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(GOV/2021/50)

# Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015)

*Report by the Director General*

## **A. Introduction**

1. This report of the Director General to the Board of Governors and, in parallel, to the United Nations Security Council (Security Council), is on the Islamic Republic of Iran's (Iran's) implementation of its nuclear-related commitments under the Joint Comprehensive Plan of Action (JCPOA) and on matters related to verification and monitoring in Iran in light of Security Council resolution 2231 (2015). It also provides information on financial matters, and the Agency's consultations and exchanges of information with the Joint Commission, established by the JCPOA.

## **B. Background**

2. The background to the matters outlined in this report can be found in previous quarterly reports of the Director General on this subject, most recently in GOV/2021/39 (paras 2–21) of 7 September 2021.

3. The estimated cost to the Agency for the implementation of Iran's Additional Protocol and for verifying and monitoring Iran's nuclear-related commitments as set out in the JCPOA is €9.2 million per annum. For 2021, and again in 2022, extrabudgetary funding is necessary for €4.0 million of the

€9.2 million per annum.<sup>1</sup> As of 11 November 2021, €8.40 million of extrabudgetary funding had been pledged to meet the cost of JCPOA-related activities for 2021, 2022 and beyond.<sup>2,3</sup>

### **C. Agency monitoring and surveillance equipment under JCPOA**

4. Since the Director General's previous quarterly report, the Vice-President of Iran and Head of the Atomic Energy Organization of Iran (AEOI), H.E. Mohammad Eslami, and the Director General met in Tehran on 12 September 2021, following which they issued a Joint Statement (hereinafter "Joint Statement").<sup>4</sup> The Joint Statement provided, inter alia, that the "IAEA's inspectors are permitted to service the identified equipment and replace their storage media which will be kept under the joint<sup>5</sup> IAEA and AEOI seals in the Islamic Republic of Iran. The way and the timing are agreed by the two sides".<sup>6</sup> From 20-22 September 2021, Iran permitted Agency inspectors to service the identified Agency monitoring and surveillance equipment and to replace storage media, at all necessary locations in Iran with the exception of the centrifuge component manufacturing workshop at the TESA Karaj complex (hereinafter "the workshop"), where the Agency was not provided with access.<sup>7</sup>

5. Iran, during the Board of Governors meeting on 27 September 2021, and subsequently in a letter to the Agency of the same date, indicated for the first time that in its view the equipment related to the workshop was not included in the "servicing" referred to in the Joint Statement and that Iran "didn't accept the Agency's request for access regarding this Complex". According to Iran, the Agency's statement that Iran's decision not to allow Agency access to the workshop was contrary to the agreed terms of the Joint Statement "is not accurate and certainly goes beyond the agreed terms of the Joint Statement".

6. The Director General, during the Board of Governors meeting on 27 September 2021, and the Agency, in a letter to Iran dated 29 September 2021, indicated that the agreement reached on 12 September 2021 did not in any way exclude certain locations and equipment and that it had been very clear in all of the Director General's discussions with the Vice-President of Iran that all of the actions necessary to rectify the situation would be carried out in order to maintain continuity of knowledge.

7. During October 2021, the Agency twice sought access to the workshop to install new cameras and/or to confirm that the production of centrifuge rotor tubes and bellows had not resumed therein. On both occasions, Iran refused to provide access for the reasons stated previously.

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<sup>1</sup> The cost of the provisional application of Iran's Additional Protocol (€3.0 million) and €2.2 million for the inspector costs related to the verification and monitoring of Iran's nuclear-related commitments as set out in the JCPOA are being met from the regular budget (GC(63)/2).

<sup>2</sup> This funding meets the cost of JCPOA-related activities until early February 2023.

<sup>3</sup> The cost implications for the Agency of Iran not implementing the Additional Protocol and its nuclear-related commitments under the JCPOA since 23 February 2021 will be assessed in due course.

<sup>4</sup> GOV/INF/2021/42, para. 5.

<sup>5</sup> The storage media will be kept under Agency seal and AEOI seal.

<sup>6</sup> GOV/INF/2021/42, Annex, para. 3.

<sup>7</sup> GOV/INF/2021/43.

8. In response to the Director General's report of 26 September 2021,<sup>8</sup> Iran provided the Agency with a communication (dated 28 October 2021), which was circulated to Member States,<sup>9</sup> in which Iran, *inter alia*, reiterated its view that the replacement of Agency cameras at the workshop were not covered by the agreement of 12 September 2021. Iran also stated that any measures taken due to this agreement were not "legal obligations" and "cannot and should not be considered by the Agency as one of its entitlements". Iran informed the Agency that its "security and judicial authorities" were "investigating whether the terrorists have used the Agency cameras to launch an attack on the complex" and requested the Agency to "cooperate in completion of the investigations... including through waiving the cameras immunity to be available for further investigations".

9. Iran has unilaterally interpreted the terms of the Joint Statement to exclude, *ex post facto*, Agency equipment and locations from the agreement reached on 12 September 2021. The Director General reiterates that Iran's unilateral interpretation is contrary to the agreement, which covered all of the Agency's activities for all identified Agency equipment, and Iranian facilities and locations. The Director General emphasizes that it is indispensable that the agreement covers all facilities and locations in Iran in order to maintain continuity of knowledge and, thereby, for the Agency to be in a position to resume the necessary verification and monitoring activities in Iran in relation to the JCPOA. The Director General categorically rejects the idea that Agency cameras played a role in assisting any third party to launch an attack on the TESA Karaj complex because the cameras, which are commercially available, are verified upon delivery to the Agency and maintained under continuity of knowledge from that moment onwards. While the Director General has not waived the cameras' immunity which is expressly reserved, he has agreed that, if Iran so requested, the Iranian authorities could inspect the cameras in the presence of Agency inspectors.

10. The Agency has not been able to install replacement cameras at the workshop and/or to verify whether the production of centrifuge rotor tubes and bellows has resumed therein. The remnants of the destroyed camera – minus the recording unit and storage media or any fragments thereof – and the three other cameras previously installed in the workshop have been placed under Agency and AEOI seal.

## **D. JCPOA Verification and Monitoring Activities**

11. Between 16 January 2016 (JCPOA Implementation Day) and 23 February 2021, the Agency verified and monitored Iran's implementation of its nuclear-related commitments in accordance with the modalities set out in the JCPOA,<sup>10</sup> consistent with the Agency's standard safeguards practices, and in an impartial and objective manner.<sup>11,12</sup> Since 23 February 2021, however, the Agency's verification and monitoring activities in relation to the JCPOA have been seriously undermined as a result of Iran's decision to stop the implementation of its nuclear-related commitments under the JCPOA, including the Additional Protocol (see Annex I). The Agency reports the following for the period since the issuance of the Director General's previous quarterly report<sup>13</sup> and three subsequent updates (see Annex II).

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<sup>8</sup> GOV/INF/2021/43.

<sup>9</sup> INFCIRC/964, 2 November 2021.

<sup>10</sup> Including the clarifications referred to in para. 3 of GOV/2021/39.

<sup>11</sup> GOV/2016/8, para. 6.

<sup>12</sup> Note by the Secretariat, 2016/Note 5.

<sup>13</sup> GOV/2021/39.

## D.1. Activities Related to Heavy Water and Reprocessing

12. During a design information verification (DIV) conducted on 10 November 2021, the Agency observed that Iran has not pursued the construction of the Arak heavy water research reactor (IR-40 Reactor) based on its original design.<sup>14,15,16,17</sup> Iran has not produced or tested natural uranium pellets, fuel pins or fuel assemblies specifically designed for the support of the IR-40 Reactor as originally designed. Iran has processed IR-40 scrap pellets<sup>18</sup> in order to recover natural uranium. All existing natural uranium pellets and fuel assemblies have remained in storage under continuous Agency monitoring (paras 3 and 10).<sup>19</sup>

13. Since 23 February 2021, Iran has neither informed the Agency about the inventory of heavy water in Iran and the production of heavy water at the Heavy Water Production Plant (HWPP),<sup>20</sup> nor allowed the Agency to monitor the quantities of Iran's heavy water stocks and the amount of heavy water produced at the HWPP (para. 15).<sup>21</sup>

14. Iran has started to process an irradiated LEU mini plate (target) to produce fission Mo-99 at the Molybdenum, Iodine and Xenon Radioisotope Production (MIX) facility.<sup>22</sup> Iran has not carried out activities related to reprocessing at the Tehran Research Reactor (TRR), the Jaber Ibn Hayan Multipurpose Laboratory (JHL) and the MIX facility or at any of the other facilities it has declared to the Agency (paras 18 and 21).<sup>23, 24</sup>

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<sup>14</sup> The calandria was removed from the reactor and rendered inoperable during preparation for Implementation Day and has been retained in Iran (GOV/INF/2016/1, Arak Heavy Water Research Reactor, paras 3(ii) and 3(iii)).

<sup>15</sup> As indicated previously (GOV/2017/24, footnote 10), Iran has changed the name of the facility to the Khondab Heavy Water Research Reactor.

<sup>16</sup> On 16 February 2021, the Agency verified that Iran had completed the installation of the refuelling machine (see GOV/2021/10, footnote 17). Iran had indicated previously that this machine was constructed based on the original design and was planned to be adapted to the new design of the reactor (see GOV/2020/41, footnote 17).

<sup>17</sup> During the DIV activities on 10 November 2021, the Agency observed the following routine activities were taking place at this facility: installation of the control room along with instrumentation and control cabinets; and civil construction work on the equipment airlock. The Agency also observed the following other activities: lining of the spent fuel pond with stainless steel plates was complete; modification of the rooms of the primary pumps to accommodate the cooling system pipework was complete; installation of two new heat exchangers and their respective pumps (to replace the previous heat exchangers and pumps for the IR-40 moderator); and the cold commissioning of the secondary cooling system using the IR-40 research reactor equipment had been completed.

<sup>18</sup> The processed IR-40 scrap pellets were produced prior to the JCPOA.

<sup>19</sup> Unless otherwise indicated, the paragraph references in parentheses throughout Sections C and D of this report correspond to the paragraphs of 'Annex I – Nuclear-related measures' of the JCPOA.

<sup>20</sup> In June 2017, Iran informed the Agency that the "maximum annual capacity of the Heavy Water Production Plant (HWPP) is 20 Tons" (see GOV/2017/35, footnote 12).

<sup>21</sup> Based on its analysis of commercially available satellite imagery, the Agency assesses that the HWPP has continued to operate during the reporting period.

<sup>22</sup> During a DIV at the MIX facility on 25 October 2021, the Agency observed that one irradiated target made of uranium enriched up to 20% U-235 was used for testing the Mo-99 production process.

<sup>23</sup> In an updated DIQ for the MIX facility, dated 9 May 2021, Iran informed the Agency of its plan to extract Mo-99, I-131 and Xe-133 from irradiated natural uranium and low enriched uranium enriched up to 20% U-235 targets (GOV/2021/28, footnote 25).

<sup>24</sup> In an updated DIQ for the JHL facility, dated 5 January 2021, Iran had informed the Agency of its research and development (R&D) plan to extract caesium from irradiated targets.

## D.2. Activities Related to Enrichment and Fuel

15. Iran has continued the enrichment of UF<sub>6</sub> at the Fuel Enrichment Plant (FEP) and the Pilot Fuel Enrichment Plant (PFEP) at Natanz,<sup>25</sup> and at the Fordow Fuel Enrichment Plant (FFEP) at Fordow.<sup>26</sup> As previously reported, Iran has been enriching UF<sub>6</sub> up to 5% U-235 since 8 July 2019<sup>27</sup> (para. 28), has been enriching UF<sub>6</sub> up to 20% U-235 since 4 January 2021,<sup>28</sup> and has been enriching UF<sub>6</sub> up to 60% U-235 since 17 April 2021.<sup>29</sup> Iran has continued to conduct enrichment activities that are not in line with its long-term enrichment and enrichment research and development (R&D) plan, as provided to the Agency on 16 January 2016 (para. 52).<sup>30</sup>

16. Since 23 February 2021, the Agency has not had access to the data and recordings collected by its surveillance equipment being used to monitor centrifuges and associated infrastructure in storage (paras 29, 47, 48 and 70).

17. Since 23 February 2021, while the Agency has had regular access to FEP, PFEP and FFEP, it has not been able to perform daily access upon request (paras 51 and 71). In addition, following an incident at FEP on 11 April 2021, due to continuing safety and security concerns, Iran and the Agency agreed to a temporary alternative approach to verify the status of the cascades instead of Agency inspectors accessing the area between the cascades.

### D.2.1. FEP

18. As previously reported, in addition to the 30 cascades of IR-1 centrifuges provided for under the JCPOA (para. 27), Iran intends to install another 19 cascades at FEP – six of IR-1 centrifuges, six of IR-2m centrifuges, six of IR-4 centrifuges, and one of IR-6 centrifuges.<sup>31</sup>

19. On 13 November 2021, the Agency verified at FEP that between 30 October and 13 November 2021, Iran had installed one of the additional planned cascades of IR-1 centrifuges and completed the installation of sub-headers for the other five planned cascades of IR-1 centrifuges.<sup>32</sup> In total, the Agency verified that 31 cascades of IR-1 centrifuges,<sup>33</sup> six cascades of IR-2m centrifuges and two cascades of IR-4 centrifuges, were installed to enrich natural UF<sub>6</sub> up to 5% U-235 at FEP, of which 28 IR-1 cascades, six IR-2m cascades and two IR-4 cascades were being fed with natural UF<sub>6</sub>. The Agency also verified that installation of centrifuges in the remaining four cascades of IR-4 centrifuges, five cascades of IR-1 centrifuges and the single cascade of IR-6 centrifuges, had yet to begin.

20. Since 23 February 2021, the Agency has not had access to the data and recordings collected by

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<sup>25</sup> GOV/INF/2019/12, para. 4.

<sup>26</sup> Under the JCPOA, “[f]or 15 years the Natanz enrichment site will be the [sole location for all of Iran’s uranium enrichment related activities including safeguarded R&D]” (para. 72).

<sup>27</sup> GOV/INF/2019/9, para. 3.

<sup>28</sup> GOV/INF/2021/2, para. 5.

<sup>29</sup> GOV/INF/2021/26, para. 3. According to Iran, fluctuations of the enrichment levels of UF<sub>6</sub> were experienced. This was confirmed by the Agency’s analysis of the environmental samples taken on 22 April 2021, which showed an enrichment level of up to 63% U-235 (see GOV/INF/2021/29, para. 7).

<sup>30</sup> GOV/INF/2019/10, GOV/INF/2019/12, GOV/INF/2019/16, GOV/INF/2020/10 and Section C.3 of this report.

<sup>31</sup> GOV/INF/2020/10, para. 2; GOV/INF/2021/15, para. 2, and GOV/INF/2020/17, para. 2; GOV/INF/2021/19, para. 3, and GOV/INF/2021/27, para. 2; GOV/INF/2021/24, para. 2.

<sup>32</sup> Iran had already installed the headers and sub-headers for all 18 cascade lines of the unit at FEP dedicated to advanced centrifuges, as previously reported (GOV/2020/51, para. 13).

<sup>33</sup> The 5060 IR-1 centrifuges installed in 30 cascades remained in the configurations in the operating units at the time the JCPOA was agreed, as provided for in the JCPOA (para. 27). The Agency observed that the additional cascade was also using one of the configurations of the aforementioned 30 cascades of IR-1 centrifuges.

its surveillance equipment installed at FEP to monitor any withdrawals by Iran of IR-1 centrifuges from those held in storage (see Section C.3 below) for the replacement of damaged or failed IR-1 centrifuges installed at FEP (para. 29.1).

### D.2.2. PFEP

21. Since the previous quarterly report, Iran has not progressed further with the planned transfer of its enrichment R&D activities to a segregated area of Building A1000 at FEP, to create a new area of PFEP (paras 27 and 40–42).<sup>34</sup> As previously reported,<sup>35</sup> the Agency verified that Iran has completed installation of sub-headers for 18 cascades for R&D activities in this new, segregated area of PFEP. On 8 November 2021, the Agency verified that there had been very limited progress in the installation of the infrastructure for these 18 cascades during this reporting period.

22. The following is reported regarding the R&D activities involving R&D lines 1–6 in the original area of PFEP (paras 32–42):

- **R&D lines 1, 4 and 6:** As previously reported,<sup>36</sup> on 17 April 2021, the Agency verified that Iran had begun the production of UF<sub>6</sub> enriched up to 60% U-235. As previously reported,<sup>37</sup> on 14 August 2021, the Agency verified that Iran had implemented modifications to “the operating lines” for a new mode of production of UF<sub>6</sub> enriched up to 60% U-235. Since then, the cascades in R&D production lines 4 and 6 have been fed with UF<sub>6</sub> enriched up to 5% U-235 to produce UF<sub>6</sub> enriched up to 60% U-235 (combined product of lines 4 and 6) and enriched up to 5% U-235 (product of line 1 while being fed with tails from lines 4 and 6). On 8 November 2021, the Agency verified that Iran was continuing to feed UF<sub>6</sub> enriched up to 5% U-235 into the two cascades in R&D production lines 4 and 6, comprising up to 164 IR-4 and up to 164 IR-6 centrifuges, respectively, to produce UF<sub>6</sub> enriched up to 60% U-235 and feeding the tails produced from these two cascades into the cascade of IR-5 and IR-6s centrifuges in R&D production line 1 to produce UF<sub>6</sub> enriched up to 5% U-235.
- **R&D lines 2 & 3:** As previously reported,<sup>38</sup> an updated design information questionnaire (DIQ) for PFEP described the following new modes of operation in R&D line 2: single centrifuges, intermediate cascades of up to 10 centrifuges and intermediate cascades of up to 20 centrifuges, would be fed with uranium enriched up to 5% U-235 or uranium enriched up to 20% U-235. In both cases, the product and tails streams would be re-combined and no product would be collected. Between 25 October and 8 November 2021, the Agency verified that Iran was feeding UF<sub>6</sub> enriched up to 20% U-235 into one single IR-6<sup>39</sup> centrifuge, one cascade of up to ten IR-6 centrifuges and one single IR-4 centrifuge in R&D line 2 and that the resulting product and tails streams were being re-combined. On 8 November 2021, the Agency verified that Iran was feeding UF<sub>6</sub> enriched up to 20% U-235 into a single IR-4 centrifuge and a cascade of seven IR-6 centrifuges in R&D line 2 and that the resulting product and tails streams were being re-combined. The other single centrifuges and the small and intermediate cascades in R&D line 2 were not being fed at that time. In a letter dated 16 November 2021, Iran informed the Agency that the new modes of operation in R&D line 2 had “finished”, and that it intended to “remove the temporary feeding set up” and return to the “former process condition”.

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<sup>34</sup> GOV/INF/2020/15, para. 2.

<sup>35</sup> GOV/2021/10, para. 22.

<sup>36</sup> GOV/INF/2021/26, para. 3.

<sup>37</sup> GOV/INF/2021/40, para. 4.

<sup>38</sup> GOV/INF/2021/44, para. 3.

<sup>39</sup> GOV/INF/2021/44, para.5.

R&D line 2 (until 23 October 2021) and R&D line 3 (throughout the reporting period) continued to accumulate uranium enriched up to 2% U-235 through feeding natural UF<sub>6</sub>. On 8 November 2021, the Agency verified that Iran had been using, for this purpose, single cascades of up to: nine IR-4 centrifuges; five IR-5 centrifuges; five IR-6 centrifuges, (two cascades of) ten IR-6 centrifuges; 19 IR-6 centrifuges; and ten IR-s centrifuges. The following single centrifuges were being tested with natural UF<sub>6</sub> but not accumulating enriched uranium: two IR-2m centrifuges, one IR-4 centrifuge; two IR-5 centrifuges; one IR-6 centrifuge; two IR-6s centrifuges; one IR-7 centrifuge; one IR-8 centrifuge; one IR-8B centrifuge; and one IR-9 centrifuge.

- **R&D line 5:** On 8 November 2021, the Agency verified that Iran was feeding natural UF<sub>6</sub> into an intermediate cascade of 18 IR-1 centrifuges and an intermediate cascade of 33 IR-2m centrifuges in R&D line 5 to produce uranium enriched up to 2% U-235.

### D.2.3. FFEP

23. As previously reported, Iran began to enrich UF<sub>6</sub> (para. 45) in one wing (Unit 2) of the facility in November 2019<sup>40</sup> and, since January 2020, has been using a total of six cascades, containing up to 1044 IR-1 centrifuges, to enrich UF<sub>6</sub> (para. 46).<sup>41</sup> In January 2021, Iran reconfigured these six cascades as three sets of two interconnected cascades and began feeding UF<sub>6</sub> enriched up to 5% U-235 into the process to start the production of UF<sub>6</sub> enriched up to 20% U-235.<sup>42</sup> Iran then informed the Agency that it planned to use eight cascades to enrich uranium in Unit 2 at FFEP as follows:<sup>43</sup> two cascades of IR-6 centrifuges would be fed with natural UF<sub>6</sub> to produce UF<sub>6</sub> enriched up to 5% U-235 to directly feed the three sets of two interconnected cascades of IR-1 centrifuges to produce UF<sub>6</sub> enriched up to 20% U-235.

24. As previously reported, in July 2021, Iran provided the Agency with an updated DIQ for FFEP which described a new configuration of the two cascades of IR-6 centrifuges that would either be fed with natural UF<sub>6</sub> to produce UF<sub>6</sub> enriched up to 5% U-235 or with UF<sub>6</sub> enriched up to 5% U-235 to produce UF<sub>6</sub> enriched up to 20% U-235.<sup>44</sup>

25. On 4 October 2021, the Agency verified that Iran had completed the installation of new sub-headers for one cascade of IR-6 centrifuges. This modification will enable Iran to change the operating configuration of the cascade more easily. In a letter dated 5 October 2021, Iran informed the Agency of a new DIQ update for the facility. On 12 October 2021, the Agency examined the updated DIQ in which Iran declared that the second cascade of IR-6 centrifuges would remain in its original, fixed configuration.

26. On 9 November 2021, the Agency verified that: Iran was using up to 1044 IR-1 centrifuges in three sets of two interconnected cascades to enrich uranium up to 20% U-235;<sup>45</sup> 166 IR-6 centrifuges were installed in the cascade with unmodified sub-headers and a cylinder containing UF<sub>6</sub> enriched up to 2% U-235 was connected for passivation purposes (whereby the tails and product are recombined);

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<sup>40</sup> GOV/2019/55, para. 15.

<sup>41</sup> GOV/2020/5, para. 17.

<sup>42</sup> GOV/INF/2021/2, para. 5.

<sup>43</sup> GOV/INF/2021/9, para. 3.

<sup>44</sup> GOV/2021/39, para. 37.

<sup>45</sup> GOV/2021/10, para. 26.

23 IR-6 centrifuges were installed in the cascade with modified sub-headers; one IR-1 centrifuge was installed in a single position.<sup>46</sup>

#### **D.2.4. FFPF**

27. The Agency verified on 26 June 2021 and on 19 July 2021 the receipts at FFPF of 16.6 kg of uranium and 16.4 kg of uranium in the form of UF<sub>6</sub> enriched up to 20% U-235 from PFEP, for the purpose of producing fuel assemblies<sup>47</sup> for the TRR, according to both the original design and the new silicide design.<sup>48</sup>

28. As previously reported, Iran informed the Agency that the new uranium silicide TRR fuel would be produced through a three-stage process. On 26 October 2021, the Agency verified that the installation of the equipment for the first stage of the process, i.e. production of UF<sub>4</sub> from UF<sub>6</sub>, while almost complete, had not progressed since the previous quarterly report.

29. As previously reported, on 28 June 2021, Iran informed the Agency about a four-step process by which it intended to produce the new TRR fuel for R&D purposes, which included, the use of natural uranium, depleted uranium and uranium enriched up to 20% U-235.<sup>49</sup>

30. In July 2021, the Agency verified that Iran had transferred, from FFPF to UCF, small batches of uranium in the form of AUC enriched up to 20% U-235, which had been produced from UO<sub>2</sub>F<sub>2</sub> for the conversion to UO<sub>2</sub> enriched up to 20% U-235 at the R&D laboratory of UCF. The Agency verified all the batches of UO<sub>2</sub> enriched up to 20% U-235 produced at UCF before their transfer to the R&D laboratory of FFPF, where the UO<sub>2</sub> had been converted to UF<sub>4</sub> and then to uranium metal.<sup>50</sup> On 14 August 2021, the Agency verified the first uranium metal sample at FFPF.

31. In this reporting period, Iran has continued to conduct R&D activities on the new TRR fuel using natural uranium, depleted uranium and uranium enriched up to 20% U-235. On 25 October 2021, the Agency verified that Iran had produced two batches of uranium silicide containing 0.43 kg of uranium enriched up to 20% U-235 and on 2 November 2021, the Agency verified that Iran had completed the four-stage process to produce the new fuel for TRR and had manufactured two fuel plates using uranium silicide containing 0.25 kg of uranium enriched up to 20% U-235, which had yet to undergo quality control.

32. As previously reported,<sup>51</sup> in April 2021, the Agency verified at FFPF that Iran had dissolved six unirradiated, scrap fuel plates for the TRR containing 0.43 kg of uranium enriched up to 20% U-235, from which a uranyl nitrate solution was extracted and converted into ammonium uranyl carbonate (AUC) (paras 58 and 60).<sup>52</sup> The AUC was then converted into U<sub>3</sub>O<sub>8</sub> powder. In April 2021, the Agency verified that 28 targets were produced using the aforementioned U<sub>3</sub>O<sub>8</sub> powder containing uranium enriched up to 20% U-235, of which 26 had been shipped to the MIX facility. In May 2021, the Agency verified that Iran repeated the same operation with an additional unirradiated scrap fuel plate for the TRR containing 0.08 kg of uranium enriched up to 20% U-235 and verified an additional 22 targets containing uranium enriched up to 20% U-235. The Agency also verified that the total of 50 targets

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<sup>46</sup> On 29 January 2018, Iran provided the Agency with updated design information for FFEP, which included a temporary setup for a single IR-1 centrifuge position for “separation of stable isotopes” in Unit 2 (see GOV/2018/7, footnote 19).

<sup>47</sup> A standard fuel assembly comprises 19 fuel plates and a control fuel assembly comprises 14 fuel plates.

<sup>48</sup> GOV/INF/2021/36, para. 4.

<sup>49</sup> GOV/INF/2021/36, para. 5.

<sup>50</sup> JCPOA, ‘Annex I – Nuclear-related measures’, paras 24 and 26.

<sup>51</sup> GOV/INF/2021/21, paras 2 and 3.

<sup>52</sup> See also the decision of the Joint Commission of 6 January 2016 (INFCIRC/907).

contained 330 g of uranium enriched up to 20% U-235.<sup>53</sup> Between May and August 2021, ten additional targets, containing 75 g of uranium enriched up to 20% U-235, were produced and shipped to the MIX facility.

33. On 3 November 2021, the Agency verified that no new targets made of uranium enriched up to 20% U-235 had been produced during this reporting period.

34. On 3 November 2021, the Agency verified that Iran had produced 17 fuel assemblies for the TRR, four of which had already been transferred to the TRR.

#### **D.2.5. UCF**

35. As previously reported, in April 2021, Iran provided the Agency with an updated DIQ for UCF in which Iran informed the Agency that it was starting to install equipment for the production of uranium metal. In May 2021, the Agency verified that installation of the equipment had been completed and that it was ready to operate with either natural or depleted uranium, although nuclear material had yet to be introduced into the production area. On 31 October 2021, the Agency verified that no nuclear material had been introduced into the production area.

#### **D.2.6. TRR**

36. On 23 October 2021, the Agency verified that all previously irradiated TRR fuel elements in Iran had a measured dose rate of no less than 1 rem/hour (at one metre in air), except one single irradiated fuel plate.<sup>54</sup> The Agency also verified that the two TRR fuel elements received from FFPF in August 2021 (see Section C.2.4 above), had yet to be irradiated and remain under Agency seals. On 25 October 2021, two additional assemblies were shipped from FFPF to TRR under Agency seals.

#### **D.2.7. Fuel Manufacturing**

37. On 25 September 2021, at the Enriched UO<sub>2</sub> Powder Plant (EUPP) at Esfahan, the Agency verified that Iran had converted 103 kg of uranium in the form of UF<sub>6</sub> enriched up to 3.5 % U-235, which had been transferred from Natanz, into UO<sub>2</sub>F<sub>2</sub>. On 18, 22 and 29 September 2021, the Agency verified that 105.0 kg of uranium in the form of UO<sub>2</sub>F<sub>2</sub><sup>55</sup> had been transferred to FFPF to be converted into AUC and subsequently to UCF for the production of uranium dioxide powder and to Fuel Manufacturing Plant (FMP) at Esfahan for the production of fuel for the Khondab Heavy Water Research Reactor (KHRR).

38. On 13 November 2021, the Agency verified that UO<sub>2</sub> enriched up to 4% U-235 has been received at FMP to manufacture several fuel assemblies for KHRR.

### **D.3. Centrifuge Manufacturing, Mechanical Testing and Component Inventory**

39. Since 23 February 2021, the Agency has not had access to the data and recordings collected by its surveillance equipment installed to monitor Iran's mechanical testing of centrifuges as specified in

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<sup>53</sup> GOV/2021/39, para. 45.

<sup>54</sup> One fuel plate containing 75 g of uranium enriched up to 20% U-235 had a dose rate below that limit. Decision of the Joint Commission of 24 December 2015 (INFCIRC/907).

<sup>55</sup> Of the 105 kg of uranium in the form of UO<sub>2</sub>F<sub>2</sub>, 27.0 kg of uranium in the form of UO<sub>2</sub>F<sub>2</sub> had an enrichment level of to 3.5% U-235 and 78.0 kg of uranium in the form of UO<sub>2</sub>F<sub>2</sub> had an enrichment level up of 3.3% U-235. The latter was obtained by mixing the uranium in the form of UO<sub>2</sub>F<sub>2</sub> with an enrichment level of to 3.5% U-235 with depleted uranium in the form of UO<sub>2</sub>F<sub>2</sub>.

the JCPOA (paras 32 and 40). In January 2021, Iran began using a new location (at a workshop at Natanz), beyond those specified in the JCPOA, for mechanical testing of centrifuges.

40. Since 23 February 2021, Iran has no longer provided declarations to the Agency of its production and inventory of centrifuge rotor tubes, bellows and rotor assemblies, nor has it permitted the Agency to verify the items in the inventory (para. 80.1). Previously, the centrifuge component manufacturing equipment declared by Iran had also been used for activities beyond those specified in the JCPOA, such as the installation of the cascades described above (para. 80.2).

41. Since 23 February 2021, the Agency has not had access to the data and recordings collected by its surveillance equipment installed to monitor both the manufacturing of rotor tubes and bellows. Consequently, the Agency has been unable to verify whether Iran has produced any IR-1 centrifuges, including IR-1 centrifuge rotor tubes, bellows or rotor assemblies to replace those that have been damaged or failed (para. 62) and has no information on the inventory of rotor tubes, bellows and rotor assemblies. Nor can the Agency confirm the extent to which Iran is continuing to manufacture centrifuge rotor tubes using carbon fibre that had not been subject to previous continuous Agency containment and surveillance measures.<sup>56,57</sup>

#### D.4. Enriched Uranium Stockpile

42. As previously reported, since 1 July 2019, the Agency has verified that Iran's total enriched uranium stockpile has exceeded 300 kg of UF<sub>6</sub> enriched up to 3.67% U-235 (or the equivalent in different chemical forms) (para. 56).<sup>58</sup> The quantity of 300 kg of UF<sub>6</sub> corresponds to 202.8 kg of uranium.<sup>59</sup>

43. Since the previous report the following changes to the inventory of uranium enriched up to 2% U-235, enriched up to 5% U-235, enriched up to 20% U-235 and enriched up to 60% U-235, as declared by Iran and verified by the Agency at the enrichment facilities, were as follows (see also Annex III):

- **FEP:** Iran has estimated<sup>60</sup> that from 28 August 2021 to 5 November 2021, 501.4 kg of UF<sub>6</sub> enriched up to 5% U-235 were produced from natural UF<sub>6</sub>.<sup>61</sup>
- **FFEP:** Iran has estimated that from 30 August to 5 November 2021, 310.8 kg of UF<sub>6</sub> enriched up to 5% U-235 were fed into cascades at FFEP,<sup>62</sup> and that 43.7 kg of UF<sub>6</sub> enriched up to 20% U-235 were produced,<sup>63</sup> and that 262.6 kg of UF<sub>6</sub> enriched up to 2% U-235 were accumulated as tails.

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<sup>56</sup> GOV/INF/2019/12, para. 6.

<sup>57</sup> Decision of the Joint Commission of 14 January 2016 (INFCIRC/907).

<sup>58</sup> GOV/INF/2019/8, paras 2 and 3.

<sup>59</sup> Considering the standard atomic weight of uranium and fluorine.

<sup>60</sup> Since 23 February 2021, as the Agency has only been able to verify Iran's production of enriched UF<sub>6</sub> once the enriched uranium product has been removed from the process, the quantity of nuclear material that remains in the process can only be estimated.

<sup>61</sup> Out of the overall production of UF<sub>6</sub> enriched up to 5% U-235 at FEP since 16 February 2021, the Agency has verified 1553.8 kg of UF<sub>6</sub>.

<sup>62</sup> Iran estimated that 4.5 kg of UF<sub>6</sub> enriched up to 5% U-235 were dumped (i.e. not used for the enrichment of UF<sub>6</sub> but remaining in the process); the nuclear material is still in process and has not been measured; its average enrichment could be slightly above the level of the feed material. This amount is included in the inventory of low enriched uranium at FFEP.

<sup>63</sup> Out of the overall production of UF<sub>6</sub> enriched up to 20% U-235 at FFEP since 16 February 2021, the Agency verified 145.5 kg of UF<sub>6</sub>.

- **PFEP:** Iran has estimated that from 30 August to 5 November 2021:<sup>64</sup> 104.2 kg of UF<sub>6</sub> enriched up to 2% U-235 were produced in R&D lines 2,<sup>65</sup> 3 and 5; 562.3 kg of UF<sub>6</sub> enriched up to 5% U-235 were fed into cascades installed in R&D production lines 1, 4 and 6; 294.5 kg<sup>66</sup> of UF<sub>6</sub> enriched up to 5% U-235 were produced in production line 1; 11.4 kg of UF<sub>6</sub> enriched up to 60% U-235 were produced in R&D production lines 4 and 6;<sup>67</sup> and 256.5 kg of UF<sub>6</sub> enriched up to 2% U-235 were accumulated as tails from R&D production line 1.<sup>68</sup>

44. On 3 November 2021, the Agency verified that the inventory of uranium enriched up to 20% U-235 in forms other than UF<sub>6</sub> was of 34.2 kg of uranium<sup>69</sup> and consisted of: 24.9 kg of uranium in the form of fuel assemblies, 8.4 kg of uranium in the form of intermediate products,<sup>70</sup> and 0.9 kg of uranium in the form of liquid and solid scrap.

45. Since 16 February 2021, the Agency has not been able to verify Iran's total enriched uranium stockpile, comprising enriched uranium produced at FEP, PFEP and FFEP and consumed as feed material at PFEP and FFEP.<sup>71</sup> Based on the information in the previous paragraphs, the Agency has estimated that, as of 6 November 2021, Iran's total enriched uranium stockpile was 2489.7 kg. This figure represents an increase of 48.4 kg<sup>72</sup> since the previous quarterly report. The estimated stockpile comprised 2313.4 kg of uranium in the form of UF<sub>6</sub>; 125.4 kg of uranium in the form of uranium oxide and other intermediate products; 35.4 kg of uranium in fuel assemblies and rods; and 15.5 kg of uranium in liquid and solid scrap.

46. As of 6 November 2021, the estimated total enriched uranium stockpile in the form of UF<sub>6</sub> of 2313.4 kg comprises: 559.6 kg of uranium enriched up to 2% U-235 (+55.8 kg since the previous quarterly report); 1622.3 kg of uranium enriched up to 5% U-235 (-152.5 kg<sup>73</sup>); 113.8 kg of uranium enriched up to 20% U-235 (+29.5 kg); and 17.7 kg of uranium enriched up to 60% U-235 (+7.7 kg).

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<sup>64</sup> During the reporting period the annual physical inventory verification (PIV) was carried out at PFEP. For this purpose, the production of UF<sub>6</sub> enriched up to 2% U-235 was stopped for nine days and the production of UF<sub>6</sub> enriched up to 60% U-235 was stopped for three days.

<sup>65</sup> Up to 23 October 2021 (see paragraph 22 above).

<sup>66</sup> This amount includes UF<sub>6</sub> enriched up to 5% U-235 in tails from R&D production lines 4 & 6 not fed into R&D production line 1.

<sup>67</sup> Out of the overall production at PFEP using lines 1, 4 and 6, since 14 April 2021, the Agency verified that the following amounts were produced: 224.0 kg of UF<sub>6</sub> enriched up to 5% U-235, 25.1 kg of UF<sub>6</sub> enriched up to 20% U-235 and 18.6 kg of UF<sub>6</sub> enriched up to 60% U-235.

<sup>68</sup> Tails from R&D line 1 have an approximate enrichment up to 2% U-235 and are included in the uranium stockpile enriched up to 2% U-235.

<sup>69</sup> 0.7 kg of uranium enriched up to 20% U-235 was down blended to less than 5% U-235.

<sup>70</sup> Including the uranium enriched up to 20% U-235 used in the experiments of the uranium metal production for the new TRR fuel.

<sup>71</sup> Under Iran's Safeguards Agreement, the Agency is able to verify the physical inventory of nuclear material at each declared facility at the annual PIV.

<sup>72</sup> Since the previous quarterly report, 364.9 kg of uranium (up to 2% U-235) in the form of UF<sub>6</sub> was mixed with depleted uranium resulting in 4512.4 kg of uranium enriched at 0.736% U-235, which is not included in the stockpile of enriched uranium.

<sup>73</sup> The overall decrease of the stockpile in the form of UF<sub>6</sub> includes 103.4 kg of uranium in the form of UF<sub>6</sub> enriched up to 5% U-235 which were transferred to EUPP and converted to uranium oxide and its intermediate products, and the figures mentioned in previous paragraphs on production and consumption of UF<sub>6</sub> enriched up to 5% U-235 at the enrichment plants.

## **E. Transparency Measures**

47. Since 23 February 2021, the Agency has not: had access to the data from its on-line enrichment monitors and electronic seals, or access to the measurement recordings registered by its installed measurement devices (para. 67.1); been provided with any information or access to data from containment and surveillance measures relating to the transfer to UCF of UOC produced in Iran or obtained from any other source (para. 68); had access to the data and recordings collected by its surveillance equipment installed to monitor the production of UOC. Iran has also not provided the Agency with any information on the production of UOC or on whether it has obtained UOC from any other source (para. 69).

48. Iran has continued to issue long-term visas to Agency inspectors designated for Iran as requested by the Agency, provided proper working space for the Agency at nuclear sites and facilitated the use of working space at locations near nuclear sites in Iran (para. 67.2). Matters relating to the treatment of Agency inspectors are set out in GOV/2021/52.

## **F. Other Relevant Information**

49. Since 23 February 2021, Iran has no longer provisionally applied the Additional Protocol to its Safeguards Agreement in accordance with Article 17(b) of the Additional Protocol (para. 64). Iran has not provided updated declarations and the Agency has not been able to conduct any complementary access under the Additional Protocol to any sites and locations in Iran during this reporting period. In addition, Iran has not implemented modified Code 3.1 of the Subsidiary Arrangements to Iran's Safeguards Agreement during this reporting period (para. 65). Subsequently, Iran informed the Agency that it does not have a plan to construct a new nuclear facility in the near future and that it was ready to work with the Agency to find a mutually acceptable solution to address the issue of modified Code 3.1. Other matters previously addressed in this section relating to Iran's implementation of its Safeguards Agreement and Additional Protocol<sup>74</sup> are addressed in GOV/2021/52.

50. During this reporting period, the Agency was unable to verify Iran's other JCPOA nuclear-related commitments, including those set out in Sections D, E, S and T of Annex I of the JCPOA.

51. During this reporting period, the Agency has attended one meeting of the Procurement Working Group of the Joint Commission (JCPOA, Annex IV – Joint Commission, para. 6.4.6).

## **F. Summary**

52. Since 23 February 2021, the Agency's verification and monitoring activities have been seriously undermined as a result of Iran's decision to stop the implementation of its nuclear-related commitments under the JCPOA, including the Additional Protocol.

53. In the absence of regular Agency access to its verification and monitoring equipment under the JCPOA, the Agency considers that the temporary agreement reached in February 2021 facilitated the maintenance of continuity of knowledge. However, the repeated prolongation of the agreement, which has now been in place for around nine months, is becoming a significant challenge to the Agency's ability to restore this continuity of knowledge.

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<sup>74</sup> GOV/2020/51, paras 33-35.

54. In addition, contrary to the agreement reached between the Agency and Iran on 12 September 2021, the lack of access to the Karaj workshop has meant that the restoration of surveillance and monitoring at all of Iran's facilities and locations could not be completed. This is seriously affecting the Agency's ability to restore continuity of knowledge at the workshop, which has been widely recognised as essential in relation to a return to the JCPOA.

55. On 15 November 2021, the Director General accepted an invitation to visit Tehran, the precise date of which is still being finalized, to hold high level consultations with the Iranian Government as agreed in the Joint Statement of 12 September 2021. The Director General looks forward to discussing current issues of mutual interest during this visit.

56. The Director General will continue to report as appropriate.



ANNEX I

**Impact on Agency verification and monitoring resulting from Iran stopping implementation of its nuclear-related commitments as envisaged in the JCPOA<sup>75</sup>**

The Agency is unable to:

Monitor or verify Iranian production and inventory of heavy water;	Para. 14 and para. 15
Verify that use of shielded cells, referred to in the decision of the Joint Commission of 14 January 2016 (INFCIRC/907), are being operated as approved by the Joint Commission;	Para. 21
Monitor and verify that all centrifuges and associated infrastructure in storage remain in storage or have been used to replace failed or damaged centrifuges	Para. 70
Perform daily access upon request to the enrichment facilities at Natanz and Fordow	Para. 71 and para. 51
Verify in-process material at enrichment facilities to enable an accurate stockpile of enriched uranium to be calculated	Para. 56
Verify whether or not Iran has conducted mechanical testing of centrifuges as specified in the JCPOA	Para. 32 and para. 40
Monitor or verify Iranian production and inventory of centrifuge rotor tubes, bellows or assembled rotors	Para. 80.1
Verify whether produced rotor tubes and bellows are consistent with the centrifuge designs described in the JCPOA	Para. 80.2
Verify whether produced rotor tubes and bellows have been used to manufacture centrifuges for the activities specified in the JCPOA	Para. 80.2
Verify whether rotor tubes and bellows have been manufactured using carbon fibre which meets the specifications agreed under the JCPOA	Para. 80.2
Monitor or verify Iranian production of UOC	Para. 69
Monitor or verify Iranian procurement of UOC from any other source	Para. 69
Monitor or verify whether UOC produced in Iran or obtained from any other source has been transferred to UCF	Para. 68
Verify Iran's other JCPOA nuclear-related commitments, including those set out in Sections D, E, S and T of Annex I of the JCPOA	
Receive any updated declarations from Iran or conduct any complementary access to any sites and locations in Iran during this reporting period	Additional Protocol

<sup>75</sup> Implementation of modified Code 3.1 is a legal obligation and is not reflected in the table.

ANNEX II

**Three updates since the Director General's previous Quarterly Report**

GOV/INF	Date	Content
2021/42	12 September 2021	The Joint Statement relating to the Agency's servicing of its monitoring and surveillance equipment under the JCPOA in Iran
2021/43	26 September 2021	Update on developments related to the Agency's monitoring and surveillance equipment under the JCPOA in Iran
2021/44	25 October 2021	R&D activities at PFEP using uranium enriched up to 20% U-235

ANNEX III

**Enriched UF<sub>6</sub> Feed, Production and Inventory  
since the Director General's previous Quarterly Report**

Facility	Centrifuge Type	Installed Cascades <sup>76</sup>	Total Planned Cascades	Feed Enrichment Level (% U-235)	Quantity Fed (kgUF <sub>6</sub> )	Product Enrichment Level (% U-235)	Quantity produced (kgUF <sub>6</sub> )
FEP	IR-1	31	36	Natural	-	<5%	501.4
	IR-2m	6	6				
	IR-4	2	6				
	IR-6	0	1				
FFEP	IR-1	6	6	<5%	310.8	<20% <2%	43.7 262.6
	IR-6	1	2	Natural or <5%		<5% or <20%	
PFEP	IR-4 (Line 4)	1	1	<5%	562.3	<60%	11.4
	IR-6 (Line 6)	1	1				
	IR-5 and IR-6s (Line 1)	1		Tails from Lines 1 & 2	N/A	<5% <2%	294.5 <sup>77</sup> 256.5
	Various (Lines 2, 3 and 5)			Natural	-	<2%	104.2

Enrichment level (% U-235)	Inventory as at 30 August 2021 (kgU)	Quantity Fed (kgU)	Quantity Produced (kgU)	Inventory as at 5 November 2021 (kgU)
<2%	503.8		420.7	559.6 <sup>78</sup>
<5%	1774.8	589.3	537.2	1622.3 <sup>79,80,81</sup>
<20%	84.3		29.5	113.8
<60%	10.0		7.7	17.7

<sup>76</sup> Different numbers of cascades were fed during the reporting period.

<sup>77</sup> See Footnote 66.

<sup>78</sup> See Footnote 73.

<sup>79</sup> See Footnote 62.

<sup>80</sup> See Footnote 70.

<sup>81</sup> See Footnote 74.