INSTITUTE FOR SCIENCE AND INTERNATIONAL SECURITY

REPORT

IAEA Iran Safeguards Report Analysis: Iran Pushes Past an Advanced Centrifuge Limit

By David Albright and Andrea Stricker

May 31, 2019

On May 31, 2019, the International Atomic Energy Agency (IAEA) released its latest safeguards report on the verification and monitoring of the Iran nuclear deal in light of United Nations Security Council Resolution 2231 (2015). The report discusses one potential violation of the 2015 Joint Comprehensive Plan of Action (JCPOA) in footnote 27, which states, "up to 33 IR-6 centrifuges have been installed, of which up to 10 have been tested with UF_6 (uranium hexafluoride)…" This number of deployed centrifuges is far in excess of what is a reasonable interpretation of the deployment rate implied in Iran's long-term enrichment plan, which stipulates:

> *Between years 1 to 8 and a half (of the JCPOA)…[Iran will] continue the testing of the IR-6 on single centrifuges and intermediate cascades (testing with uranium of roughly 10 centrifuges and then roughly 20 centrifuges, with each of these groups being tested with uranium for approximately equal time periods).*
>
> *Between years 8 to 10… [Iran will] commence the testing of up to 30 IR-6 centrifuges from one and a half years before the end of year 10.*

The IAEA appears unable to state that Iran remains within a reasonable interpretation of the limits of this provision, since it is above even the limit of 30 IR-6 centrifuges that it may operate starting in year 8 or 8.5. Paragraph 19 of the IAEA's report states that "Iran's enrichment R&D with and without uranium has been conducted *using centrifuges specified in the JCPOA*." This statement is a change from the IAEA's usual phrasing, "Iran's enrichment R&D with and without uranium has been conducted *using centrifuges within the limits defined in the JCPOA…*" The IAEA states that "technical discussions in relation to the IR-6 centrifuges are ongoing."

As of the reporting date, Iran was under the JCPOA's limits for production of low enriched uranium (LEU) and heavy water. Iranian President Hassan Rouhani recently announced that Iran would no longer ship out its excess stocks of LEU and heavy water, which was understood as an intention to eventually surpass the caps. We assess that Iran could surpass the 300-kilogram (kg) limit on its stock of LEU rapidly if it sought to, or within about a month. Within 60

days of about May 8, 2019, Rouhani also stated that Iran may enrich to higher levels than the 3.67 percent permitted under the JCPOA. The IAEA reported that Iran had not yet surpassed an enrichment level of 3.67 percent. In addition, Iran stated an intention to resume construction of the Arak heavy water reactor according to its original design after the 60 days, halting a Chinese-led construction project to reorient the reactor into a less proliferation-prone design. The IAEA reported that Iran has not yet pursued construction based on the original design. A detailed breakdown of the IAEA's report in several key areas follows.

Arak Reactor and Heavy Water Production:

The IAEA reported that Iran had "not pursued the construction of the Arak heavy water research reactor (IR-40 Reactor) based on its original design." It had also not produced natural uranium fuel for the reactor. The IAEA does not discuss whether it had questioned Iran about a spare set of calandria tubes that the head of its Atomic Energy Organization stated that Iran procured during JCPOA negotiations in order to hedge and be able to circumvent the deal restrictions.

The JCPOA limits Iran to a heavy water stock of 130 metric tonnes. Iran's heavy water stock as of May 26 was 125.2 metric tonnes, up slightly from the February IAEA report's quantity of 124.8 metric tonnes. The IAEA reported that Iran temporarily halted production of heavy water at the HWPP from April 15 to May 22. Since the previous report, "0.1 metric tonnes of heavy water had been shipped out of Iran and Iran had used 2.0 metric tonnes of heavy water for research and development (R&D) activities related to the production of deuterated compounds for medical applications." Under a loophole in the JCPOA, Iran has shipped surplus heavy water to Oman that it has not yet sold on the international market. The United States has stated an intention to sanction this exploitation of this loophole in Oman. It is unclear whether Iran will continue to export its surplus heavy water or exceed its current stock by the end of this summer, given its recent statements.

Low Enriched Uranium:

Iran is permitted to produce up to 300 kilograms of LEU (hexafluoride mass), or the equivalent of 202.8 kg of uranium mass, enriched to up to 3.67 percent at the Natanz enrichment plant, which do not include those forms of LEU exempted by the JCPOA Joint Commission. The IAEA stated that Iran had not enriched uranium above 3.67 percent during the reporting period. The IAEA does not provide a total inventory for all forms of LEU in Iran. However, it reports on quantities of several forms. The February vs. May 2019 comparisons of these quantities show that Iran had increased its production of UF_6. The net increase in the total stock of LEU in Iran as of May 20 was 10.3 kilograms U-mass. We assess that Iran could rapidly exceed the limit of 202.8 kg U-mass if it sought to, or within about a month.

(All quantities in uranium mass)	February 2019	May 2019
UF_6	139.8 kg	153.2 kg
Uranium oxides and their intermediate products	10.4 kg	10.4 kg
Uranium in fuel assemblies and rods	4.3 kg	4.3 kg
Uranium in liquid and solid scrap	9.3 kg	6.2 kg
Totals	**163.8 kg (U-mass)**	**174.1 kg (U-mass)**

Centrifuge Deployments:

Natanz Fuel Enrichment Plant (FEP): During the previous reporting period, Iran withdrew no IR-1 centrifuges from storage to replace damaged or failing IR-1 centrifuges at Natanz, of which it is permitted to operate no more than 5,060. By contrast, it withdrew 52 centrifuges during the current reporting period, suggesting that Iran is ramping up its enrichment efforts at Natanz and continuing to experience IR-1 centrifuge breakage (the IAEA does not provide a total of the currently operating IR-1s). Without knowing more detail about the number of enriching centrifuges, we cannot estimate a breakage rate. However, in the past, the breakage rate of IR-1 centrifuges was about 20 to 30 percent a year.

Fordow Fuel Enrichment Plant (FFEP): During the current reporting period, no increase was observed in the number of deployed centrifuges at Fordow. Iran had 1,020 IR-1 centrifuges installed in six cascades, out of 1,044 allowed, during the previous and current reporting periods. The IAEA stated, "Throughout the reporting period, Iran has not conducted any uranium enrichment or related research and development (R&D) activities, and there has not been any nuclear material at the plant." The IAEA observed no changes in Iran's arrangement and deployment of centrifuges from one period to the next. It is worth noting that only a very small number of centrifuges are involved in the stable isotope separation program at Fordow.

- Ten IR-1 centrifuges were installed in a layout of 16 IR-1 centrifuge positions and one IR-1 centrifuge was installed in a single position "for the purpose of conducting initial research and R&D activities related to stable isotope production."
- 13 IR-1 centrifuges were not installed and were stored within the facility under Agency monitoring.
- On November 26, 2018 and May 2, 2019, "the Agency verified that Iran had removed two IR-1 centrifuge rotors from storage at the FEP to a declared centrifuge manufacturing facility that is subject to Agency monitoring, for the purpose of testing such rotors for stable isotope production."

Advanced Centrifuge Deployments:

Iran is permitted under the JCPOA to undertake enrichment-related R&D using limited quantities of advanced centrifuges at the Natanz Pilot Fuel Enrichment facility, where it may test the centrifuges with UF_6 and remix the product and tails to produce natural uranium.

Iran's long-term enrichment plan, which the Institute transcribed and published (along with The Associated Press), stipulates the limits for operation of these centrifuges for each year of the JCPOA. The IAEA reports one potential violation of the plan in footnote 27 of its report, which states, "up to 33 IR-6 centrifuges have been installed, of which up to 10 have been tested with UF_6 (uranium hexafluoride)…" This number of deployed centrifuges is far in excess of what is a reasonable interpretation of the deployment rate implied in the long-term enrichment plan, which stipulates:

> *Between years 1 to 8 and a half (of the JCPOA)…[Iran will] continue the testing of the IR-6 on single centrifuges and intermediate cascades (testing with uranium of roughly 10 centrifuges and then roughly 20 centrifuges, with each of these groups being tested with uranium for approximately equal time periods).*
>
> *Between years 8 to 10… [Iran will] commence the testing of up to 30 IR-6 centrifuges from one and a half years before the end of year 10.*

The IAEA appears unable to state that Iran remains within a reasonable interpretation of the limits of this provision, since it is above even the limit of 30 IR-6 centrifuges that it may operate starting in year 8 or 8.5. Paragraph 19 of the IAEA's report states that "Iran's enrichment R&D with and without uranium has been conducted *using centrifuges specified in the JCPOA*." This statement is a change from the IAEA's usual phrasing, "Iran's enrichment R&D with and without uranium has been conducted *using centrifuges within the limits defined in the JCPOA…*" The IAEA states that "technical discussions in relation to the IR-6 centrifuges are ongoing." The Associated Press quoted a diplomat who stated that these discussions involve the JCPOA member states, and also noted that "the feed line is under agency seal" and blocked to the additional IR-6 centrifuges (not to the ten that the IAEA notes are being tested with UF_6).

The IAEA did not report quantities of deployed advanced centrifuges in the February safeguards report. Iran's deployed advanced centrifuge quantities during the current reporting period include:

	May 2019
IR-4	Up to 11 (permitted)
IR-5	Single (permitted)
IR-6	Up to 33 (at issue, see above discussion)
IR-8	Single (permitted)

Verification and Monitoring:

The IAEA once again states that Iran "continues to provisionally apply the Additional Protocol to its Safeguards Agreement…pending its entry into force. The Agency has continued to evaluate Iran's declarations under the Additional Protocol, and has conducted complementary accesses under the Additional Protocol to all the sites and locations in Iran which it needed to visit." The IAEA again states, "Timely and proactive cooperation by Iran in providing such access facilitates

implementation of the Additional Protocol and enhances confidence." It is unclear whether this commonly repeated sentence is meant to encourage cooperation that has been withheld by Iran.

The IAEA reports that it attended one meeting of the Procurement Working Group at the United Nations, which authorizes imports of nuclear and nuclear-related equipment by Iran.

The IAEA does not report details on how it is implementing Section T of the JCPOA, which controls Iran's use and possession of equipment related to nuclear weaponization. The IAEA once again states that it is implementing Section T, but does not describe how it implements it or how it is verifying known dual-use equipment in Iran's possession that is covered by Section T.

The IAEA fails to report on the status of its investigation into the Iranian Nuclear Archive, a trove of materials related to Iran's nuclear weapons program up until 2003 provided to the IAEA by Israel. It does not state whether it has conducted visits to sites, reviewed relevant documentation, or interviewed personnel mentioned in the archive.

The IAEA reports, "Evaluations regarding the absence of undeclared nuclear material and activities for Iran remained ongoing." This means that the IAEA has not yet been able to reach a Broader Conclusion about the peaceful nature of Iran's nuclear program.