

IAEA Safeguards Report on Iran: Iran making progress but not yet reliably operating an enrichment plant

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The International Atomic Energy Agency's (IAEA's) latest report on the status of Iran's compliance with UN Security Council makes clear that Iran continues to defy the Council¹ and continues to make slow but steady progress in operating large numbers of P1 centrifuges at Natanz. However, Iran's early progress in multi-cascade operations should not be overstated. Iran still has technological hurdles that it must overcome.

According to the IAEA, as of May 13, 2007 the Natanz underground Fuel Enrichment Plant (FEP) had eight operational centrifuge cascades, had two cascades running under vacuum (without uranium hexafluoride), and was in the process of finishing the construction of three additional cascades. Each cascade contains 164 centrifuges connected by pipes. If natural uranium is fed into the cascade, the product discharged at the "top" of the cascade is uranium enriched to less than 5 percent, or low enriched uranium (LEU). Iran's stated objective is the installation of a complete module, consisting of 18 cascades, or some 2,952 centrifuges that would operate in parallel, each producing low enriched uranium. It appears that Iran can achieve its objective of installing all 18 cascades by late June if it maintains its current pace. Exactly when all of these centrifuges will enrich uranium efficiently remains uncertain.

While Iranian officials can be expected to tout their achievement of rapidly expanding the work at the FEP, it is important to examine critically their achievements and understand how far Iran still has to go before it can be said to have become competent in operating an enrichment plant.

How far has Iran come?

For the last several months, Iran has been installing cascades in the FEP, but it did not start feeding the cascades with uranium hexafluoride until about mid-April 2007, a step reported by the IAEA in a communication to the IAEA Board of Governors on April 18. This letter stated that Iran had fed "some" uranium hexafluoride into the eight cascades. From mid-April until about May 13, Iran fed 260 kilograms of uranium hexafluoride into the eight cascades. This step marked the first time that Iran had run more than one cascade simultaneously, achieving an important milestone.

The IAEA report does not contain detailed centrifuge usage data, but based on Iran's 2006 stated maximum feed rate of 70 grams per hour, we can estimate that these cascades

¹ Available at www.isis-online.org

operated, on average, about 65 percent of the time with uranium hexafluoride.² This amount of uranium feed is estimated to have produced up to 26 kilograms of low enriched uranium, again based on published Iranian values.³ (The actual value is considered confidential by the IAEA but is believed to be less.) The IAEA's report specifies only that the enrichment levels did not exceed 4.8 percent U-235.

Based on interviews with knowledgeable officials, however, the feed rate quoted above and reported publicly by senior Iranians may be higher than the optimal value sought currently in each of the eight cascades. Assuming that the lower rate is the actual one, the cascades are estimated to have enriched at this lower optimal level on average almost 90 percent of the time during this one-month period. Although this higher percentage appears to suggest that Iran has made a significant accomplishment, it actually implies that the cascades are operating less efficiently and producing less enriched uranium than expected by Iranian officials in 2006.

If Iran is deliberately underfeeding the cascades, it may be that plant operators are engaged at an intermediate step in a systematic process of increasing the amount of uranium hexafluoride until an optimal feed level is reached. Alternatively, underfeeding may represent operator uncertainty about what may occur in the cascades, including the possibility of large-scale breakage or "crashing" of centrifuges or unexpected interruptions in cascade operations. This caution could be driven by inexperience in operating and controlling a large number of cascades, particularly involving centrifuges subject to excessive vibration.

Under either scenario, Iran still has more to do before it demonstrates that it can reliably operate an enrichment plant. In particular, it must operate its centrifuge cascades with uranium hexafluoride on a sustained basis.

Iran is not using the pilot fuel enrichment plant at Natanz to demonstrate such a capability. This plant remains unfinished, and the IAEA report states that one of the two cascades in the pilot plant has been disconnected. Contrary to expectations, Iran did not use the pilot plant to demonstrate the simultaneous operation of cascades. The reason for this is unknown but there are several possible explanations. One is that Iran is sufficiently confident in its abilities to operate the cascades that it felt it could safely forgo the pilot plant stage; another is that it is choosing to use the FEP as a pilot plant. In this way, Iran has the opportunity to orient itself with larger-scale cascade operations involving an entire module, or block of centrifuges. It is also possible that Iran is taking a technological risk, jumping as quickly as it can into industrial-scale operation without an adequate testing phase, and that the speed with which it has installed centrifuges at the FEP will later prove problematic.

² This information is drawn from an interview that Gholamreza Aqazadeh gave to the *Tehran Vision of the Islamic Republic of Iran Network 2* on April 12, 2006 in which he said in relevant part, "In the 164 chain [sic], the maximum amount of material we can feed the system is 70 grams an hour, with a 10 percent product of 7 grams." He said that the product is 3.5 percent uranium 235. The P1 centrifuge can achieve even a higher enrichment output.

³ Ibid.

We do not yet know how well Iran's centrifuges at the FEP will perform over time. Iran is likely to need several more months to a year to get the module fully operational. A key variable to continue watching, which will help indicate how well the centrifuges are operating, is how much uranium hexafluoride Iran introduces into the cascades over the next several months.

Iran eroding safeguards

While the status of Iran's uranium enrichment program understandably dominates discussion of Iran's nuclear efforts, it is important not to overlook the on-going inability of the IAEA to conduct adequate verification of Iran's past and current activities. Of particular concern is Iran's refusal to declare to the IAEA any centrifuge construction projects prior to the start of construction or operation. Iran is insisting on abiding by an outdated, 1976 safeguards measure that requires such inspections only 6 months before the introduction of nuclear material into the facility. Iran is the only country insisting that the IAEA apply this safeguards relic.⁴

Iran has also refused the IAEA's request to permit design information verification inspections of the 40 megawatt-thermal heavy water reactor under construction at Arak. In this case, Iran has already turned over design information and has no legal basis for refusing the IAEA's requests to verify design information at the facility.

As a consequence of this and other measures, the IAEA reported that its knowledge of certain elements of Iran's program has "deteriorated" and that "unless Iran addresses the long outstanding verification issues, and implements the Additional Protocol and the required transparency measures, the Agency will not be able to ... provide assurances about the absence of undeclared nuclear material and activities in Iran or about the exclusively peaceful nature of that programme."

⁴ This condition was changed by the IAEA after it learned in the early 1990s that Germany had been operating several hundred centrifuges under vacuum (without introducing uranium hexafluoride) in a research and development facility for years without declaring the facility to inspectors.