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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 covers the period since the issuance of the Director General's previous report.¹

2. 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 \notin 9.8 million per annum, of which \notin 4.5 million is funded by extrabudgetary contributions.² As of 20 May 2024, extrabudgetary funding had been pledged sufficient to meet the cost of JCPOA-related activities until late November 2024.³

¹ GOV/2024/7.

² These figures have been adjusted to reflect current costs and the latest 2024 budget update.

³ The additional costs that the Agency has been incurring since 23 February 2021, while Iran has not been implementing its nuclear-related commitments under the JCPOA, will be communicated in due course once they have been assessed.

B. Background

3. On 14 July 2015, China, France, Germany, the Russian Federation, the United Kingdom, the United States of America,⁴ with the High Representative of the European Union for Foreign Affairs and Security Policy (E3/EU+3) and Iran agreed on the JCPOA. On 20 July 2015, the Security Council adopted resolution 2231 (2015), in which, inter alia, it requested the Director General to "undertake the necessary verification and monitoring of Iran's nuclear-related commitments for the full duration of those commitments under the JCPOA" and "[r]eport to the Board of Governors and in parallel to the Security Council, at any time if the Director General has reasonable grounds to believe there is an issue of concern directly affecting fulfilment of Iran's nuclear-related commitments as set out in the JCPOA" (GOV/2015/53 and Corr.1, para. 8). In August 2015, the Board of Governors authorized the Director General to implement the necessary verification and monitoring of Iran's nuclear-related commitments in light of Security Council resolution 2231 (2015), subject to the availability of funds and consistent with the Agency's standard safeguards practices.⁵

C. JCPOA Verification and Monitoring Activities

4. Between 16 January 2016 (JCPOA Implementation Day) and 8 May 2019, the Agency verified and monitored Iran's implementation of its nuclear-related commitments in accordance with the modalities set out in the JCPOA,⁶ consistent with the Agency's standard safeguards practices.^{7,8}

5. From 8 May 2019 onwards, however, Iran stopped implementing its nuclear-related commitments under the JCPOA on a step-by-step basis until, on 23 February 2021, it stopped implementing them altogether, including the Additional Protocol. As a result, Iran no longer allows the Agency to conduct the following verification and monitoring activities in relation to the JCPOA:

- Monitor or verify Iranian production and stocks of heavy water (paras 14 and 15⁹).
- Verify that the use of shielded cells at two locations, 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).
- Implement continuous monitoring to verify that all centrifuges and associated infrastructure in storage remain in storage or have been used to replace failed or damaged centrifuges (para. 70).

⁴ On 8 May 2018, the then President of the United States of America, Donald Trump, announced that the "United States will withdraw from the Iran nuclear deal", 'Remarks by President Trump on the Joint Comprehensive Plan of Action', at: https://trumpwhitehouse.archives.gov/briefings-statements/remarks-president-trump-joint-comprehensive-plan-action/.

⁵ More background information to the matters outlined in this report can be found in previous quarterly reports of the Director General (most recently in GOV/2021/39).

⁶ Including the clarifications referred to in para. 3 of GOV/2021/39.

⁷ GOV/2016/8, para. 6.

⁸ Note by the Secretariat, 2016/Note 5.

⁹ The paragraph references in these bullet points correspond to the paragraphs of 'Annex I – Nuclear-related measures' of the JCPOA.

• Perform daily access upon request to the enrichment facilities at Natanz and Fordow, including to monitor Iran's production of stable isotopes (paras 71 and 51).

• Verify in-process low enriched nuclear material at enrichment facilities as part of the total enriched uranium stockpile (para. 56).

• Verify whether or not Iran has conducted mechanical testing of centrifuges as specified in the JCPOA (paras 32 and 40).

• Monitor or verify Iranian production and inventory of centrifuge rotor tubes, bellows or assembled rotors; verify whether produced rotor tubes and bellows are consistent with the centrifuge designs described in the JCPOA; verify whether produced rotor tubes and bellows have been used to manufacture centrifuges for the activities specified in the JCPOA (paras 80.1 and 80.2); verify whether rotor tubes and bellows have been manufactured using carbon fibre which meets the specifications agreed under the JCPOA¹⁰.

• Monitor or verify the uranium ore concentrate (UOC) produced in Iran or obtained from any other source; and whether such UOC has been transferred to the Uranium Conversion facility (UCF) (paras 68 and 69).

• 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.

6. This has seriously affected the Agency's JCPOA-related verification and monitoring activities. The situation was exacerbated in June 2022 by Iran's decision to remove all of the Agency's JCPOA-related surveillance and monitoring equipment. As a result, the Agency has lost continuity of knowledge in relation to the production and inventory of centrifuges, rotors and bellows, heavy water and UOC.

C.1. Activities Related to Heavy Water and Reprocessing

7. As of 23 May 2024, minor civil construction work was ongoing at the Khondab Heavy Water Research Reactor (KHRR). Iran had previously informed the Agency that the commissioning of KHRR was expected in 2023 using the IR-20 dummy fuel assemblies;¹¹ to date, no update to this schedule has been communicated to the Agency. The Agency did not observe any significant changes compared to the Director General's previous quarterly report.

¹⁰ Decision of the Joint Commission of 14 January 2016 (INFCIRC/907).

¹¹ The IR-20 dummy fuel assemblies have already been manufactured, based on an Iranian design (GOV/2023/57, para. 8).

C.2. Verification and monitoring of Iran's nuclear-related commitments

8. The status of the Agency's verification and monitoring of Iran's nuclear-related commitments under the JCPOA is as follows:

JCPOA Section	Commitment	Most recently verified
В	Arak Heavy Water Research Reactor	23 May 2024
С	Heavy Water Production Plant (HWPP)	February 2021 ¹² *
D	Other Reactors	Unavailable since February 2021
Е	Spent Fuel Reprocessing Activities	TRR: 20 May 2024
		MIX Facility: 20 May 2024
		JHL: 20 May 2024
		Shielded cells: February 2021*
F	Enrichment Capacity	FEP: 21 May 2024
		FFEP: 25 May 2024
		PFEP: 25 May 2024
G	Centrifuge Research and Development	25 May 2024
Н	Fordow Fuel Enrichment Plant (FFEP)	25 May 2024
Ι	Other Aspects of Enrichment	See Sections F, G and H above
J	Uranium Stocks and Fuels	10 May 2024
Κ	Centrifuge Manufacturing	February 2021*
L	Additional Protocol (AP) & Modified Code 3.1	February 2021*
Ν	Modern Technologies and Long-term Presence of	OLEM: June 2022
	IAEA	120 inspectors currently designated
0	Transparency related to UOC	February 2021*
Р	Transparency related to enrichment	February 2021*
Q	Access	Unavailable since February 2021
R	Centrifuge Component Manufacturing Transparency	February 2021*
S	Other Uranium Isotope Separation Activities	February 2021*
Т	Activities Which Could Contribute to the Design and Development of a Nuclear Explosive Device	February 2021*

* Verification and monitoring no longer allowed by Iran.

¹² Based on its analysis of commercially available satellite imagery, the Agency assessed that HWPP continued to operate during the reporting period.

C.3. Activities Related to Enrichment

Facility	Centrifuge Type	Total Planned Cascades ¹³	Installed Cascades	Total Operating Cascades ¹⁴
	IR-1	36	36	36
Fuel	IR-2m	21	21	9
Enrichment Plant (FEP) ¹⁵	IR-4	12	12	3
Plant (FEP)	IR-6	3	3	3
Fordow Fuel	IR-1	16 ¹⁷	6	6
Enrichment Plant (FFEP) ¹⁶	IR-6		2	2
	IR-4 (Line 4)	1	1	1
	IR-6 (Line 6)	1	1	1
Pilot Fuel Enrichment	IR-4 and IR-6 (Line 5)	1	1	1
Plant (PFEP) ¹⁸	Various (Lines 1, 2 and 3)			
	Various (Hall A1000)	See Section C.3.2		

C.3.1. Enrichment Capacity

There has been no change in the number of operating cascades since the previous report.

¹³ The figures for FEP do not include the planned installation of centrifuges in Hall B1000 or in two additional enrichment units in Hall A1000, for which no details of centrifuge types or numbers of cascades have yet been provided by Iran.

¹⁴ Cascades are considered to be operating if they have been fed with UF₆ for enrichment of collected product.

¹⁵ On 21 May 2024, the Agency verified at FEP that 35 IR-1 cascades, 5 IR-2m cascades, 3 IR-4 cascades and 3 IR-6 cascades were being fed with natural UF6 to produce UF6 enriched up to 5% U-235.

¹⁶ On 25 May 2024, the Agency verified at FFEP in Unit 2 that Iran was continuing to feed UF6 enriched up to 5% U-235 into: up to 1044 IR-1 centrifuges in three sets of two interconnected cascades to enrich UF6 up to 20% U-235; and into one set of two interconnected cascades of 166 IR-6 centrifuges to enrich UF6 up to 60% U-235.

¹⁷ Iran has declared that the eight cascades planned in Unit 1 could contain either IR-1 or IR-6 centrifuges and that it will replace the six cascades of IR-1 centrifuges in Unit 2 with IR-6 centrifuges.

¹⁸ On 25 May 2024, the Agency verified that the activities involving R&D lines 1–6 in the original area of PFEP were as follows:

R&D lines 1, 2 and 3: Iran has continued to accumulate uranium enriched up to 2% U-235 through feeding natural UF6 into small and intermediate cascades comprising up to: 12 IR-1 centrifuges; 99 IR-2m centrifuges and four IR-2m centrifuges; 20 IR-4 centrifuges and ten IR-4 centrifuges; six IR-5 centrifuges and 19 IR-5 centrifuges; ten IR-6 centrifuges, 18 IR-6 centrifuges, 19 IR-6 centrifuges and four IR-6 centrifuges. The following single centrifuges were being tested with natural UF6 but not accumulating enriched uranium: two IR-2m centrifuges; five IR-4 centrifuges; two IR-5 centrifuges; four IR-6 centrifuges; one IR-7 centrifuge; one IR-8 centrifuge; and one IR-9 centrifuge.

R&D production lines 4, 5 and 6: Iran was feeding UF6 enriched up to 5% U-235 into two interconnected 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 UF6 enriched up to 60% U-235, and the tails produced from line 6 were being fed into a cascade of 168 IR-4 and four IR-6 centrifuges in R&D production line 5 to produce UF6 enriched up to 5% U-235.

- 9. In addition to the installed cascades listed in the table above:
 - **FEP:** On 21 May 2024, the Agency verified that installation of sub-headers in all 18 cascades in one enrichment unit in Hall A1000¹⁹ had been completed; sub-headers had been installed in six cascades in an additional enrichment unit in Hall A1000;²⁰ and the planned installation of additional enrichment units in Hall B1000 had yet to start.
 - **FFEP:** On 25 May 2024, the Agency verified that the installation of the necessary infrastructure for the planned eight new cascades in Unit 1, containing either IR-1 or IR-6 centrifuges, was ongoing, but that installation of centrifuges had yet to begin. No IR-1 centrifuges had been replaced with IR-6 centrifuges in Unit 2.

C.3.2. Centrifuge Research & Development (R&D)

10. In January 2024, the Agency verified at PFEP that installation of infrastructure for feeding and withdrawing UF₆ from the 18 R&D production lines in Hall A1000²¹ had been completed and was under commissioning. On 25 May 2024, the Agency verified that a cascade of 20 IR-4 centrifuges was installed in Line A, a cascade of 20 IR-6s centrifuges was installed in Line B and a cascade of 20 IR-6 centrifuges was installed in Line C; and that no nuclear material had yet been introduced in this area of PFEP.

C.4. Activities Related to Fuel

11. **Fuel Plate Fabrication Plant (FPFP):** On 19 May 2024, the Agency verified that no progress had been made regarding the remaining two stages of the process²² for the production of UF_4 from UF_6 . Installation of the equipment for the first stage of the process had been completed but had yet to undergo testing using nuclear material. As of 19 May 2024, Iran has not produced any uranium metal during this reporting period.

12. UCF: As of 21 May 2024, the Agency verified that no nuclear material had been introduced into the production area of the UCF at Esfahan, where installation of equipment for the production of uranium metal had been completed and which was ready to operate.²³

13. **Tehran Research Reactor (TRR):** As of 25 May 2024, 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 control fuel assembly.²⁴ On the same day, the Agency verified that 13 fresh TRR standard fuel assemblies and one control fuel assembly, previously received from FPFP, had yet to be irradiated.

¹⁹ GOV/2023/39, para. 16.

²⁰ On 24 December 2023, Iran informed the Agency that it intended to "install some infrastructure" in one additional enrichment unit of FEP in Hall A1000. The installation of cascade sub-headers in this enrichment unit was first observed in April 2024.

²¹ GOV/2024/7, para.10.

²² GOV/INF/2021/3, para. 5.

²³ GOV/2023/24, para. 49.

²⁴ The amount of uranium in the irradiated control fuel assembly has been included in the enriched uranium stockpile.

C.5. Enriched Uranium Stockpile

14. Iran has estimated²⁵ that at FEP from 10 February 2024 to 10 May 2024, 903.3 kg of UF₆ enriched up to 5% U-235 were produced from natural UF₆.

15. Iran has estimated that at PFEP from 10 February 2024 to 10 May 2024:

- 97.4 kg of UF_6 enriched up to 2% U-235 were produced in R&D lines 1, 2 and 3;
- 306.4 kg of UF₆ enriched up to 5% U-235 were fed into cascades installed in R&D production lines 4, 5 and 6;
- 92.6 kg of UF_6 enriched up to 5% U-235 were produced in R&D production line 5;
- 202.7 kg of UF₆ enriched up to 2% U-235 were accumulated as tails from R&D production line 5; and
- 11.1 kg of UF₆ enriched up to 60% U-235 were produced in R&D production lines 4 and 6.²⁶

16. Iran has estimated that at FFEP from 10 February 2024 to 10 May 2024:

- 17.5 kg of UF₆ enriched up to 60% U-235 were produced;²⁷
- 56.0 kg of UF₆ enriched up to 20% U-235 were produced;²⁸
- 742.4 kg of UF₆ enriched up to 5% U-235 were fed into cascades at FFEP;²⁹ and
- 643.7 kg of UF₆ enriched up to 2% U-235 were accumulated as tails.

17. Since 16 February 2021, the Agency has not been able to verify Iran's total enriched uranium stockpile³⁰ precisely on any given day, needing to rely instead on a small proportion of the total being based on Iran's estimates. Based on the information provided by Iran as described in the previous paragraphs and summarised in Annex I, the Agency has estimated that, as of 11 May 2024, Iran's total enriched uranium stockpile was 6201.3 kg. This figure represents an increase of 675.8 kg since the previous quarterly report. The estimated stockpile comprised: 5841.3 kg of uranium in the form of UF₆; 203.5 kg of uranium in the form of uranium oxide and other intermediate products; 47.2 kg of uranium in fuel assemblies, plates and rods; 4.4 kg of uranium in targets; and 104.9 kg of uranium in liquid and solid scrap.

 $^{^{25}}$ Since 23 February 2021, as the Agency has only been able to verify Iran's production of enriched UF6 at FEP 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. Out of the overall production of UF6 enriched up to 5% U-235 at FEP since 16 February 2021, the Agency has verified 11 932.4 kg of UF6 enriched up to 5% U-235.

²⁶ Out of the overall production at PFEP using R&D production lines 4, 5 and 6, since 14 April 2021, the Agency has verified that the following amounts of UF₆ had been produced: 2026.5 kg of UF₆ enriched up to 5% U-235, 25.1 kg of UF₆ enriched up to 20% U-235 and all 173.8 kg of UF₆ enriched up to 60% U-235.

 $^{^{27}}$ The Agency has verified all 104.7 kg of UF₆ enriched up to 60% U-235 that had been produced since 21 November 2022. This includes 2.0 kg of UF₆ enriched up to 60% U-235 that was detached from the process and verified during the reporting period.

²⁸ Out of the overall production of UF₆ enriched up to 20% U-235 at FFEP since 16 February 2021, the Agency has verified 923.0 kg of UF₆ enriched up to 20% U-235.

²⁹ Iran estimated that 25.3 kg of UF₆ were "dumped". Of this, 2.0 kg of UF₆ is declared to have an enrichment level above 5% and has been included in the stockpile of UF₆ enriched up to 20% U-235. The remainder is included in the inventory of LEU enriched up to 5% U-235 at FFEP. Upon its removal from the process, it will be verified by the Agency.

³⁰ Comprising enriched uranium produced at FEP, PFEP and FFEP and used as feed material at PFEP and FFEP.

18. As of 11 May 2024, the Agency has estimated that the total enriched uranium stockpile in the form of UF6 of 5841.3 kg comprised:

- 2571.0 kg of uranium enriched up to 2% U-235 (+637.0 kg since the previous quarterly report);
- 2376.9 kg of uranium enriched up to 5% U-235 (-19.9 kg);
- 751.3 kg of uranium enriched up to 20% U-235 (+39.1 kg); and
- 142.1 kg of uranium enriched up to 60% U-235 (+20.6 kg).^{31,32}

19. As of 11 May 2024, the Agency verified that the inventory of uranium enriched up to 20% U-235 in forms other than UF₆ was 30.0 kg, consisting of 21.7 kg of uranium in fuel assemblies,³³ plates and rods, 2.8 kg of uranium in targets, 5.0 kg of uranium in other intermediate products, and 0.5 kg of uranium in liquid and solid scrap.

20. As of 11 May 2024, the inventory of uranium enriched up to 60% U-235 in forms other than UF₆ remains as 2.0 kg of uranium as previously reported, consisting of 1.6 kg of uranium in irradiated targets,³⁴ verified at TRR on 25 May 2024, and 0.4 kg of uranium in liquid and solid scrap, verified at FPFP on 7 May 2024.

D. Other Relevant Information

21. As previously reported,³⁵ in September 2023, Iran informed the Agency of its decision to withdraw the designation of several experienced Agency inspectors designated for Iran. This followed a previous recent withdrawal of the designation of another experienced Agency inspector designated for Iran. This measure, while formally permitted by the NPT Safeguards Agreement, was exercised by Iran in a manner that directly and seriously affects the Agency's ability to conduct effectively its verification activities in Iran, in particular at the enrichment facilities. In late October 2023, the Director General requested Vice-President Eslami to reconsider the withdrawal of the designations for these inspectors.

22. Iran has yet to reverse its decision to withdraw the designations for any of the aforementioned inspectors previously designated for Iran. The Agency would expect Iran to do so in the context of the ongoing consultations between the Agency and Iran.

³¹ This includes 1.3 kg of uranium enriched up to 60% U-235 that was detached from the process and verified during the reporting period.

 $^{^{32}}$ Since 11 May 2024, the Agency verified that Iran had mixed a total of 5.9 kg of uranium enriched up to 60% U-235 from the stockpile of 142.1 kg with 12.5 kg of uranium enriched up 2% U-235 from the stockpile of 2571.0 kg to produce an additional 18.4 kg of uranium enriched up to 20% U-235.

³³ During the reporting period, one fresh fuel assembly containing 1.0 kg of uranium enriched up to 20% U-235 was loaded into the reactor core at TRR and this amount of nuclear material was thus removed from the stockpile.

³⁴ Irradiated at TRR and stored in the reactor pool.

³⁵ GOV/INF/2023/14, para. 1.

E. Summary

23. The Agency's JCPOA-related verification and monitoring has been seriously affected by the cessation of Iran's implementation of its nuclear-related commitments under the JCPOA. The situation has been exacerbated by Iran's subsequent decision to have all of the Agency's JCPOA-related surveillance and monitoring equipment removed.

24. The Agency has lost continuity of knowledge in relation to the production and inventory of centrifuges, rotors and bellows, heavy water and UOC as a result of not having been able to perform related JCPOA verification and monitoring activities for more than three years.

25. Iran's decision to remove all of the Agency's equipment previously installed in Iran for JCPOA-related surveillance and monitoring activities has also had detrimental implications for the Agency's ability to provide assurance of the peaceful nature of Iran's nuclear programme.

26. It has also been more than three years since Iran stopped provisionally applying its Additional Protocol and, therefore, since it provided updated declarations and the Agency was able to conduct complementary access to any sites and other locations in Iran.

27. The Director General deeply regrets that Iran has yet to reverse its decision to withdraw the designations for several experienced Agency inspectors. This is essential to fully allow the Agency to conduct its verification activities in Iran effectively.

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

Annex I

Enriched UF₆ Feed, Production and Inventory since the Director General's previous Quarterly Report

Facility	Centrifuge Type	Feed Enrichment Level (% U-235)	Quantity Fed (kgUF6)	Product Enrichment Level (% U-235)	Quantity Produced (kgUF6)
FEP	IR-1				
	IR-2m	Natural			
	IR-4		-	<5%	903.3
	IR-6				
FFEP	IR-1	<5%	742.4	<2%	643.7
				<20%	56.0
	IR-6			<60%	17.5
PFEP	IR-4 (Line 4) and IR-6 (Line 6)	<5%	306.4	<60%	11.1
	IR-4 and	Tails from		<5%	92.6
	IR-6 (Line 5) Line 6	N/A	<2%	202.7	
	Various (Lines 1, 2 and 3)	Natural	_	<2%	97.4

Enrichment level (% U-235)	Inventory as at 10 February 2024 (kgU)	Quantity Fed (kgU)	Quantity Produced (kgU)	Inventory as at 11 May 2024 (kgU)
<2%	1934.0		637.0	2571.0
<5%	2396.8	707.9	672.2	2376.9 ³⁶
<20%	712.2		37.8	751.3 ³⁷
<60%	121.5		19.3	142.1 ³⁸

³⁶ See footnote 29.

³⁷ See footnote 29.

³⁸ See footnote 31.

Annex II

List of acronyms

AEOI	Atomic Energy Organization of Iran
DIQ	Design Information Questionnaire
DIV	Design Information Verification
EUPP	Enriched Uranium Powder Plant
FEP	Fuel Enrichment Plant
FLUM	Flow-rate Unattended Monitoring
FMP	Fuel Manufacturing Plant
FPFP	Fuel Plate Fabrication Plant
FFEP	Fordow Fuel Enrichment Plant
HWPP	Heavy Water Production Plant
JCPOA	Joint Comprehensive Plan of Action
JHL	Jaber Ibn Hayan Multipurpose Laboratory
KHRR	Khondab Heavy Water Research Reactor
MIX facility	Molybdenum, Iodine and Xenon Radioisotope Production facility
OLEM	On-Line Enrichment Monitor
PFEP	Pilot Fuel Enrichment Plant
PIV	Physical Inventory Verification
TRR	Tehran Research Reactor
UCF	Uranium Conversion Facility
UOC	Uranium Ore Concentrate