Reactor**: is a 5-megawatt-thermal (MWth) MTR pool-type light-water reactor.

- **Arak Research Reactor**: It is an heavy water reactor, which is under construction and under Agency safeguards.
Waste facility storage

- Anarak site: Anark is Iran's repository nuclear waste site, the waste from Bushehr and Tehran store in the Anarak waste storage facility
Facility linkages and material flows

- Iran’s main nuclear facilities and the flows between them **Before implementation of JCPOA**:
  - Conversion of UOC into natural UF6 at UCF, transfer to Natanz
  - Receipt of natural UF6 at Natanz, enrichment to 5 and 20 percent U-235
  - Enrichment of UF6 up to 20 percent at Fordow
Iran's strategy for spent fuel

- Iran does not have any fuel reprocessing facilities, so Iran’s fuel cycle is open cycle.
- Iran don't get any decision (depended to the national policy) for spent full and it is still open.
- Bushehr and Tehran spent fuel store in the spent full pool for cool down.
- Capacity of SFP is new problem, so we are study to design an built dual-purpose (transport and storage) dry cask for Tehran Research Reactor spent full.
- Accordingly , with dry cask storage we obtain experience and waiting to do for national policy in the future.
Thanks for your attention