INSTITUTE FOR SCIENCE AND INTERNATIONAL SECURITY
REPORT

ISIS Analysis of IAEA Iran Safeguards Report

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On February 19, 2015 the International Atomic Energy Agency (IAEA) released its report the implementation of the NPT safeguards agreement in Iran and the status of Iran's compliance with United Nation Security Council resolutions.

Key Findings:

1) No progress has been achieved in this reporting period on resolving the IAEA's concerns on the possible military dimensions of Iran's nuclear program. In particular, Iran has not proposed any new practical measures to resolve this issue in a fourth step under the IAEA/Iran Framework for Cooperation. It has also not addressed the last two measures in the third step of the Framework for Cooperation that had been agreed upon in May 2014;

2) Suspicious activities continue at the Parchin military site which the IAEA states undermines its ability to conduct effective verification;

3) Iran's average daily production of 3.5 percent low enriched uranium (LEU) has decreased significantly compared to earlier periods. In light of this, point 4 discusses a relevant question;

4) Iran could be artificially lowering the separative work output of its IR-1 cascades at the Natanz Fuel Enrichment Plant and thus the average output of its IR-1 centrifuges. Given Iran's oft-stated desire to maintain as many centrifuges in operation as it can, one has to ask whether Iran is deliberately lowering the separative work output of its cascades in order to argue to keep more IR-1 centrifuges in a hoped-for deal that would establish limits on annual separative work output. But finally, the number of centrifuges is the key variable in establishing true limits on the breakout potential of Iran's nuclear program, where it should be assumed that the centrifuges would operate in a potential breakout at least as well as IR-1 centrifuges have done previously;

5) Iran has not managed to produce 3.5 percent LEU oxide from 3.5 percent LEU hexafluoride fed into the Enriched $U0_2$ Powder Plant (EUPP). It has fed 2,720 kilograms of such LEU hexafluoride into the process lines but the output remains in intermediate forms of enriched uranium. The reason for not being able to make LEU oxide, as expected, is unknown;

6) Iran is moving to institute a scrap recovery capability to recover the near 20 percent LEU it has converted. However, Iran has agreed under the extension agreements of the Joint Plan of Action not to process at least certain portions of this scrap. This new capability poses a challenge to the extension agreements of the Joint Plan of Action. This issue requires clarification, at least, and better, a commitment by Iran not to commence operation of such a scrap recovery capability;

7) Iran has increased the rate of feeding of natural uranium hexafluoride (UF_6) into its advanced centrifuges at the Natanz pilot fuel enrichment plant (PFEP). The feeding rate is significantly greater than the previous three reporting periods and more than double the rate of the last reporting period. In the advanced centrifuges, after enrichment and the measurement of the enrichment level of the product, the product is remixed with the tails or waste, producing natural uranium; and

8) The IR-5 centrifuge located at the PFEP has been disconnected and is unable to enrich uranium without reconnecting the pipework. This disconnection reflects Iran addressing concerns about its enrichment in the centrifuge in the last reporting period. The disconnection provides additional confidence that Iran is abiding by its commitments under the Joint Plan of Action.

LEU Production and Centrifuge Levels at the Natanz Fuel Enrichment Plant (FEP)

Iran's total 3.5 percent low enriched uranium (LEU) production at the FEP through February 7, 2015 is reported to be 13,730 kilograms (kg). The FEP is Iran's primary enrichment facility, where the majority of its IR-1 centrifuges are installed. Activity at the Pilot Fuel Enrichment Plant (PFEP), where Iran has enriched uranium up to the 20 percent level until January 20, 2014, is discussed below.

The average monthly production of 3.5 percent LEU at the FEP decreased from the past reporting period from approximately 233 kg per month to approximately 206 kg per month of LEU hexafluoride. This is the lowest monthly production rate since May 2013.

Since November 10, 2013, Iran has had 90 IR-1 centrifuge cascades fully installed for a total of 15,420 IR-1 centrifuges, the same as the previous reporting periods. The number of cascades enriching, namely 54 cascades, remains constant since the previous reporting period; these cascades fed with uranium hexafluoride contain 9,156 centrifuges.[1] Iran fed 9,879 kg of natural

[1] It is possible that not all centrifuges within the cascades fed with uranium hexafluoride were operational during the reporting period.

uranium hexafluoride into the cascades at the FEP, which corresponds to a daily feed rate of about 85 kg. This rate is slightly higher compared to previous daily feed rates.

Figures 1-5 describe IR-1 centrifuge trends with time, historical average monthly uranium feed and 3.5 percent LEU production rates, and cumulative LEU production in the Natanz FEP.

Between November and December 2014, the IAEA carried out a physical inventory verification (PIV) at the Fuel Enrichment Plant at Natanz. The IAEA is currently evaluating the results in order to verify the inventory as declared by Iran on November 16, 2014. The IAEA is also evaluating the results from the PIV at the Pilot Fuel Enrichment Plant.

Iran's centrifuge performance at the FEP can also be evaluated in terms of separative work units (swu). ISIS derives this value from information about LEU production. In the most recent reporting period, the LEU is taken as on average as being 3.5 percent enriched[2], and the waste is assumed to have on average a 0.711 percent feed assay and tails assay of 0.4 percent.[3] The IAEA did not provide updated concentrations in this report, but these older numbers are used, based on a variety of interviews with knowledgeable senior officials close to the IAEA. Using standard idealized enrichment calculations, 785 kg of LEU translates to roughly 1,930 swu, or an average of 16.6 swu/day. On an annualized basis, this is about 6,073 swu per year (see Figure 6). These are the lowest FEP operation numbers since 2012.

The average swu/centrifuge-year for this period was 0.66 swu/centrifuge-year, significantly lower than the performance at the FEP in 2013 and 2014.[4] For most of 2010, this value was about 0.9 kg U swu per year per centrifuge (see Table 1, which lists these values on a quarterly basis since the FEP started operation, and Figure 6, which displays this data graphically).

A Note on Iran's Lower Separative Output

The reason for the lower performance in the IR-1 centrifuges at the FEP is not provided in the report. However, given the sensitivity of the negotiations between Iran and the P5+1, including Iran's oft-stated desire to maintain as many centrifuges in operation as it can, one has to ask whether Iran is deliberately lowering the separative output of its cascades in order to argue to keep more IR-1 centrifuges. It may be seeking to do so under its own proposals for a deal that would establish a limit on total annual separative output. In this scheme, the less the average separative output per centrifuge, the greater the number of centrifuges that would remain under this limit.

[2] The IAEA safeguards report mentions an enrichment level of "up to 5 percent," which is a source of some uncertainty. But Iran has had difficulty achieving five percent enriched uranium, and its average value was 3.5 percent for many years. The ideal cascade model utilized by ISIS uses an enrichment level of 3.5 percent for the product. Although this is not a precise figure, it provides an estimate which is reasonable considering Iran's past performance in this area.

[3] The calculations are performed using an idealized cascade model, which does not account for a variety of issues in the actual performance of the cascade, including – but not limited to – centrifuges breaking down or performing below their nominal capacity. While an ideal cascade is not achievable in practice, this estimate provides a method to compare swu calculations.

[4] The value from the previous two reporting periods was 0.75 swu/centrifuge-year.

But finally, the number of centrifuges is the key variable in establishing true limits on the breakout potential of Iran's nuclear program. Negotiators will likely not and should not focus primarily on achieving such a separative work limit, instead focusing on limits on the numbers of IR-1 centrifuges operating, assuming that they will operate in a potential breakout at least as well as IR-1 centrifuges did in the past. If Iran maintains high numbers of IR-1 centrifuges under the types of schemes Iran has proposed, it could quickly ramp up its separative output, negating any negotiated limit.

Installation of Advanced Centrifuges at Natanz Fuel Enrichment Plant

In a letter dated January 23, 2013, Iran informed the IAEA that its advanced, carbon fiber-based centrifuge, designated the IR-2m, "will be used" in one of the modules of Production Hall A. This statement is being widely interpreted as Iran announcing that it intended to install about 3,000 IR-2m centrifuges, which is the normal deployment in a module.

Under the Joint Plan of Action, Iran agreed to halt installation of any additional centrifuges and to not begin enriching in any new IR-2m machines. In the unit containing IR-2m centrifuges, as of February 8, 2015 , the situation remained unchanged from the IAEA's previous report: six cascades had been fully installed with IR-2m centrifuges; none of these cascades had been fed with natural uranium hexafluoride; and preparatory installation work had been completed for the other 12 IR-2m cascades in the unit.

Iran had not begun enriching in any of these cascades. Figure 7 tracks the IR-2m installation at the FEP.

Centrifuge Research and Development (R&D) at the Natanz Pilot Fuel Enrichment Plant

Iran is not precluded from continuing its centrifuge R&D activities under the Joint Plan of Action. It did agree that it cannot feed uranium hexafluoride into any centrifuges that had not been fed with UF_6 as of November 2013. Moreover, in the advanced centrifuges, after enrichment and the measurement of the enrichment level of the product, the product is remixed with the tails or waste, producing natural uranium.

The IAEA reported in its November 2014 report that Iran had started to feed UF_6 into one of its advanced centrifuges, the IR-5 centrifuge. The United States reportedly asked Iran to halt this activity. **The most recent report states that Iran did comply with the request and that the IR-5 is now in place but without connections.**

Four out of six cascades at the pilot plant are dedicated to this on-going centrifuge research and development. They are cascades 2, 3, 4 and 5. As of February 10, 2015, there were:

In Cascade 2: 12 IR-4 centrifuges (down from 13 IR-4 centrifuges in November); 13 IR-6 centrifuges (up from nine in November); 2 IR-1 centrifuges (down from 14 in November); and one unconnected IR-5 centrifuge and one unconnected prototype IR-8 centrifuge installed;

In Cascade 3: 15 IR-1 centrifuges (up from total of 14 in four previous reports); 2 IR-2m centrifuges (same as previous report); and 23 IR-4 centrifuges installed (all newly added since previous report);

In Cascade 4: 164 IR-4 centrifuges (same as in the past year plus);

In Cascade 5: 162 IR-2m centrifuges (same as in the past year plus).

Natural UF_6 Feeding Increased into PFEP Advanced Centrifuges

As in previous reports, Iran has intermittently fed natural uranium hexafluoride into IR-6s centrifuges as single machines and into IR-1, IR-2m, IR-4, and IR-6 centrifuges, sometimes into single machines and sometimes into cascades of various sizes. As discussed above, feeding has been halted into the IR-5 centrifuge.

The average rate of feeding of natural UF_6 during the period since the last IAEA report was significantly greater than the feed rate in the previous three reporting periods (October 2013 to October 2014) and more than double the rate of the last reporting period's feed rate:

- Between October 26, 2013 and February 9, 2014, Iran had fed a total of 430.1 kg of natural UF_6 into the centrifuges in the R&D area (107 day period so 4.01 kg per day), but recombined the enriched product and depleted tails.
- Between February 10, 2014 and August 18, 2014, a total of approximately 397.8 kg of natural UF_6 was fed into centrifuges in the R&D area (158 days at 2.52 kg per day);
- Between August 19, 2014 and October 10, 2014, a total of approximately 166.2 kg of natural UF_6 was fed into centrifuges in the R&D area (53 days at 3.17 kg per day); and
- Between October 11, 2014 and February 1, 2015, 790.9 kg of natural UF_6 was fed into centrifuges in the R&D area (113 days at 7.00 kg per day), but no LEU was withdrawn as the product and the tails were recombined at the end of the process.

So, for these four periods, Iran fed a total of 1,785 kg of natural UF_6 into the advanced centrifuges. It is not known why Iran has increased its rate of feed into these advanced centrifuges. ISIS will continue to monitor developments in future reports.

There is no new, specific information about the performance of these advanced centrifuges in the report. Because the product and tails are remixed, the IAEA cannot learn about the amount of enriched uranium produced in these advanced centrifuges and is unable to judge the performance of the advanced centrifuges. However, Iran appears to be seeking to make advancements in its advanced centrifuges within the allowed parameters of the Joint Plan of Action and its two extension agreements.

19.75 Percent LEU Production at the Natanz Pilot Plant: Still Halted

From February 2010 to January 2014, Iran designated two, tandem cascades at the smaller, above-ground Pilot Fuel Enrichment Plant for the production of LEU enriched to nearly 20 percent uranium-235, ostensibly for the Tehran Research Reactor. One of these cascades enriched from 3.5 percent LEU to almost 20 percent LEU, while the second one received the tails from the first and outputted roughly 10 percent LEU and a tails of natural uranium. The ten percent material was fed into the first cascade in addition to 3.5 percent LEU. This process allowed Iran to more efficiently use its 3.5 percent LEU stock. **Per its agreement with the P5+1, Iran ceased production of 19.75 percent enriched uranium in these cascades and began producing 3.5 percent enriched uranium as of January 20, 2014.**

Between October 26, 2013 and January 20, 2014, 90 kg of 3.5 percent low enriched uranium in the form of uranium hexafluoride was introduced into the two, interconnected cascades. Iran withdrew from the tandem cascades a total of 13 kg of nearly 20 percent LEU hexafluoride during this reporting period. This rate, approximately 4.6 kg per month, represented a slight decrease of 0.35 kg per month from previous reporting periods. **In total, Iran has fed 1,631 kg of 3.5% LEU to produce 202 kg of 19.75% uranium since the beginning of operations in February 2010.**

As of January 21, 2014, the IAEA reported that Iran began enriching to 3.5 percent in the cascades previously designated for 19.75 percent enrichment. Between January 20, 2014 and February 1, 2015, Iran had fed 961.6 kg to produce 91 kg of LEU enriched up to 5 percent of U-235.

On January 20, 2013, in line with its commitment under the JPA, Iran began downblending some of its inventory of UF_6 enriched to 20 percent U-235 to no more than five percent LEU hexafluoride. Between January 20 and July 20, 2014, Iran down blended a total of 108.4 kg of that material, fulfilling its commitment to down blend half of the 209.1 kg of the nuclear material that had been in the form of UF_6 enriched up to 20% U-235 on 20 January 2014. As of June 19, 2014, it had also fed 100 kg of the remaining near 20 percent LEU hexafluoride into the conversion process at its Fuel Plate Fabrication Plant at Esfahan.

Fordow Fuel Enrichment Plant (FFEP)

The Fordow site has two enrichment halls, Units 1 and 2, which together are designed to contain up to 2,976 centrifuges in 16 cascades. Iran was operating the four cascades of 174 IR-1 centrifuges each in two, tandem sets to produce 19.75 percent LEU in a total of 696 enriching centrifuges, the same number of centrifuges enriching as was reported since 2012. In compliance with the Joint Plan of Action, Iran stopped enriching to 19.75 percent in these cascades and began enriching to no greater than 5 percent LEU hexafluoride.

The Fordow facility remains nearly fully outfitted with centrifuges, though Iran has not increased the number of centrifuges enriching in five reporting periods. Figure 11 displays the number of centrifuges enriching and installed at the FFEP graphically.

As of January 21, 2014, the IAEA reported that Iran began enriching to 3.5 percent in the cascades previously designated for 19.75 percent enrichment. Between January 20 and February 9, 2015, Iran had fed 2472.7 kg of natural uranium hexafluoride to produce a total of 238.3 kg of LEU enriched up to 5 percent U-235. Between January 24 and February 8, 2015, The IAEA carried out a PIV at the Fordow Fuel Enrichment Plant. The results are currently being evaluated by the IAEA. On February 8, 2014, as previously reported by the IAEA, Iran updated the facility's Design Information Questionnaire as it "had taken measures due to change in level of enrichment and that the measures are temporarily taken during the first step implementation of the JPA."

Production of Near 20 Percent Uranium Oxide

Iran reported in August 2012 that it began feeding its 19.75 percent uranium hexafluoride into the Fuel Plate Fabrication Plant at Esfahan (FPFP). As of February 17, 2015,[5] Iran had fed a total of 337.2 kg of 19.75 percent enriched uranium hexafluoride into the process at Esfahan to produce U_3O_8 containing about 162.8 kg of enriched uranium oxide (uranium mass). The 337.2 kg of near 20 percent LEU hexafluoride contains about 227.6 kg of enriched uranium (uranium mass). Of the total produced, 0.6 kg of this material was stored in hexafluoride form as reference material for mass spectrometry and placed under IAEA seal. The IAEA verified 55.4 kilograms of uranium in liquid or solid scrap form. Thus, approximately 9.4 kg of near 20 percent LEU (uranium mass) remain held up in the process or in waste.

According to the IAEA, Iran has used a total of 90.6 kg for the manufacturing of fuel items for the TRR, and a total of 31.8 kilograms since July 24, 2014. The IAEA also reports that as of February 10, 2015, Iran had produced one experimental fuel assembly and 32 Tehran Research Reactor (TRR)-type fuel assemblies, which constitutes an increase of two fuel assemblies. The TRR fuel and assemblies and plates contain about 42 kilograms of near 20 percent LEU (U-mass). Thus, of the total amount of 227.6 kg of near 20 percent LEU (uranium mass) sent for conversion, about 19 percent has so far been made into fuel assemblies for the TRR.

Iran temporarily stopped manufacturing fuel assemblies on November 25, 2014 in preparation for the IAEA's verification of the "physical inventory taking" at the facility. This verification was carried out between 14 and 16 December 2014.

As of February 8, 2015, 16 of the 30 assemblies transferred to TRR were in the core, which on this date comprised a total of 33 fuel assemblies. Since the last reporting period, one additional control fuel assembly and two additional standard assemblies have been irradiated. These assemblies contained a total of 3.8 kilograms of uranium.

As the IAEA reports, between July 24, 2014 and November 24, 2014, 6.2 kilograms were generated as scrap, followed by an additional 1.8 kilograms since November 24, for a total of 8

[5] The entire inventory of this material had been processed by July 20, 2014; the date given merely serves as a reference point for the IAEA.

kilograms of scrap material. This materials, deemed by Iran unfit for fuel fabrication, remains at FPFP (see below on issue of scrap recovery).

Iran Seeking to Produce Miniature Fuel Plates for Production of Molybdenum-99

Also on December 28, 2014 Iran notified the IAEA that it would start manufacturing miniature fuel plates for the Molybdenum, Iodine and Xenon Radioisotope Production (MIX) Facility, for the production of Molybdenum-99. As of February 9, the IAEA confirmed that one fuel plate containing a mixture of U_3O_8 enriched up to 20 percent U-235 and aluminum were at the MIX Facility after transfer from the FPFP and was being used for R&D activities for the production of ^{99}Mo, ^{133}Xe, and ^{132}I isotopes. As the IAEA reports, since July 24, 2014, Iran has used 0.084 kg of near 20 percent uranium oxide for the purpose of producing ^{99}Mo.

According to a February 10, 2015 DIV at the MIX Facility and a February 9 DIV at the TRR, the IAEA confirms no ongoing reprocessing activities are taking place at those facilities.

Near 20 Percent LEU Scrap Recovery Processing Line: Another Conflict with the Joint Plan of Action?

In producing near 20 percent LEU oxide from its hexafluoride form and in making TRR fuel elements at the Fuel Plate Fabrication Plant at Esfahan (FPFP), Iran has generated a considerable amount of scrap in solid and liquid forms (see above). LEU in scrap is generally recoverable, and according to the IAEA report, Iran is creating the capability to recover the near 20 percent LEU from this scrap at the FPFP.

According to the IAEA report, "In a letter dated 28 December 2014, Iran informed the Agency [IAEA] of the operational schedule for FPFP [Fuel Plate Fabrication Plant at Esfahan] and **indicated its intention to establish process lines for the recovery of uranium from solid and liquid scrap.** In its reply dated 19 January 2015, the Agency requested that Iran provide further clarification. On 10 February 2015, the Agency observed that the process lines had yet to commence operation and that Iran had started R&D activities related to the recovery of uranium from solid scrap."

Under the Joint Plan of Action extension agreements, Iran has agreed to process near 20 percent LEU oxide into TRR fuel elements—25 kilograms under the July 2014 extension agreement and another 35 kilograms under the November 2014 extension. The negotiators recognized that much of this LEU would not end up in TRR fuel elements and would instead end up as scrap or waste (see above for amounts of material in each form). But once the near 20 percent LEU was either in fuel or scrap form, it would be much less useful in a nuclear weapons breakout scenario. However, this pledge would be undermined if Iran recovered the LEU from the scrap. As a result, Iran committed under the extension agreements not to work on the near 20 percent LEU scrap.

It is unknown how much near 20 percent LEU scrap would be recovered, or whether the scrap sent for processing would be covered explicitly by the extension agreements. However, **Iran**

moving to institute a scrap recovery capability poses a challenge to the extension agreements of the Joint Plan of Action. This issue requires clarification, at least, and better, a commitment by Iran not to commence operation of such a scrap recovery capability.

Enriched UO_2 Powder Plant (EUPP)

The commissioning of the EUPP facility began in May 2014 using natural uranium. The IAEA's most recent report states that as of February 13, 2015, Iran has fed a total of 5506 kg of natural UF_6 into the conversion process and produced 1375.5 kg of uranium in the form of UO_2.

Since July 2014, when the plant began operations, Iran has fed 2,720 kg of UF_6 enriched up to 5% U-235 into the conversion process for the production of UO_2. However, Iran has not managed to produce 3.5 percent LEU oxide from this hexafluoride material. The output remains in intermediate forms of enriched uranium. The reason for not being able to make LEU oxide, as expected is unknown.

Slightly Enriched Uranium Blended Down Under Joint Plan of Action (JPA)

On August 17, 2014, Iran informed the IAEA that it would blend down into natural uranium about 4,118 kilograms of uranium hexafluoride enriched up to 2 percent in the isotope uranium 235. As of November 24, 2014, Iran had downblended these 4,118 kg of 2% UF_6. Twenty two kilograms remained in the equipment used for the down blending process. The resulting material totals 7,706 kilograms of natural uranium, and is likely in hexafluoride form. Iran committed to this downblending under the extension of the Joint Plan of Action in late July, 2014. The slightly enriched nuclear material originates from the tails, or waste, produced during the enrichment of uranium hexafluoride up to 20 percent LEU and from dump tanks associated with the cascades. Enriched material in the cascades is evacuated into the dump tanks as an emergency measure when there is a risk that the centrifuges in the cascade could break or "crash."

It is important to note that all of this slightly enriched uranium was not included in the IAEA's statement of the total amount of LEU enriched up to 5 percent that had been produced so far and thus also not included in ISIS's reporting. In the most recent report the IAEA specified that all this material had a level of enrichment below 2 percent.

The properties of this material are unknown – for example, did the dump tank material contain impurities that would have complicated reuse? In any case, because of questions about its ability to be reused in a straightforward manner, ISIS has not factored this enriched uranium into its breakout estimates.

Taking Stock

According to the most recent IAEA report, Iran has produced a total of 14,174.9 kilograms of 3.5 percent LEU hexafluoride, which constitutes an increase of 877.6 kilograms since the previous report

In any case, 115.6 kg of this material comes from down blending. About 3,437 kilograms had been used to make the 19.75 percent LEU hexafluoride. Across its three centrifuge facilities, Iran has installed 18,458 IR-1 centrifuges and 1,008 IR-2m centrifuges. Figure 7 shows IR-2m trends in Iran, and Figure 8 shows historical cumulative IR-1 centrifuge trends in Iran.

Combined, the PFEP at Natanz and the FFEP have produced 448 kg of 19.75 percent uranium, though Iran ceased production of this material on January 20, 2014. Figure 9 represents the cumulative production of 19.75 percent enriched uranium in Iran.

Under the terms of the Joint Plan of Action, Iran has downblended a total 110 kg of 19.75 percent LEU hexafluoride into LEU enriched to less than five percent, including 1.6 kg diluted previously. Since Iran began conversion at its declared facilities, it has fed into the process line at the Fuel Plate Fabrication Plant at Esfahan 337.2 kilograms of uranium hexafluoride enriched up to 20 percent uranium-235, or 227.6 kilograms of enriched uranium, and it produced 162.8 kilograms of near 20 percent enriched uranium in the form of U_3O_8 powder (U-mass). At present, Iran does not possess a stock of near 20 percent LEU hexafluoride. **Table 2 summarizes these findings. It should be noted that Iran retains a large total stock of near 20 percent LEU in oxide form. The size of this stock poses a challenge to the P5+1/Iran negotiations.**

Iran has achieved varying rates of separative work in the IR-1 centrifuge at its enrichment plants. Although Iran continues to install and enrich in additional centrifuges at the FEP, the enrichment output measured in swu/centrifuge-year at this plant has varied and declined overall. During this reporting period, the FFEP achieved 0.80 swu/centrifuge-year, a decrease from the previous reporting period's 0.05 swu/centrifuge-year, and the PFEP cascades achieved 0.65 swu/centrifuge-year, the same as in the previous reporting period. Table 3 compares the enrichment output at the FEP, PFEP, and FFEP. Figure 10 shows the average swu per year per centrifuge at the PFEP and FFEP.

Arak IR-40 Reactor and Heavy Water Production Plant

The IAEA conducted a Design Information Verification (DIV) inspection of the IR-40 Reactor on February 8, 2015 and verified that Iran has not installed any major components, nor has it manufactured any more fuel assemblies for the reactor at the Fuel Manufacturing Plant (FMP) since the previous report, in accordance with its obligations under the extended Joint Plan of Action.

Since the IAEA's previous report, the IAEA has verified through an inspection and DIV on January 20, 2015 that Iran has removed 36 prototype fuel assemblies from the core of the

Heavy Water Zero Power Reactor at Esfahan after testing them. These assemblies were produced at the FMP and are currently stored at the facility.

Framework for Cooperation and Resolution of Possible Military Dimensions (PMD) Remains Stalled

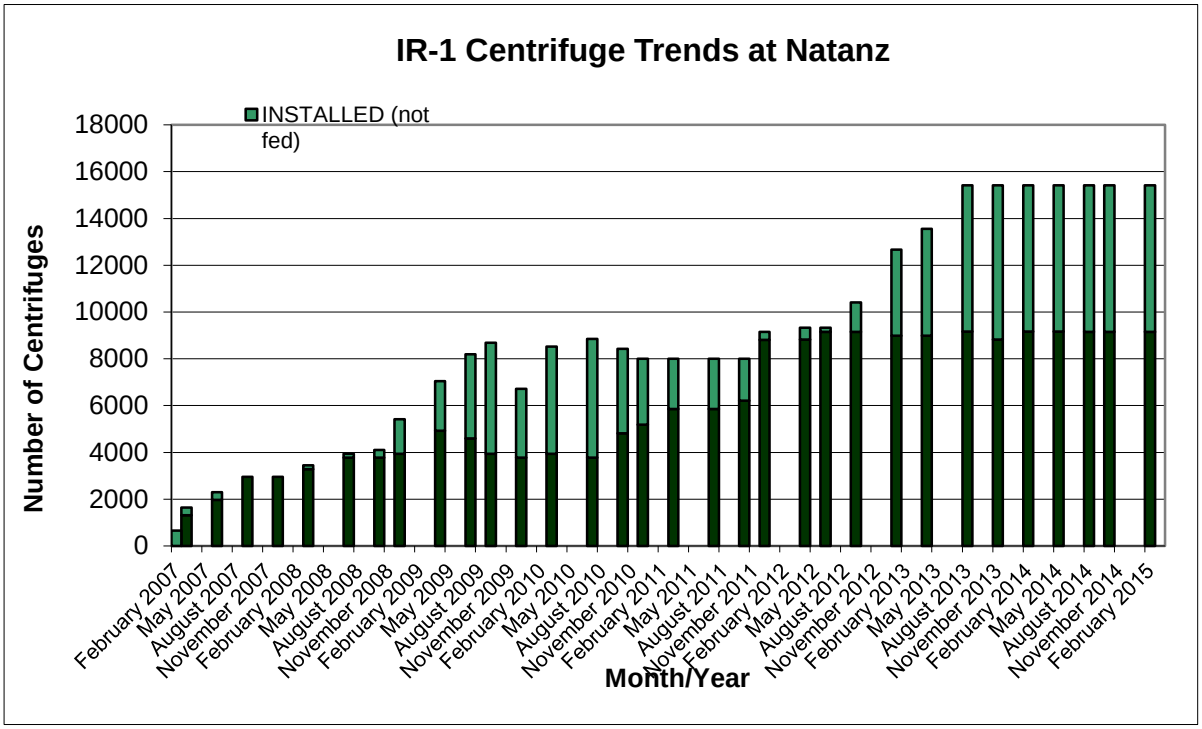
Although Iran has pledged to cooperate on addressing the past and present issues related to the possible military dimensions of its nuclear program, the latest IAEA report notes no further progress on resolving them. In particular, Iran has not proposed any new practical measures to resolve its PMD file in a fourth step under the IAEA/Iran Framework for Cooperation. It has also not addressed the last two measures in the third step of the Framework for Cooperation that had been agreed upon in May 2014. These two measures concern the initiation of high explosives and neutron transport calculations possibly related to the development of nuclear weapons. In August, the IAEA had also invited Iran to propose new measures for a new step in the Framework for Cooperation, but Iran has since then failed to do so. The IAEA reports that Director General Yukiya Amano and Iranian Foreign Minister Javad Zarif met on February 7, 2015 in Munich during which Amano reaffirmed the importance of continuing the dialogue between Iran and the IAEA.

Ongoing Activities at Parchin

The IAEA also reports viewing in satellite imagery further activity at the Parchin military site. It has observed construction materials, vehicles, and other equipment present at a specific location at Parchin where nuclear weapons-related high explosive activities are alleged to have taken place. It notes no further external changes to the buildings. The IAEA reports that the activities that have taken place at the site since February 2012 have likely "undermined its ability to conduct effective verification" and that Iran must address its questions and provide access to the site.

Similarly, through analysis of commercial satellite imagery dated between August 12, 2014 and January 31, 2015, ISIS has also detected various activities and the presence of construction materials at the site in question, as seen in Figures 12 and 13. In the most recent imagery, resurfacing or re-asphalting activities can be seen as well as cleanup of construction materials and debris, all of which would be consistent with the IAEA's findings. A more detailed summary of these activities can be found in a recent ISIS Imagery Brief.

Figure 1: IR-1 Centrifuge Trends at Natanz FEP**



** The dark green bar represents the number of IR-1 centrifuges enriching, while the light green represents the number of IR-1 centrifuges installed but not enriching. The sum of the two represent the total number of IR-1 centrifuges installed at the FEP.

Figure 2: Uranium Hexafluoride Feed at the Natanz FEP

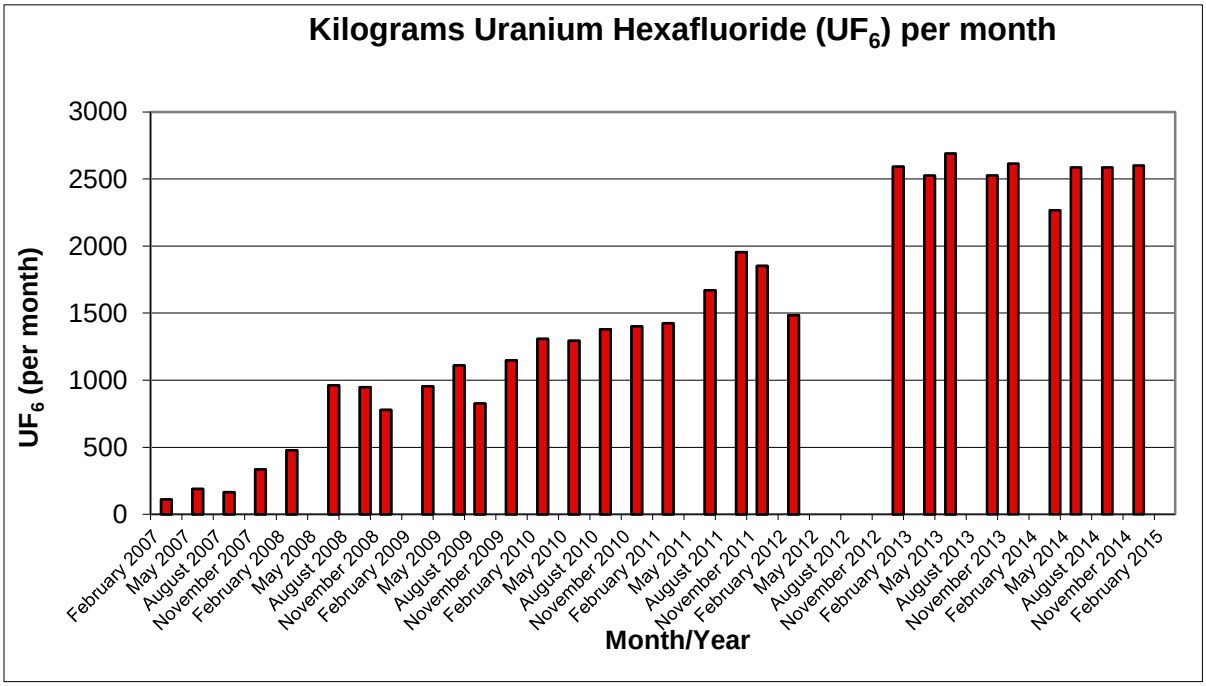


Figure 3: LEU Production (kilograms uranium hexafluoride per month) at Natanz FEP

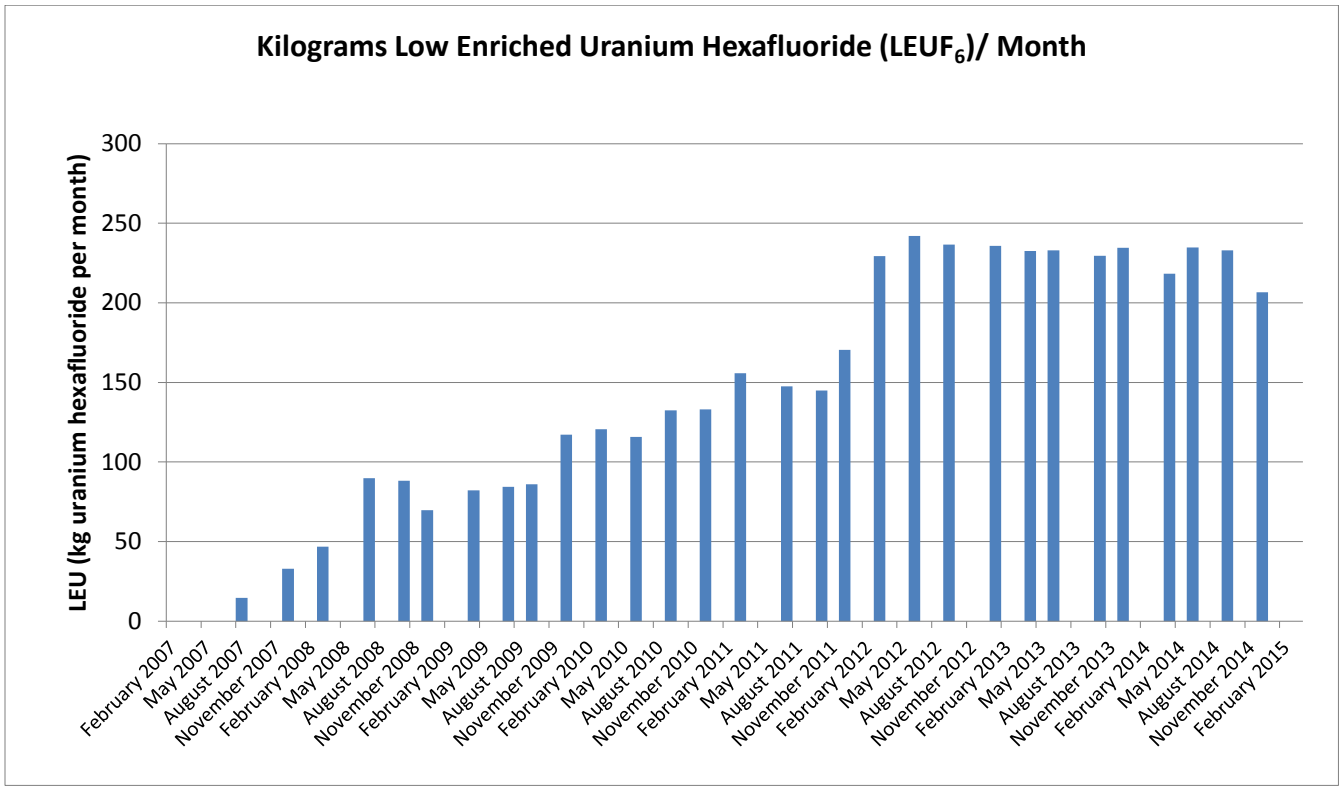


Figure 4: Overall Trends at Natanz FEP

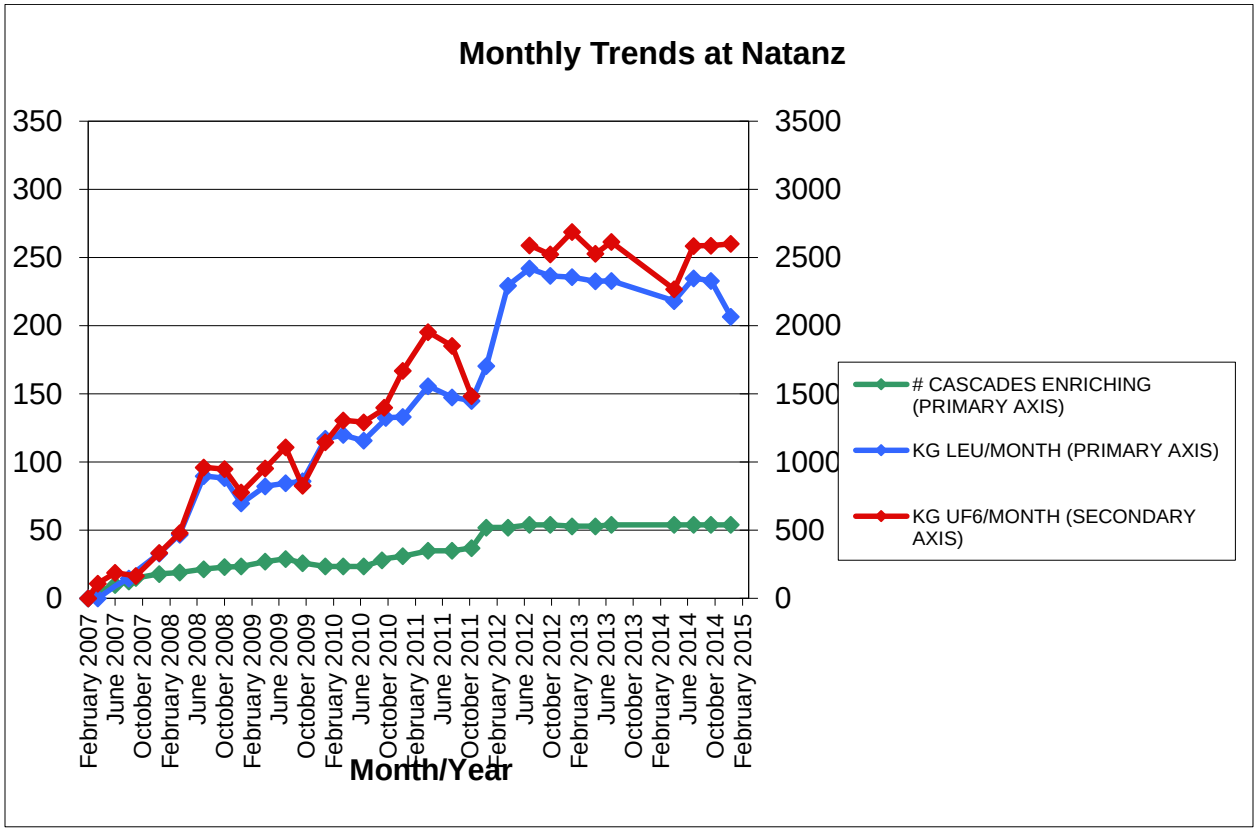


Figure 5: Cumulative LEU Production at the Natanz FEP

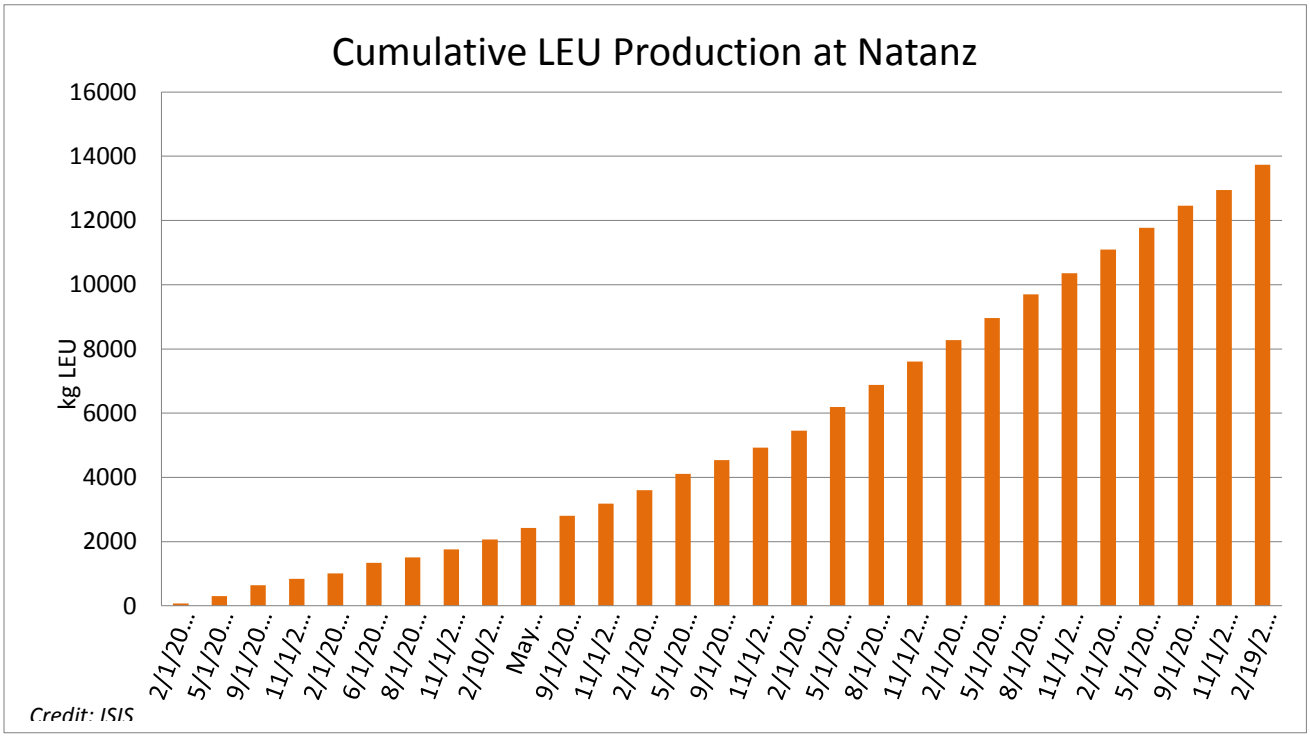


Figure 6: Annualized SWU at Natanz FEP

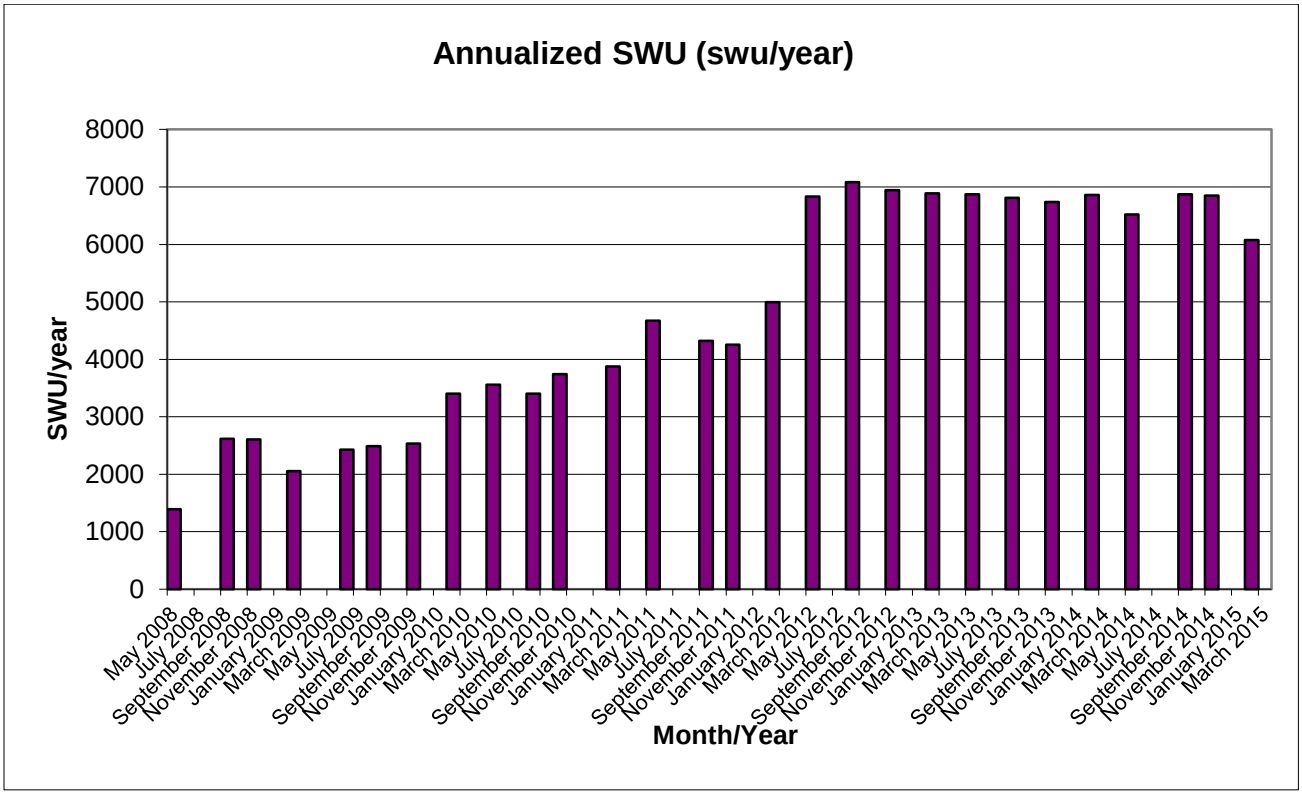


Figure 7: IR-2m Progress at the FEP

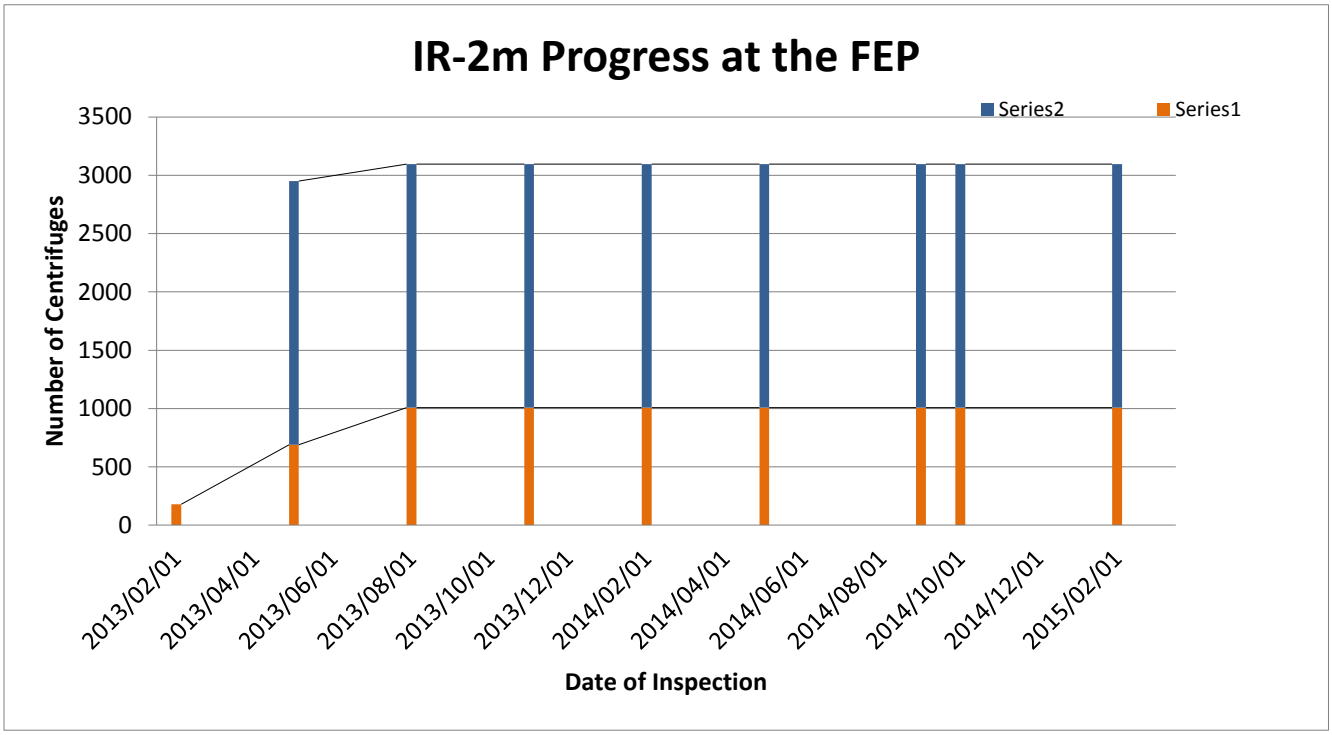


Figure 8: Total Number of Deployed IR-1 Centrifuges in Iran

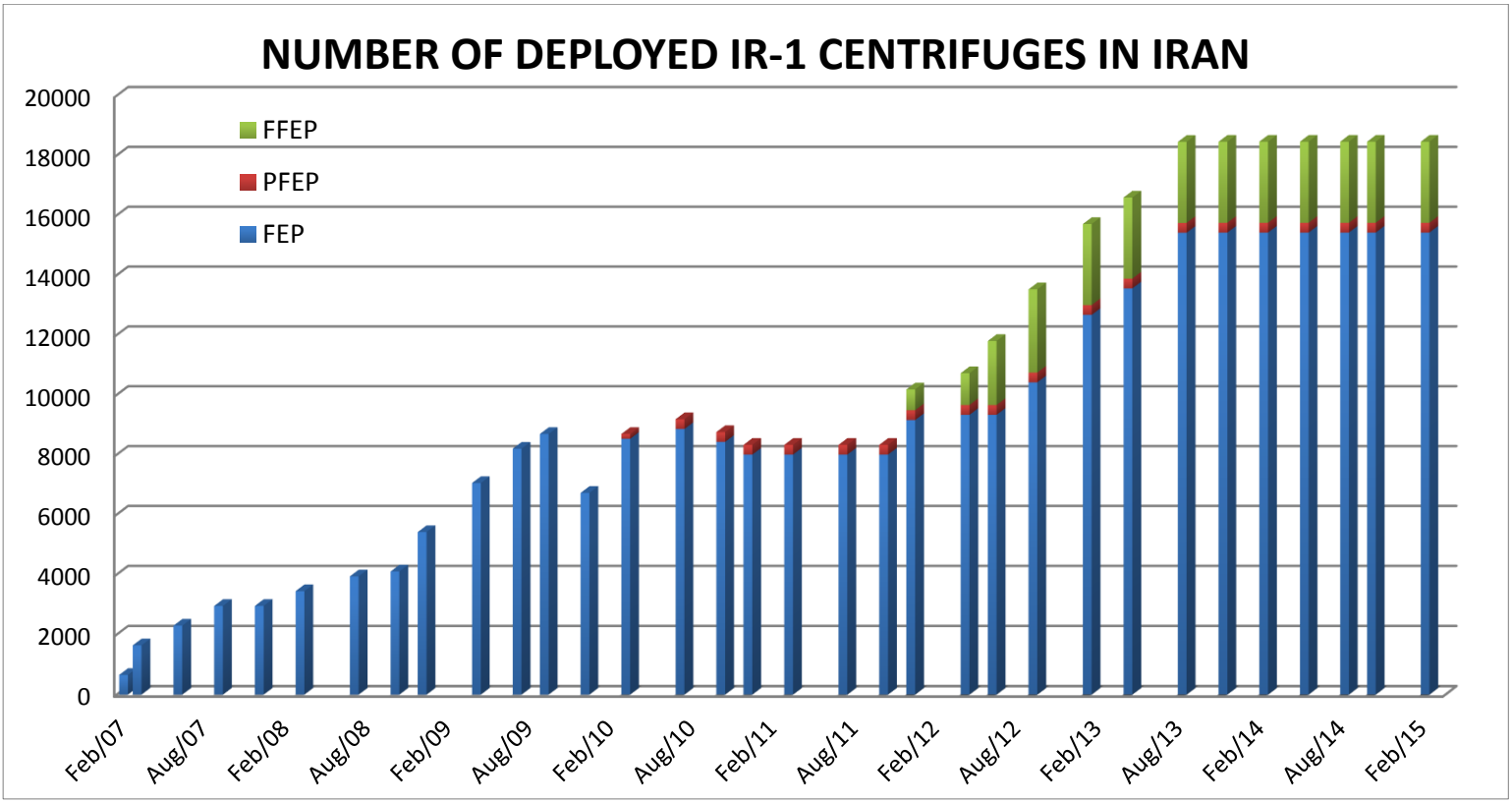


Figure 9: Cumulative 19.75 Percent Uranium Production in the PFEP and FFEP

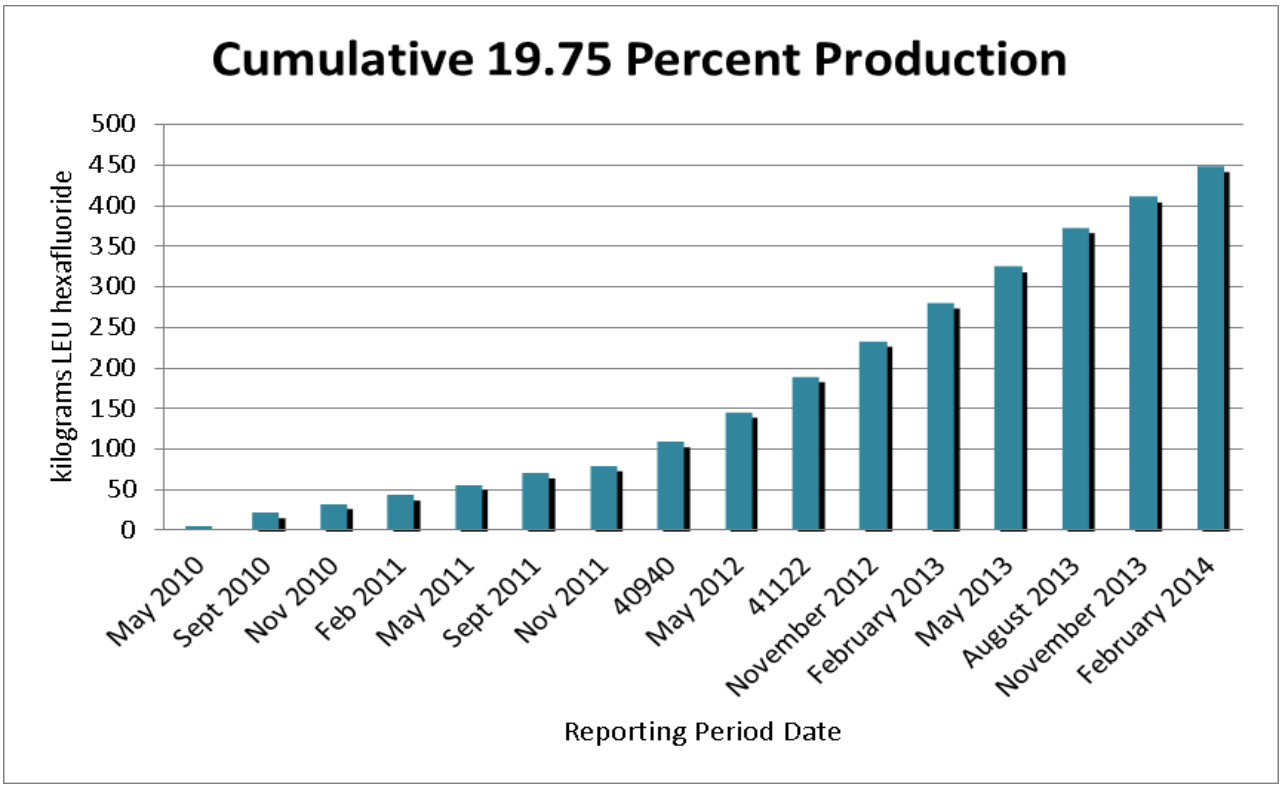


Figure 10: SWU/Centrifuge-year at the Fordow Fuel Enrichment Plant and Pilot Fuel Enrichment Plant

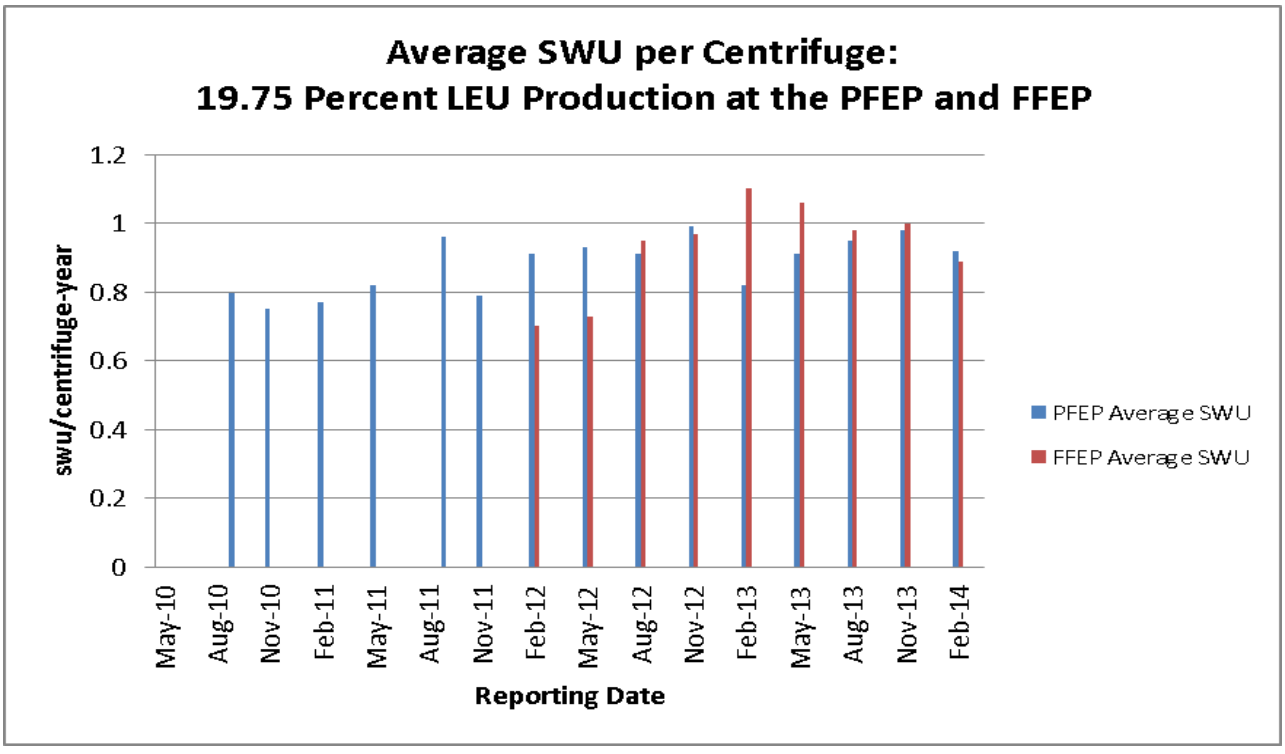
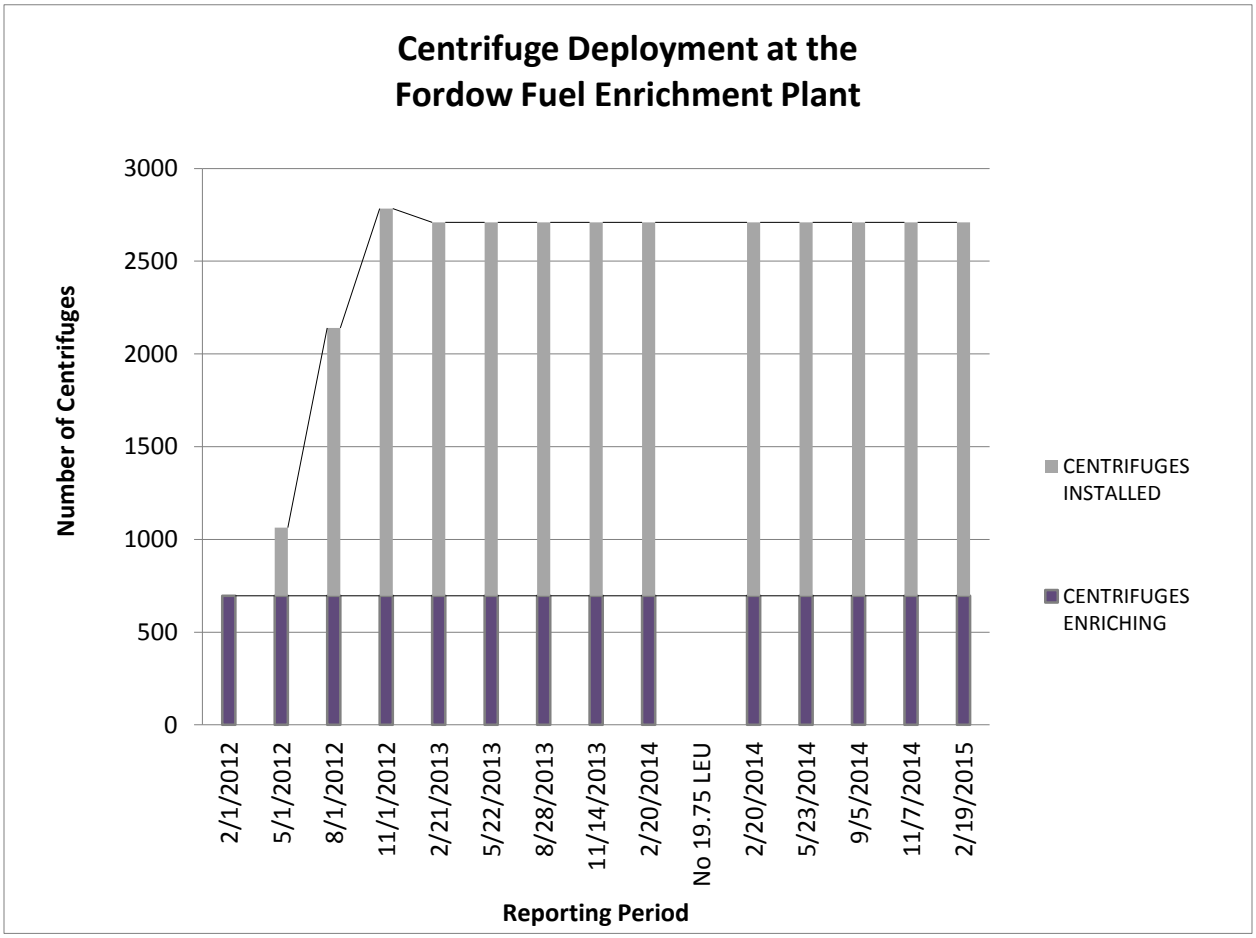


Figure 11: IR-1 Centrifuges Enriching and Installed at the Fordow Fuel Enrichment Plant



Note: All centrifuges are now dedicated to the production of 3.5 percent LEU.

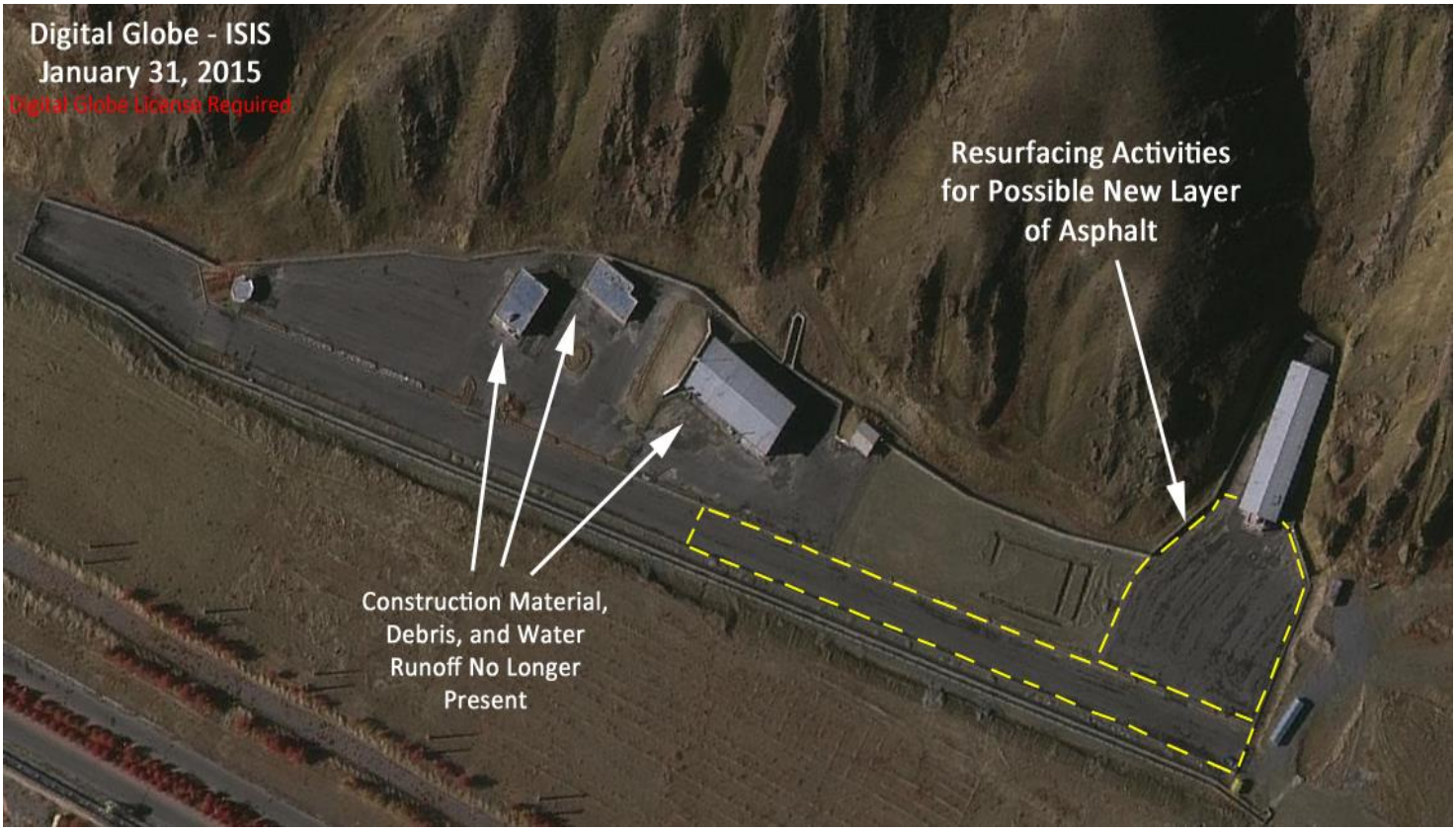


Figure 12. Digital Globe imagery showing the status of the alleged high explosive test site at the Parchin military complex on October 7 and 9, 2014.

Figure 13. Digital Globe imagery shows the status of the alleged high explosive test site at the Parchin military complex on August 12, 2014.

Table 1: Minimal Average Separative Capacity of an IR-1 Centrifuge at the FEP (kg U swu/year-centrifuge)

Period	*Start of Period*	*End of Period*
12/13/2007 – 05/06/2008	0.47	0.43
05/07/2008 – 08/30/2008	0.80	0.69
08/31/2008 – 11/07/2008	0.69	0.69
11/08/2008 – 11/31/2009	0.55	0.52
02/01/2009 – 05/31/2009	0.62	0.49
06/01/2009 – 07/31/2009	0.51	0.54
08/01/2009 – 10/30/2009	0.55	0.64
11/23/2009 – 01/29/2010	0.88	0.92
01/30/2010 – 05/01/2010	0.92	0.90
05/02/2010 – 08/06/2010	0.90	0.92
08/07/2010 – 10/31/2010	0.99	0.78
10/18/2010 – 02/05/2011	0.75	0.81 (1.0 if 1,000 questionable centrifuges ignored)
02/06/2011 – 05/13/2011	0.90	0.80
05/14/2011 – 08/13/2011	0.74	0.74
08/14/2011 – 11/01/2011	0.73	0.68
11/02/2011 – 02/04/2012	0.76 (Note: Iran began enriching in approximately 2,600 additional centrifuges during this period. Therefore, these data are likely skewed.)	0.53
02/05/2012 – 05/11/2012	0.77	0.77
05/12/2012 – 08/06/2012	0.77	0.77
08/07/2012 – 11/9/2012	0.77	0.76
11/10/2012 – 02/03/2013	0.75	0.76
02/04/2013 – 05/04/2013	0.76	0.76
05/05/2013 – 08/16/2013	0.76	0.74
08/17/2013 – 11/05/2013	0.74	0.76
11/06/2013 – 02/09/2014	0.78	0.75
02/10/2014 – 05/13/2014	0.71	0.71
05/14/2014 – 08/13/2014	0.75	0.75
08/14/2014 – 10/15/2014	0.75	0.75
10/15/2014 – 2/7/2015	0.66	0.66

Table 2: CUMULATIVE TOTALS OF NATURAL AND ENRICHED URANIUM FEED AND 3.5 AND 19.75 PERCENT LEU HEXAFLUORIDE PRODUCT IN IRAN

LOCATION	0.711 percent hex feed	3.5 percent LEU hex product	3.5 percent LEU hex feed	19.75 percent LEU hex product
FEP	156,734 kg	13,730 kg	N/A	N/A
PFEP	961.6 kg	91 kg	1,631 kg*	202 kg*
FFEP	2,472.7 kg	238.3 kg	1,806 kg*	246 kg*
GROSS TOTAL	160,168.3 kg	14,174.9 kg**	3,437 kg	448 kg
NET TOTAL	160,168.3 kg	7,965.1 kg***	3,437 kg	0.6 kg****

* Figures as of January 20, 2014, when the production of 20 percent enriched LEU has ceased.
** This total also includes the LEU (<5% uranium 235) resulting from downblending the near 20 percent LEU hexafluoride covered by the Joint Plan of Action, or 115.6 kg.
*** This number, based on step-by-step calculations, differs slightly from the amount given by the IAEA in its latest report, which is 7952.9 kilograms, for a difference of 12.2 kilograms. This difference was also present in every report dating back to February 2014. The difference in the November 2013 report was 0.4 kilograms. The reason for the differences are unclear.
**** Reference material, under IAEA seal. It should also be noted that Iran maintains a relatively large stock of new 20 percent LEU oxide.

Table 3: COMPARATIVE SWU Rate* IN IR-1 CENTRIFUGES AT IRAN'S ENRICHMENT FACILITIES

LOCATION	IR-1 centrifuges producing 3.5 percent enriched uranium	IR-1 centrifuges producing 19.75 percent enriched uranium
FEP	**0.66 swu/cent-year**	**N/A**
PFEP	**0.65 swu/cent-year**	**N/A**
FFEP	**0.80 swu/cent-year**	**N/A**

***SWU rate represents an average of the SWU/centrifuge-year calculated using the number of centrifuges at both the beginning and the end of the reporting period.