IAEA
International Atomic Energy Agency

# Board of Governors

Derestricted 29 November 2004
*(This document has been derestricted by a decision of the Board of Governors 29 November 2004).*

**GOV/2004/83**
Date: 15 November 2004

Original: English

**For official use only**

Item 4(d) of the provisional agenda
(GOV/2004/82)

# Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran

*Report by the Director General*

1. At its meeting in September 2004, the Board of Governors considered the latest report submitted by the Director General on the implementation of the Agreement between the Islamic Republic of Iran (hereinafter referred to as Iran) and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (the Safeguards Agreement[1]).[2]

2. On 18 September 2004, the Board of Governors adopted resolution GOV/2004/79, in which, inter alia, it:

- Strongly urged that Iran respond positively to the Director General's findings on the provision of access and information by taking such steps as are required by the Agency and/or requested by the Board in relation to the implementation of Iran's Safeguards Agreement, including the provision of prompt access to locations and personnel, and by providing further information and explanations when required by the Agency and proactively to assist the Agency to understand the full extent and nature of Iran's enrichment programme and to take all steps within its power to clarify the outstanding issues before the Board's 25 November 2004 meeting, specifically including the sources and reasons for enriched uranium contamination and the import, manufacture and use of centrifuges;
- Emphasized the continuing importance of Iran acting in accordance with all provisions of the Additional Protocol, including by providing all access required in a timely manner; and urged Iran once again to ratify its Protocol without delay;
- Deeply regretted that the implementation of Iranian voluntary decisions to suspend enrichment-related and reprocessing activities, notified to the Agency on 29 December 2003 and 24 February 2004, fell significantly short of the Agency's understanding of the scope of those commitments and also that Iran had since reversed some of those decisions; stressed that such suspension would provide the Board with additional confidence in Iran's future activities; and

[1] INFCIRC/214.

[2] The initial report to the Board of Governors on this specific matter was provided by the Director General orally at the Board's meeting on 17 March 2003. The Director General subsequently submitted six written reports to the Board: GOV/2003/40, dated 6 June 2003; GOV/2003/63, dated 26 August 2003; GOV/2003/75, dated 10 November 2003; GOV/2004/11, dated 24 February 2004; GOV/2004/34, dated 1 June 2004, and Corr.1, dated 18 June 2004; and GOV/2004/60, dated 1 September 2004.

considered it necessary, to promote confidence, that Iran immediately suspend all enrichment related activities, including the manufacture or import of centrifuge components, the assembly and testing of centrifuges and the production of feed material, including through tests or production at the Uranium Conversion Facility (UCF), under Agency verification so that this could be confirmed in the reports requested by the Board in paragraphs 7 and 8 of resolution GOV/2004/79;

- Called again on Iran, as a further confidence-building measure, voluntarily to reconsider its decision to start construction of a research reactor moderated by heavy water;
- Underlined the need for the full and prompt cooperation with the Agency of third countries in relation to the clarification of outstanding issues, and expressed appreciation for the cooperation received by the Agency to date;
- Requested the Director General to submit in advance of the November Board: a report on the implementation of this resolution; and a recapitulation of the Agency's findings on the Iranian nuclear programme since September 2002, as well as a full account of past and present Iranian cooperation with the Agency, including the timing of declarations, and a record of the development of all aspects of the programme, as well as a detailed analysis of the implications of those findings in relation to Iran's implementation of its Safeguards Agreement; and
- Requested the Director General to submit in advance of the November Board a report on Iran's response to the requests made of it by the Board in previous resolutions, especially requests relating to full suspension of all enrichment related and reprocessing activities.

3. The present report is submitted to the Board in response to these requests. Section I addresses questions relevant to safeguards implementation in Iran, including the development of Iran's nuclear programme, Agency findings, implications, Iran's cooperation and an overall assessment; Section II addresses questions relevant to the suspension by Iran of enrichment related and reprocessing activities. The report also includes a list of locations relevant to the implementation of safeguards in Annex 1 and, in Annex 2, a list of abbreviations and terms used in this report.

# I. SAFEGUARDS IMPLEMENTATION[3]

# A. Development, Findings and Implications

## A.1. Development and Findings

### A.1.1. Uranium Mining and Ore Concentration

#### Development

4. Iran has a long-standing programme of exploration for uranium deposits, and has selected two locations for development as mines. At the Saghand Mine, located in Yazd in central Iran, low grade hard rock ore bodies will be exploited through conventional underground mining techniques. The annual estimated production design capacity is forecast as 50 t of uranium. The infrastructure and shaft sinking are essentially complete, and tunnelling towards the ore bodies has started. Ore production is

[3] Since the meeting of the Board of Governors in September 2004, the Agency has continued its verification activities in Iran, including inspections, complementary access and design information verification. In addition, an Agency team, headed by the Deputy Director General for Safeguards and the Director of Safeguards Operations Division B, met in Tehran with Iranian authorities between 12 and 16 October 2004 to discuss outstanding issues.

forecast to start by the end of 2006. The ore is to be processed into uranium ore concentrate (UOC/yellowcake) at the associated mill at Ardakan, the Yellowcake Production Plant. The design capacity of the mill corresponds to that of the mine (50 t of uranium per year). The mill startup is forecast to coincide with the start of mining at Saghand. The mill site is currently at an early stage of development; the installation of the infrastructure and processing buildings has been started. In the south of Iran, near Bandar Abbas, Iran has constructed the Gchine uranium mine and its co-located mill. The low but variable grade uranium ore found in near-surface deposits will be open-pit mined and processed at the associated mill. The estimated production design capacity is 21 t of uranium per year. Iran has stated that, as of July 2004, mining operations had started and the mill had been hot tested, during which testing a quantity of about 40 to 50 kg of yellowcake was produced.

5. Iran has explored two other potential uranium production routes. One was the extraction of uranium from phosphoric acid. Using research scale equipment, small quantities of yellowcake were successfully produced at the Tehran Nuclear Research Centre (TNRC) laboratories. Iran has stated that there are no facilities in Iran for separating uranium from phosphoric acid other than the research facilities at TNRC. The second route explored by Iran was the production of yellowcake using percolation leaching. Using this technique, Iran produced an estimated several hundred kilograms of yellowcake using temporary facilities, now dismantled, located at the Gchine mining site.

## Findings

6. In its Additional Protocol declarations of 21 May 2004, Iran provided information to the Agency on the location, operational status and estimated annual production capacity of the Gchine mine and mill, the Saghand Mine and the Yellowcake Production Plant. The Agency carried out complementary access at Gchine on 17 July 2004, at the Saghand Mine on 6 October 2004 and at the Ardakan Yellowcake Production Plant on 7 October 2004, in the course of which the Agency was able to confirm the declared status of these operations.

7. Access to these sites, and clarifications requested by the Agency, have been provided by Iran in a timely manner. The Agency's assessment of the information related to these mines and mills as declared by Iran under the Additional Protocol is ongoing, as is the analysis of samples taken from those locations.

## A.1.2. Uranium Conversion

## Development

8. Iran carried out most of its experiments in uranium conversion between 1981 and 1993 at TNRC and at the Esfahan Nuclear Technology Centre (ENTC), with some experiments (e.g. those involving pulse columns) being carried out through early 2002.

9. In 1991, Iran entered into discussions with a foreign supplier for the construction at Esfahan of an industrial scale conversion facility. Construction on the facility, UCF, was begun in the late 1990s. UCF consists of several conversion lines, principal among which is the line for the conversion of UOC to $UF_6$ with an annual design production capacity of 200 t uranium as $UF_6$. The $UF_6$ is to be sent to the uranium enrichment facilities at Natanz, where it will be enriched up to 5% U-235 and the product and tails returned to UCF for conversion into low enriched $UO_2$ and depleted uranium metal. The design information for UCF provided by Iran indicates that conversion lines are also foreseen for the production of natural and enriched (19.7%) uranium metal, and natural $UO_2$. The natural and enriched (5% U-235) $UO_2$ are to be sent to the Fuel Manufacturing Plant (FMP) at Esfahan, where Iran has said it will be processed into fuel for a research reactor and power reactors.

10. In March 2004, Iran began testing the process lines involving the conversion of UOC into $UO_2$ and $UF_4$, and $UF_4$ into $UF_6$. As of June 2004, 40 to 45 kg of $UF_6$ had been produced therefrom. A larger test, involving the conversion of 37 t of yellowcake into $UF_4$, was initiated in August 2004. According to Iran's declaration of 14 October 2004, 22.5 t of the 37 t of yellowcake had been fed into the process and that approximately 2 t of $UF_4$, and 17.5 t of uranium as intermediate products and waste, had been produced. There was no indication as of that date of $UF_6$ having been produced during this later campaign.

## Findings

11. Iran has stated that UCF was to have been constructed under a turn-key contract with a foreign supplier, but that when the contract was cancelled in 1997, Iran retained the engineering designs and used them as the basis to construct UCF with Iranian resources. Iran provided preliminary design information to the Agency in July 2000. The Agency has been carrying out continuous design information verification (DIV) since that time.

12. The Agency's enquiry into the chronology and scope of Iran's uranium conversion activities has focused on two central issues:

- Assessment of Iran's statements concerning the basis for its design of UCF (including conversion experiments), with a view to ascertaining whether Iran has declared all of its activities involving nuclear material; and
- Assessment of the declared intended uses for the products of the various UCF process lines.

***Design Basis and Conversion Experiments***

13. In February 2003, Iran acknowledged that it had imported in 1991 natural uranium, in a variety of forms, which it had not previously reported to the Agency[4], and that it had used some of these materials, at locations which had not previously been reported to the Agency, for testing certain parts of the UCF conversion process (i.e. uranium dissolution, purification using pulse columns and the production of uranium metal). On a number of occasions between February and July 2003, Iran stated that this information, along with documentation provided by the foreign supplier, had been sufficient to permit Iran to complete indigenously the detailed design and manufacturing of the equipment for UCF. Iran repeatedly stated that it had not carried out any research and development (R&D) or testing, even on a laboratory scale, of other more complex processes (e.g. conversion of $UO_2$ to $UF_4$ and conversion of $UF_4$ to $UF_6$) using nuclear material.

14. Following the discovery by the Agency of indications of depleted $UF_4$ in samples of waste taken at the Jabr Ibn Hayan Multipurpose Laboratories (JHL) at TNRC, Iran acknowledged, in a letter dated 19 August 2003, that it had carried out $UF_4$ conversion experiments on a laboratory scale during the 1990s at the Radiochemistry Laboratories of TNRC using depleted uranium which had been imported in 1977 and exempted from safeguards upon receipt, and which Iran had declared in 1998 (when the material was de-exempted) as having been lost during processing. In October 2003, Iran further acknowledged that, contrary to its previous statements, practically all of the materials important to uranium conversion had been produced in laboratory and bench scale experiments (in kilogram quantities) carried out at TNRC and at ENTC between 1981 and 1993 without having been reported to the Agency. The information provided in Iran's letter of 21 October 2003 stated that, in conducting these experiments, Iran had also used yellowcake imported by Iran in 1982 but only confirmed in 1990

[4] In the form of $UF_6$ (1000 kg), $UF_4$ (400 kg) and $UO_2$ (400 kg).

as having been received.[5] Iran subsequently explained that it had decided to stop domestic R&D on $UF_4$ and $UF_6$ in 1993 in anticipation of its receipt of assistance from a foreign supplier in the design and construction of UCF.

15. The extensive UCF design documentation said to have been provided by the foreign supplier was made available to the Agency. Based on an examination of a selection of that documentation, and taking into account the declarations by Iran concerning its UCF related conversion experiments, Agency conversion experts concluded that Iran's declaration that UCF was being built essentially on the basis of this documentation, augmented by the results of the indigenous experiments, appeared to be credible.

16. The Agency has also sought to confirm the declarations of Iran concerning the quantities of nuclear material involved in Iran's conversion experiments. Given the inherent difficulties with investigating activities that ended over a decade ago, it is not possible to verify in detail the chronologies and descriptions of the experiments which took place in Iran. Thus, the Agency's activities have had to focus on assessing the consistency of the information provided by Iran and examining the remaining equipment and nuclear material.

17. In this context, the Agency focused its investigation on the small quantities of nuclear material said to have been used and produced during these experiments in light of the size, quality and capacity of the equipment involved, and the status and use of the equipment during the period between when the activities were said to have ceased (between 1991 and 1993) and April 1999, when most of the equipment was said to have been dismantled and put into storage until January 2004[6]. Taking into account the age of the activities and the lack of records with regard to the amount of uranium (especially that said to be contained in waste), a precise nuclear material accounting is not possible. However, examination of the equipment prior to and during its destruction revealed the equipment to be in very good condition and apparently to have been little used, which is consistent with the declared scale of its use.

18. As indicated in the Director General's last report to the Board (GOV/2004/60), further follow-up on Iran's conversion activities will be carried out as a routine safeguards implementation matter.

***Intended uses of UCF products***

19. In the design information for UCF provided in July 2000, the facility was described as being intended for the conversion of UOC into $UF_6$, for enrichment outside Iran, and for the subsequent conversion (at UCF) of: low enriched $UF_6$ into low enriched $UO_2$ (5% U-235); low enriched $UF_6$ into low enriched uranium metal (19.7% U-235); and depleted $UF_6$ into depleted $UF_4$. In the course of a DIV in 2002, the Agency noticed that the depleted $UF_4$ process line had been extended to include a process line for uranium metal production, and requested Iran to submit updated design information, which it did in April 2003. Following its declaration in February 2003 of the Pilot Fuel Enrichment Plant (PFEP) and the Fuel Enrichment Plant (FEP) at Natanz, Iran also acknowledged that it intended to carry out enrichment of $UF_6$ domestically, up to 5% U-235, as per the declared maximum enrichment level for PFEP and FEP. Iran has not provided specific information on the intended source of the 19.7% enriched $UF_6$ which will serve as feed for the production at UCF of 19.7% enriched uranium metal, as declared by Iran, but did indicate in 2000 that it would be secured from abroad.

---

[5] In addition, it should be noted that, in 1982, Iran imported 531 t of natural $U_3O_8$ concentrate, which it reported to the Agency in 1990.

[6] In January 2004, the equipment was examined by the Agency and the nuclear material hold-up recovered therefrom. At the initiative of the Iranian authorities, the equipment was destroyed in the course of these recovery activities.

20. Before the revelation by Iran in October 2003 of its laser enrichment programme, various explanations were given for the intended use of uranium metal. In July 2003, Iranian officials explained, that, "[i]n the early [1990's] when the country decided to reconsider its nuclear program, we were not sure whether it will consist of CANDUs, Magnox [reactors], or LWRs. Therefore, it was decided to include a U-metal production line in UCF, which could also be used to produce shielding material. However, as the picture is now more clear, uranium metal experiments could be considered as a process to gain know-how in nuclear material production."[7] The rationale given for the production of depleted uranium metal was to reduce the storage requirements for depleted $UF_6$.

21. In its letter of 21 October 2003, Iran acknowledged that the uranium metal had been intended not only for the production of shielding material, as previously stated, but also for use in its laser enrichment programme (the existence of which, as discussed below, Iran had previously not acknowledged, and which was only declared to the Agency in that same letter of 21 October 2003). Iran stated that the uranium metal process line at UCF had been developed by Iranian scientists at the TNRC laboratories, and that a small quantity of the metal produced at TNRC during the development tests (about 2 kg) had been given to the laser group for its evaluation.

22. In light of this, the declared rationale for the original construction of the natural uranium metal process line at UCF (i.e. the supply of uranium metal to its laser enrichment programme) is credible.

### A.1.3. Uranium Enrichment – Gas Centrifuge Technology

### Development

23. In 1985, Iran initiated its efforts in gas centrifuge enrichment with a search of available technical literature. In 1987, Iran acquired through a clandestine supply network drawings for a P-1 centrifuge, along with samples of centrifuge components. According to Iran, gas centrifuge R&D testing began at TNRC in 1988 and continued there until 1995, when those activities were moved to a workshop of the Kalaye Electric Company, a company in Tehran belonging to the Atomic Energy Organization of Iran (AEOI). Between 1994 and 1996, Iran received another — apparently duplicate — set of drawings for the P-1 centrifuge design, along with components for 500 centrifuges. According to Iran, it was at this time as well when Iran received design drawings for a P-2 centrifuge through the same network. Between 1997 and 2002, Iran assembled and tested P-1 centrifuges at the Kalaye Electric Company workshop where Iran says it fed $UF_6$ gas into a centrifuge for the first time in 1999 and, in 2002, fed nuclear material into a number of centrifuges (up to 19 machines).

24. In 2001, Iran began the construction of two facilities at Natanz: the smaller scale PFEP, planned to have some 1000 centrifuges for enrichment up to 5% U-235; and the large scale commercial FEP, which is planned to contain over 50 000 P-1 centrifuges for enrichment up to 5% U-235.

25. On 25 June 2003, Iran introduced $UF_6$ into the first centrifuge at PFEP. As of October 2003, the installation of a 164-machine cascade was being finalized. In November 2003, the cascade was shut down. As of the Agency's latest inspection on 11 October 2004, the cascade had not been operated and no further $UF_6$ gas had been fed into centrifuges at PFEP. FEP has been scheduled to start receiving centrifuges in early 2005, after the design is confirmed by the tests to be conducted in PFEP.

26. According to Iran, the only work that has been done on the P-2 design was carried out between 2002 and 2003, largely at the workshop of a private company under contract with the AEOI, and the work was limited to the manufacture and mechanical testing of a small number of modified P-2

---

[7] Candu reactors use natural uranium oxide fuel; Magnox reactors use natural uranium metal fuel; and light water reactors (LWRs) use enriched uranium oxide (generally less than 5% U-235).

composite rotors. Iran has stated that "no other institution (including universities), company or organization in Iran has been involved in P-2 R&D" and that "no P-2 R&D has been undertaken by or at the request of the Ministry of Defence". Iran has also said that all R&D on P-2 centrifuges had been terminated and that no other work on that, or any other centrifuge design, was done prior to 2002 or has been done since 2003. However, in its Additional Protocol declarations, Iran has foreseen P-2 R&D activities for the future.

## Findings

27. Between February and October 2003, Iran took a number of steps intended to conceal the origin, source and extent of Iran's enrichment programme, including: denying access to the Kalaye Electric Company workshop in February 2003 and refusing to permit the Agency to take environmental samples there in March 2003; dismantling equipment used at the workshop and moving it to Pars Trash (another subsidiary company of the AEOI located in Tehran); renovating part of the Kalaye Electric Company workshop in order to prevent detection of the use of nuclear material; and submitting incorrect and incomplete declarations. A detailed description of these efforts is reflected in the previous reports of the Director General to the Board.[8]

28. Following adoption by the Board of its resolution in September 2003,[9] on 16 October 2003, H.E. Dr. H. Rohani, Secretary of the Supreme National Security Council of Iran, informed the Director General that a decision had been taken to provide the Agency with a full disclosure of Iran's past and present nuclear activities. On 21 October 2003, Iran submitted to the Agency a letter providing what it described as a full picture of its nuclear activities, in which it acknowledged, inter alia, its use of nuclear material in the testing of centrifuges.

### *P-1 Centrifuge Programme*

29. In February 2003, in response to Agency enquiries since August 2002 prompted by open source reports, Iran acknowledged for the first time the existence of the two centrifuge enrichment plants under construction at Natanz: PFEP and FEP. Iran also acknowledged that the Kalaye Electric Company workshop in Tehran had been used for the production of centrifuge components, but stated that there had been no testing of centrifuges assembled from these components involving the use of nuclear material, either at that workshop or at any other location in Iran.

30. According to information provided at that time by Iran, the design, research and development work, which it said had been started only five years earlier (i.e. 1997), had been based on information available from open sources and extensive computer modelling and simulation, including tests of centrifuge rotors without nuclear material. In June 2003, Iran reiterated that its centrifuge R&D had commenced only in 1997, with centrifuge testing having taken place in the Plasma Physics buildings of TNRC. The Agency was shown the areas within the buildings where the testing was said to be been conducted, and was again told that no nuclear material had been used during the test programme. Based on their own observations and their discussions with Iranian authorities, the Agency enrichment technology experts concluded that it was not possible for Iran to have developed enrichment

---

[8] GOV/2003/40, paras 25–29; GOV/2003/63, paras 27–43; GOV/2003/75, paras 30–41, Annex 1 paras 34–65; GOV/2004/11, paras 32–55; GOV/2004/34, paras 22–30, Annex paras 21–45; and GOV/2004/60, paras 22–32, Annex paras 17–39.

[9] In resolution GOV/2003/69, the Board of Governors decided it was essential and urgent for Iran to take a number of measures by the end of October 2003, including "providing a full declaration of all imported material and components relevant to the enrichment programme, especially imported equipment and components stated to have been contaminated with high enriched uranium particles, and collaborating with the Agency in identifying the source and date of receipt of such imports and the locations where they have been stored and used in Iran."

technology to the level seen at Natanz based solely on open source information, computer simulation and mechanical testing.

31. In August 2003, Iran amended these statements, informing the Agency that the decision to launch a centrifuge enrichment programme had actually been taken in 1985, and that Iran had in fact received drawings of the P-1 centrifuge through a foreign intermediary around 1987. Iran stated that the centrifuge R&D programme had been situated at TNRC between 1988 and 1995, and had been moved to the Kalaye Electric Company workshop in 1995. According to Iran, the centrifuge R&D activities were carried out at the Kalaye Electric Company workshop between 1995 and 2003, and were moved to Natanz in 2003.

32. During its August 2003 visit to Iran, the Agency was shown electronic copies of the centrifuge engineering drawings (including the general arrangement, sub-assembly and component drawings). Agency inspectors were also able to visit and take environmental samples at the Kalaye Electric Company workshop, where they noted that, since their first visit to the workshop in March 2003, considerable renovation had been made to one of the buildings on the site. As was anticipated by the Agency at the time, the renovation, which was carried out in connection with Iran's attempt to conceal the activities carried out there, has interfered with the Agency's ability to resolve issues associated with Iran's centrifuge enrichment programme, since the Agency was unable to see the equipment in situ and could not take environmental samples while the equipment was there.

33. In its letter of 21 October 2003, Iran finally acknowledged that "a limited number of tests, using small amounts of $UF_6$," had been conducted in 1999 and 2002 at the Kalaye Electric Company workshop. [10]

34. In October/November 2003 and again in October 2004, Agency inspectors interviewed a former official of the AEOI, said by Iran to have been involved in its centrifuge R&D work from 1987 until he left the Kalaye Electric Company in 2001. During the latter meeting, he provided, in particular, details on the negotiations which had resulted in Iran's procurement around 1987 of the P-1 design (and sample components), and on the supply of the duplicate set of P-1 designs and the components for 500 P-1 centrifuges, delivered through intermediaries to Iran in two shipments said to have taken place in March 1994 and July 1996, and the supply of bellows in 1997 to replace previously provided poor quality bellows. He also confirmed that meetings with the intermediary continued after 1996, and included discussions on technical issues. According to the information provided by Iran, 13 official meetings took place with the clandestine supply network between 1994 and 1999.

35. Iran has been requested to provide information on what, if any, meetings related to Iran's centrifuge programme took place prior to 1994. The Agency has also requested Iran to present the shipping documents associated with the 1994 and 1996 deliveries, and to provide information on the content of the technical discussions held with the intermediaries and explain why no meetings involving AEOI officials took place after June 1999.

36. In addition to its enquiries into Iran's acquisition of enrichment technology, the Agency has conducted extensive environmental sampling (approximately 300 samples) at locations where Iran has

---

[10] In a meeting with Agency enrichment technology experts shortly following that letter, the Iranian authorities explained that the tests had involved the 1.9 kg of $UF_6$ that had been imported in 1991 (and not declared to the Agency until February 2003), the absence of which the Iranian authorities had earlier attempted to conceal by attributing its loss to evaporation due to leaking valves on the bottles containing the gas during their storage in a room under the roof of the Tehran Research Reactor (TRR) building. In a letter dated 4 February 2004, Iran modified its explanation for the contamination, stating that the source probably had been leakage of bottles containing $UF_6$ which had been produced through R&D conversion activities carried out between 1991 and 1993 (not the $UF_6$ imported in 1991, as Iran had initially informed the Agency) stored there between 1997 and 1998. The Agency continues to regard as not technically plausible Iran's explanation that the contamination was due to leaking bottles. However, the Agency will only be able to pursue this issue if new information becomes available to it.

declared that centrifuge components were manufactured, processed and/or stored (including Natanz, the Kalaye Electric Company workshop, TNRC, Farayand Technique, Pars Trash and centrifuge component manufacturing workshops in Iran), as necessary, with a view to assessing the correctness and completeness of Iran's declarations concerning its enrichment activities.

37. Analysis of these environmental samples has revealed particles of LEU and HEU[11] indicative of types of nuclear material that are not included in Iran's inventory of declared nuclear material, and has thus called into question the completeness of Iran's declarations about its centrifuge enrichment activities. The Iranian authorities have attributed the presence of these particles to contamination originating from imported centrifuge components. In that context, Iran has stated that it has not enriched uranium beyond 1.2% U-235 using centrifuges.

38. The analytical results from the environmental sampling have been studied carefully by the Agency. The most important observations from the results available to date can be summarized as follows:

a. Domestic components showed predominantly LEU contamination, while imported components showed both LEU and HEU contamination;

b. The contamination at PFEP differed from that found at the Kalaye Electric Company workshop and at its subsidiary Farayand Technique;

c. The samples taken from the imported components that were used in the manufacturing workshops and are now stored at Natanz and Pars Trash, as well as samples taken from the Kalaye Electric Company workshop and the balancing machines used there, showed enrichments up to about 70% U-235, but practically no depleted uranium;

d. The LEU and HEU particles in many samples have an elevated U-236 content that suggests the use of recycled uranium as a feed material; some of the results provided to the Agency by a possible country of origin also have an elevated U-236 content (albeit at a different level);

e. Regarding particles of ~36% U-235 (in the range of 32%–38%):

   (i) 36% U-235 contamination was found at the Kalaye Electric Company workshop (mainly in one room) and on the balancing machines which had been relocated from the workshop to Farayand Technique;

   (ii) at the workshop, there were significantly more particles of 36% U-235 compared to the number of particles of U-235 with other enrichment levels;

f. Numerous particles of ~54% U-235 (in the range of 50%-60%) were found on imported components and on tested rotors assembled using the imported components; some ~54% U-235 contamination was also found at the Kalaye Electric Company workshop; and

g. Some particles of 54% U-235 were found in a sample collected from the chemical traps of the PFEP, which had not yet commenced operation at the time the sample was taken.

---

[11] High enriched uranium (HEU) is uranium enriched to 20% or above in the isotope U-235; low enriched uranium (LEU) is uranium enriched to between 0.72% and 20% U-235.

39. Based on the above, and other verification activities of the Agency, the Agency's current assessment regarding the contamination issue is as follows:

- From information provided by the State from which most of the imported P-1 centrifuge components originated, it appears that not all HEU particles found in the samples taken in Iran came from that State;
- It is possible that the domestic components sampled were produced in relatively clean conditions and that they had not been used in an enrichment process but had been contaminated through quality control equipment used on both imported and domestic components;
- It seems plausible that the HEU contamination found at the Kalaye Electric Company workshop and at Natanz may not have resulted from the enrichment of uranium at these particular locations in Iran; however, further investigation is necessary (e.g. on the chemical and physical composition of particles and on samples taken at the point of origin of the components) before a firm conclusion can be drawn.

40. In summary, the Agency's current overall assessment is that the environmental sampling data available to date tends, on balance, to support Iran's statement about the origin of much of the contamination. However, while contamination due to imported components and equipment is one possible explanation, other possible explanations continue to be investigated by the Agency, including the possibility of the contamination having resulted from undeclared enrichment activities conducted by Iran, from imported uranium not declared to the Agency and/or from contaminated equipment imported from sources other than those known to the Agency. The Agency has visited three locations in another State where, according to Iran, the centrifuge components had been located in the mid-1990s. Environmental samples have been taken from the warehouses and from some of the equipment situated there, the analysis of which is in progress.

41. In addition, the Agency has asked to be allowed to sample the centrifuges and centrifuge components at relevant locations in the State from which most of the imported components originated, so that the Agency may independently analyse the samples. Such independent sampling and analysis may enable the Agency to confirm the actual source of contamination and the correctness of statements made by Iran. Consultations on this matter are progressing, and agreement can be expected shortly on the appropriate modalities for such sampling.

***P-2 Centrifuge Programme***

42. In January 2004, in response to a follow-up inquiry by the Agency on Iran's centrifuge enrichment programme, Iran acknowledged, for the first time, that it had received in 1994 P-2 centrifuge drawings from foreign sources. Iran also stated that the AEOI had concluded a contract with the owner of a private company located in Tehran to develop a P-2 centrifuge, and that some mechanical tests had been conducted, without nuclear material, on a small number of domestically manufactured rotors based on a modified P-2 design. In its communication of 5 March 2004[12], Iran indicated that R&D activities on P-2 centrifuges had not been mentioned in its 21 October 2003 declaration because "Iran intended to submit information on $P_{II}$ along with further declarations it is required to provide in accordance with its obligations under the Additional Protocol within the timetable established by the IAEA."

43. In clarifications provided in April and May 2004, Iran stated that the P-2 drawings had been received around 1995, but that, due to a shortage in professional resources and changes in AEOI

[12] Reproduced in Agency document INFCIRC/628.

management, priority was placed at that time on resolving difficulties being encountered by Iran in connection with the P-1 centrifuge, and that no actual work on the P-2 centrifuge had commenced until after the contract was concluded in early 2002.

44. The Agency has been able to interview the owner of the private company on a number of occasions since then. According to the contractor, he first saw the design for the P-2 centrifuge in early 2002, and after having received copies and reviewing them, he had decided that, since in his view Iran was not capable of manufacturing maraging steel cylinders with bellows, work should proceed with a shorter, sub-critical carbon composite rotor. He explained further that he had manufactured seven rotors and had performed some mechanical tests on them, but without using nuclear material. He said that the contract was terminated in March 2003, but that he continued to work on his own until June 2003, and that all of the centrifuge equipment had been moved to Pars Trash. In October 2004, the Agency also interviewed the former AEOI official referred to above, who was said to have originally received the P-2 centrifuge design. During these discussions, he described the negotiations that had led to the supply of the P-2 design drawings, which he recalled as having taken place around 1995 or 1996, as well as the reasons for the apparent gap of seven years before the R&D test work on the P-2 design had begun.

45. The Iranian authorities have stated that Iran did not obtain any P-2 centrifuges from abroad, and that the components that it did have had been produced domestically in the contractor's workshop, with the exception of some raw materials and minor items supplied to the contractor by the P-1 R&D team, and a few items which had been purchased from abroad in connection with the P-2 contract, such as bearings, oils and magnets. The contractor acknowledged that he had made enquiries with a European intermediary about the procurement of 4000 magnets with specifications suitable for use in P-2 centrifuges and that he had also mentioned to the intermediary the possibility of much higher numbers in order to attract the supplier and to get a good price by suggesting that larger orders would follow. The Iranian authorities have stated that no magnets were actually delivered by that intermediary to Iran, but that imported magnets relevant to P-2 centrifuges had been procured from other foreign suppliers in 2002.

46. The Agency has reiterated its previous requests for further information from Iran, along with supporting documentation, on the procurement of magnets for the P-2 centrifuges (in particular, on the sources of all such magnets), including attempted procurement and enquiries about procurement, and the procurement of any other relevant components, with a view to facilitating completion by the Agency of its assessment of the P-2 experiments said to have been carried out by the private contractor. In October 2004, Iran provided the Agency with more information in this regard, which is currently being assessed. However, there remains further information requested by the Agency which has yet to be provided.

47. After a number of requests by the Agency, on 19 October 2004, Iran finally provided the Agency with copies of the contract and the report, which had been informally translated by Iran in April 2004. These documents appear to confirm the Iranian statements about the nature of the work requested of and carried out by the contractor between 2002 and 2003.

48. Iran has reiterated that no work was carried out on the P-2 design (or any centrifuge design other than the P-1 design) prior to 2002. The reasons given by Iran for the apparent gap between 1995 and 2002, however, do not provide sufficient assurance that there were no related activities carried out during that period, particularly given that the contractor was able to make the modifications necessary for the composite cylinders within a short period after early 2002 when, according to Iran, he had seen the drawings for the first time. The Agency is attempting to verify this information, inter alia, through the network of suppliers.

## A.1.4. Uranium Enrichment – Laser Technology

### Development

49. Between 1975 and 1998, Iran concluded with four foreign suppliers contracts related to laser enrichment using both atomic vapour laser isotope separation (AVLIS) and molecular laser isotope separation (MLIS) techniques. In connection with the first two contracts, the Agency has confirmed that the AVLIS spectroscopy equipment Iran received never properly functioned, and that Iran did not receive all of the components of the MLIS equipment.

50. In connection with the third contract, Iran carried out testing in the supplied Laser Separation Laboratory (LSL) and Comprehensive Separation Laboratory (CSL) at TNRC between 1993 and 2000, and dismantled the supplied equipment between 2000 and 2003.

51. With assistance provided by the fourth supplier, Iran established a pilot plant for isotope separation at Lashkar Ab'ad in 2002, where it conducted laser enrichment experiments in December 2002 and January 2003. Iran dismantled the equipment in May 2003. Iran has stated that it currently has no plans to resume the enrichment of uranium using laser isotope separation. It has indicated that it is continuing with its R&D on laser activities, such as those involving copper vapour lasers (CVLs) and Nd:YAG lasers, but that that work is not part of a programme to use such lasers for uranium enrichment.

### Findings

52. As with respect to its centrifuge enrichment activities, Iran's responses between February 2003 and October 2003 to the Agency's enquiry into the possible existence in Iran of a laser enrichment programme were characterized by concealment, including the dismantling of the laser enrichment laboratories at TNRC and the pilot laser enrichment plant at Lashkar Ab'ad and the transfer of the equipment and material involved to Karaj, and by failures to declare nuclear material, facilities and activities.

53. Although Iran acknowledged the existence of a substantial programme on lasers in May 2003, it stated that no uranium enrichment related laser activities had taken place in Iran and that it currently had no programme for laser isotope separation. The Agency requested at that time to visit a laser laboratory at Lashkar Ab'ad, which it was allowed to do only in August 2003. During that visit, Iran stated that the laboratory had been devoted to laser fusion research and laser spectroscopy, and reiterated that no nuclear material had been involved in the laser experiments. In early October 2003, the Iranian authorities acknowledged that Iran had imported, and installed at TNRC, laser related equipment imported from two States in 1992 and 2000 in connection with those studies. At that time, Agency inspectors were finally permitted to take environmental samples at Lashkar Ab'ad. The inspectors also visited a warehouse at the AEOI's Nuclear Research Centre for Agriculture and Medicine (NRCAM) at Karaj, and took environmental samples from a large vacuum vessel and associated hardware stored there. The Iranian authorities stated that the equipment had been imported in 2000, that it had never been used, and that it had now been packed for shipment back to the manufacturer, since the contract related to its supply had been terminated by the foreign partner in 2000.

54. In its letter dated 21 October 2003, Iran finally acknowledged that, between 1975 and 1998, it had concluded contracts related to laser enrichment using both AVLIS and MLIS techniques with four

foreign entities[13]. In the letter, Iran provided detailed information on the various contracts, and acknowledged that it had carried out laser enrichment experiments using previously undeclared imported uranium metal at TNRC between 1993 and 2000, and that it had established a pilot plant for laser enrichment at Lashkar Ab'ad, where it had also carried out experiments using imported uranium metal. According to information provided subsequently by the Iranian authorities, the equipment used there had been dismantled in May 2003, and transferred to Karaj for storage together with the uranium metal used in the experiments, before the Agency was permitted to visit Lashkar Ab'ad in August 2003. The equipment and material were presented to Agency inspectors at Karaj on 28 October 2003.

55. During the Agency's complementary access to the mass spectrometry laboratories at Karaj in December 2003, the Agency examined two mass spectrometers that had not been included in Iran's declaration of 21 October 2003. Iran acknowledged that the mass spectrometers had been used at Karaj in the past to provide analytical services (isotope enrichment measurements) to the AVLIS programme, and gave the Agency a list of samples that had been analysed. The Agency collected environmental samples from the mass spectrometers; no uranium particles were found in these samples. As requested by the Agency following complementary access at Karaj, Iran submitted additional information to the Agency on 5 January 2004 to clarify the role of the mass spectrometers in relation to Iran's uranium enrichment programme. The laboratory containing the equipment is now part of the safeguarded facility at Karaj.

56. The Agency has reviewed a number of documents provided by Iran in May and August 2004 on the operation of the LSL and CSL prior to their dismantlement in 2000, taken environmental samples, and held discussions with Iranian officials on this matter. The Agency's review indicates that the equipment at the CSL operated fairly well until 1994, when foreign scientists completed their work. According to Iran, "the enrichment separation envisaged in the contract [for the CSL], and in some experiments higher enrichment were achieved in mgr" (the contract provided for "getting one milligram Uranium enriched with 3% concentration of U235 in no longer than eight hours"). As confirmed in an analysis which had been carried out by the foreign laboratory involved in the project, the results of which were given to the Agency by Iran, the highest average enrichment achieved was 8%, and the peak enrichment was 13%. According to the information provided to the Agency, a total of 8 kg of the 50 kg of uranium metal also supplied under the relevant contract (and not previously declared to the Agency), had been used in LSL and CSL experiments. However, according to Iran, 500 g of it was vapourized in the experiments, in the course of which only milligram quantities of enriched uranium were collected. Examination by the Agency of the laboratory notebook and other supporting documents provided by Iran tends to confirm Iran's statement that isotope separation was not successful after 1994, due to continuous technical problems encountered with CVLs, electron beam guns and dye lasers.

57. The contract for the supply of AVLIS equipment to Lashkar Ab'ad was followed by the conclusion of a number of related agreements with the same supplier. Iran has stated that, due to the inability of the supplier to secure export licences for some of the equipment, only some of it, along with some training and documentation, was provided under the contract. Iran has stated that it made attempts to procure the missing equipment, such as additional CVLs and electron beam guns, with limited success. According to Iranian officials, as a consequence of these difficulties, Iran took advantage of the existing CVLs and dye lasers from CSL acquired under the earlier contracts, and installed them in the pilot scale vessel in Lashkar Ab'ad, where it carried out experiments involving about 500 g of the 50 kg of uranium metal referred to above. Iran has declared that enrichment levels

[13] For a detailed description of these contracts and their implementation, see GOV/2003/75, the report of the Director General to the Board of Governors for its November 2003 meeting.

of 0.8% U-235 were achieved during these experiments. The results of the Agency's analysis to date indicate enrichment levels (0.99% U-235 $\pm$ 0.24%) consistent with those declared by Iran.

58. While the contract for the AVLIS facility at Lashkar Ab'ad was specifically written for the delivery of a system that could demonstrably achieve enrichment levels of 3.5% to 7%, it is the opinion of Agency experts that the system, as designed and reflected in the contract, would have been capable of HEU production had the entire package of equipment been delivered. In response to Agency questions in connection with this assessment, Iran referred to the contract and the design parameters contained therein, and provided information demonstrating the very limited capabilities of the equipment actually delivered to Iran under this contract to produce HEU (i.e. only in gram quantities). Iranian AVLIS researchers maintain that they were not aware of the significance of these features when they negotiated and contracted for the supply and delivery of the Lashkar Ab'ad AVLIS facility.

59. The Agency has completed its review of Iran's AVLIS programme and has concluded that Iran's descriptions of the levels of enrichment achieved using AVLIS at the TNRC CSL and at Lashkar Ab'ad and the amounts of material used in its past activities are consistent with information available to the Agency to date. Iran has presented all declared key equipment, which has been verified by the Agency. If, as stated by Iran, the evaporated uranium and some collectors were discarded as waste, mainly at the Qom disposal site, recovery of the small quantities of nuclear material involved would not be feasible and therefore accurate nuclear material accountancy is not possible. The Agency will continue to monitor laser related activities in Iran as a routine safeguards implementation matter.

### A.1.5. Fuel Fabrication

### Development

60. In 1985, Iran brought into operation a Fuel Fabrication Laboratory (FFL) at Esfahan, about which it informed the Agency in 1993 and for which design information was provided to the Agency in 1998. It is still in operation, and is suitable for producing, on a small scale, fuel pellets.

61. The fuel manufacturing plant to be constructed at Esfahan (FMP) is scheduled to be commissioned in 2007. According to the preliminary design information that has been provided by Iran, the facility is planned to produce 40 t per year of $UO_2$ fuel (with a maximum enrichment of 5%) for research and power reactors.

62. Iran is also building a Zirconium Production Plant (ZPP) at Esfahan which, when complete, will have a capacity to produce 10 t of zirconium tubing per year.

### Findings

63. In a letter dated 5 May 2003, Iran informed the Agency of its plan to commence in 2003 the construction of FMP. On 1 November 2003, Iran submitted preliminary design information for FMP stating that the plant capacity would be 30 t $UO_2$ per year. On 31 August 2004, Iran submitted updated design information which reflected an increase in plant capacity to 40 t $UO_2$ per year, declared to have been to accommodate the fuel needs for the Bushehr Nuclear Power Plant (BNPP) (about 25 t $UO_2$ per year) and the 40 MW pressurized heavy water research reactor (IR-40) (about 10 t $UO_2$ per year).

## A.1.6. Reactor Programme

### Development

64. Iran currently has three research reactors in operation[14] under Agency safeguards:

- TRR, located at the TNRC — a 5 MW pool type light water research reactor which has been in operation since the late 1960s; it originally used high enriched uranium aluminium (U/Al) alloy fuel, but was reconfigured in the early 1990s, and now uses fuel of $U_3O_8$/Al enriched to around 20% U-235;
- The Miniaturized Neutron Source Reactor (MNSR), located at ENTC — a 30 kW light water reactor, in operation since the mid-1990s, that uses U/Al fuel enriched to 90.2% U-235; and
- The Heavy Water Zero Power Reactor (HWZPR), also located at ENTC — a 100 W heavy water reactor, in operation since the mid-1990s, that uses natural uranium metal fuel.

65. In addition, Iran is in the process of constructing the IR-40 at Arak (although originally planned to be built at Esfahan, a decision is said to have been taken in 2002 to build the reactor at Arak instead). The basic design of the IR-40 was completed in 2002, and provides for the use of natural uranium oxide as fuel. It is planned to go into operation in 2014. Iran is also building a heavy water production plant (HWPP) at Arak, and has said that it intends to start producing heavy water there in 2004.

66. Unit 1 of BNPP is a 1000 MW(e) light water reactor designed to use low enriched uranium oxide (up to 5% U-235). It is scheduled to reach first criticality in 2006.

### Findings

67. During the Director General's visit to Iran in February 2003, Iran confirmed open source information about the construction of the HWPP. Although no specific information was provided on its intended use, Iran pointed to the possibility of exporting heavy water. In May 2003, Iran informed the Agency about its construction of the IR-40 reactor, and provided the Agency with preliminary design information for the reactor. Iran subsequently informed the Agency that a decision to start R&D for a heavy water reactor programme had been taken in the early 1980s, and that, in the mid-1980s, laboratory scale experiments had been carried out at ENTC on the production of heavy water. Iran further stated that a decision to construct a heavy water reactor had been taken in the mid-1990s.

68. On 12 July 2003, the Iranian authorities made a presentation on the technical features of IR-40, said to have been based on indigenous design. The purpose of the reactor was declared to be research and development and the production of radioisotopes for medical and industrial use. During a visit to Iran in July 2003, Agency inspectors were provided with drawings of the IR-40. The drawings contained no references to hot cells, even though the declared purpose of the facility was radioisotope production. The Agency raised this issue with the Iranian authorities, particularly in light of open source reports of recent efforts by Iran to acquire from abroad heavy manipulators that would be suitable for use in large hot cells.

69. In its letter of 21 October 2003, Iran acknowledged that two hot cells had been foreseen for the reactor project. In that letter, Iran also made reference to its plans for nine hot cells for the production of radioisotopes (molybdenum, iodine, xenon, cobalt-60 and iridium-192); specifically, "four for the production of radioisotopes, two for the production of cobalt and iridium and three for waste

---

[14] Iran also has at Esfahan a light water sub-critical reactor (LWSCR) using uranium metal fuel, which operates a few days out of the year, and a decommissioned graphite sub-critical reactor (GSCR) which also used uranium metal fuel.

management processing" (along with ten back-up manipulators). According to the information provided in that letter, however, neither the design nor detailed information about the dimensions or the actual layout of the hot cells were available yet, since the Iranian authorities did not know the characteristics of the manipulators and lead glass shielding windows which they could procure. In the IR-40 design information provided by Iran in November 2003, Iran confirmed that it had tentative plans for a building, in the proximity of the IR-40 facilities, with hot cells for the production of "long lived radioisotopes" [15]. Iran agreed to submit the relevant preliminary design information with respect to that building in due course. In May 2004, Iran provided updated design information for the reactor, in which it noted that the planning of hot cells for "long lived radioisotopes" was no longer under consideration in light of difficulties with the procurement of equipment.

70. In August 2004, Iran presented to the Agency detailed drawings that Iran had received from a foreign company in 1977 for hot cells that were to have been constructed at Esfahan. Iran stated that it had not yet made more detailed plans for hot cells for the IR-40 complex at Arak, but that it had used information from those drawings as the basis for specifications in its efforts to procure manipulators for hot cells intended for the production of cobalt and iridium isotopes. In a letter dated 19 August 2004 Iran reconfirmed the nine hot cell project at Arak. During its October 2004 visit to Iran, the Agency showed Iran evidence of Iran's enquiries about the purchase of hot cell manipulators and lead glass windows, and requested clarification of how such precise and detailed specifications could have been provided on a procurement request if no preliminary hot cell designs existed. In response, Iran gave the Agency documents relevant to other enquiries about lead glass windows. Iran reiterated, however, that the specifications it had used for its enquiries had been based on designs provided by a foreign supplier in the 1970s, as well as on its own experience with the hot cells at the MIX Facility (a laboratory for the production of radioisotopes of molybdenum, iodine and xenon from natural uranium oxide) at TNRC. Iran provided a sketch of the hot cells with a calculated capability of handling activity levels from 100 to 10 000 curies (3.7 to 370 TBq). However, Iran stated that the design would be completed only upon successful procurement by Iran of manipulators and lead glass windows. The Agency has received some of the requested information from Iran, which it is assessing, but is still awaiting other information.

## A.1.7. Reprocessing

### Development

71. Between 1988 and 1993, Iran carried out plutonium separation experiments at TNRC. The shielded glove boxes in which these experiments were carried out were dismantled in 1993, relocated to JHL and used for other purposes. In 1995, Iran started constructing the MIX Facility. However, as the neutron flux of TRR is not sufficient for the production of the radioisotopes referred to above using natural uranium targets, the facility has not yet been commissioned.

### Findings

72. In its letter of 21 October 2003, Iran acknowledged the irradiation of depleted $UO_2$ targets at TRR and subsequent plutonium separation experiments in shielded glove boxes in the Nuclear Safety Building of TNRC. Neither the activities nor the separated plutonium had been reported previously to the Agency.

73. In meetings held in Iran between 27 October and 1 November 2003, Iran provided additional information about these experiments. According to Iranian officials, the experiments took place between 1988 and 1993, and involved pressed or sintered $UO_2$ pellets prepared at ENTC using

[15] Cobalt-60 and iridium-192 have half-lives of 5.2 years and 74 days, respectively.

depleted uranium that had been exempted from safeguards in 1978. Iran stated that the capsules containing the pellets had been irradiated in TRR in connection with a project to produce fission product isotopes of molybdenum, iodine and xenon, and that some of the capsules had been processed and the plutonium separated. The plutonium separation was carried out at TNRC in three shielded glove boxes, which, according to Iran, were dismantled in 1993 and moved to the JHL building, where the glove boxes were used for iodine production until 1999. They were dismantled in 1999, decontaminated and sent to ENTC in 2000, where they have been stored along with related equipment since then. Iran has stated that these experiments were carried out to learn about the nuclear fuel cycle, and to gain experience in reprocessing chemistry.

74. On 8 November 2003, the Agency was able to take samples from the separated plutonium, which was presented to the Agency in the form of plutonium solution contained in two bottles, one of which had completely leaked out of its container. During their inspection at JHL, Agency inspectors were also shown four heavily shielded containers said by Iran to contain the unprocessed irradiated targets. The containers had been buried on the site of TNRC, but were dug up and presented to the Agency for verification. Using available non-destructive analysis equipment, Agency inspectors were able to confirm that one of the containers (selected at random) contained highly radioactive material characteristic of irradiated targets. All four containers have been placed under Agency seal for future examination.

75. However, on the basis of information available to it as of November 2003, the Agency concluded: that the amount of separated plutonium declared by Iran had been understated (quantities in the milligram range rather than the microgram range as stated by Iran); that the plutonium samples taken from a glove box said to have been involved had plutonium-240 (Pu-240) abundance higher than that found in the plutonium solution bottles presented; that there was an excess amount of americium-241 (Am-241) in the samples; and that the age of the plutonium solution in the bottles appeared to be less than the declared 12–16 years.

76. On the basis of a subsequent recalculation carried out by it using corrected irradiation data and a corrected equation, Iran acknowledged in May 2004 that its theoretical estimations of the quantities of plutonium produced had been understated (micrograms rather than milligrams) and accepted the Agency's estimate of about 100 mg as having been correct.

77. Iran has stated that the plutonium with higher Pu-240 abundance originated from work carried out between 1982 and 1984 at the TNRC Radiochemistry Laboratory on the production of smoke detectors using Am-241. Iran stated that the Am-241 had been imported from abroad prior to the Iranian revolution in 1979, and explained that, in 1990, the glove box that had been used in connection with the Am-241 had been transferred to the building where the plutonium separation took place, but that it had been used for training purposes and not for plutonium experiments. This work, in Iran's view, not only explained the Pu-240 contaminant, but also the high Am-241 content in the samples. According to Iran, the glove box involved in this work, along with other glove boxes, was moved in 2000 to a warehouse at ENTC.

78. The age of the plutonium solutions was discussed during meetings that took place in early August 2004. The Agency explained in detail the methodology it had used for dating the plutonium that had been separated, and additional on going work to validate the results. The Iranian officials reiterated their previous statement that the experiments had been completed in 1993 and that no plutonium had been separated since then. The Agency agreed to further analyse the available data. On 15 September 2004, a new set of samples was taken from the plutonium solution. The preliminary results of the analyses of the samples thus far are the same as those previously obtained, indicating that the plutonium could have been separated after 1993. On 29 October 2004, the Agency requested additional clarifications, which are needed for a final assessment.

## A.1.8. Polonium-210

### Development

79. Between 1989 and 1993, Iran irradiated two bismuth targets, and attempted to extract polonium from one of them, at TRR as part of a feasibility study for the production of neutron sources. Iran has stated that it does not have a project either for the production of Po-210 or for the production of neutron sources using Po-210 and that "there [had] not been in the past any studies or projects on the production of neutron sources using Po-210".

### Findings

80. In September 2003, the Agency noticed from TRR operating records that bismuth metal samples had been irradiated during the same general period as the reprocessing experiments had been carried out (1989–1993). Although bismuth is not nuclear material requiring declaration under a comprehensive safeguards agreement, the irradiation of bismuth is of interest to the Agency as it produces polonium-210 (Po-210), an intensely radioactive alpha emitting radioisotope[16] that can be used not only for certain civilian applications (such as radioisotope thermoelectric generators (RTGs), in effect, nuclear batteries[17]), but also, in conjunction with beryllium, for military purposes (specifically, as a neutron initiator in some designs of nuclear weapons).

81. In a letter to the Agency dated 17 November 2003, Iran informed the Agency that the bismuth irradiation had been to produce radioisotope batteries, and not neutron sources. During its visits to Iran in November and December 2003, the Agency requested further clarification and, in January 2004, was able to interview two Iranian scientists involved in the bismuth irradiation. According to the scientists, two bismuth targets had been irradiated, and an attempt had been made, unsuccessfully, to extract polonium from one of them. The other irradiated bismuth target was said to have been discarded. A statement submitted to the Agency by one of the scientists confirmed that these activities had been part of a scientific "project to carry out a feasibility study on the production [and] use of radioisotope batteries."

82. In February 2004, Iranian officials said that the experiments had also been part of a study about neutron sources, but that, as there were few remaining records related to the project, Iran was not able to provide evidence to support its claims as to the stated purpose. However, Iran provided the Agency with a document reflecting the approval of the project (by TNRC management) in which reference is made to these applications. In the meeting on 21 May 2004, Iranian authorities continued to maintain that the purpose of the bismuth irradiation had been to produce pure Po-210 on a laboratory scale, noting that, if production and extraction of Po-210 were successful, it could be used in radioisotope thermoelectric batteries, as was the case in the SNAP-3 application (a US developed power source for use in space probes).

83. The Agency has requested access to the glove box used for the Po-210 separation; however, according to Iran, the glove box has been discarded. The Agency has also requested to see the original project proposal by the scientists involved seeking permission to carry out the project. Iran has stated that the original documentation could not be found, and has provided instead a document which it has certified as being a "correct accurate and authentic" copy.

---

[16] Po-210 has a half-life of 138 days.

[17] The reported applications of Po-210 based RTGs are limited in number.

84. The Agency does not have any concrete information that is contrary to the statements made by Iran. It remains, however, somewhat uncertain regarding the plausibility of the stated purpose of the experiments given the very limited applications of short lived Po-210 sources.

## A.2. Implications

85. Based on all information currently available to the Agency, it is clear that Iran has failed in a number of instances over an extended period of time to meet its obligations under its Safeguards Agreement with respect to the reporting of nuclear material, its processing and its use, as well as the declaration of facilities where such material has been processed and stored. In his June, August and November 2003 reports to the Board of Governors (GOV/2003/40, GOV/2003/63, and GOV/2003/75), the Director General identified a number of instances of such failures and the corrective actions that were being, or needed to be, taken with respect thereto by Iran.

86. As assessed in light of all information available to date, these failures can now be summarized as follows:

a. Failure to report:

   (i) the import of natural uranium in 1991, and its subsequent transfer for further processing;

   (ii) the activities involving the subsequent processing and use of the imported natural uranium, including the production and loss of nuclear material where appropriate, and the production and transfer of waste resulting therefrom;

   (iii) the use of imported natural $UF_6$ for the testing of centrifuges at the Kalaye Electric Company workshop in 1999 and 2002, and the consequent production of enriched and depleted uranium;

   (iv) the import of natural uranium metal in 1993 and its subsequent transfer for use in laser enrichment experiments, including the production of enriched uranium, the loss of nuclear material during these operations and the production and transfer of resulting waste;

   (v) the production of $UO_2$, $UO_3$, $UF_4$, $UF_6$ and ammonium uranyl carbonate (AUC) from imported depleted $UO_2$, depleted $U_3O_8$ and natural $U_3O_8$, and the production and transfer of resulting wastes; and

   (vi) the production of natural and depleted $UO_2$ targets at ENTC and their irradiation in TRR, the subsequent processing of those targets, including the separation of plutonium, the production and transfer of resulting waste, and the storage of unprocessed irradiated targets at TNRC.

b. Failure to declare:

   (i) the pilot enrichment facility at the Kalaye Electric Company workshop; and

   (ii) the laser enrichment plants at TNRC and the pilot uranium laser enrichment plant at Lashkar Ab'ad.

c. Failure to provide design information, or updated design information, for:

   (i) the facilities where the natural uranium imported in 1991 (including wastes generated) was received, stored and processed (JHL, TRR, ENTC, waste storage facility at Esfahan and Anarak);

(ii) the facilities at ENTC and TNRC where $UO_2$, $UO_3$, $UF_4$, $UF_6$ and AUC from imported depleted $UO_2$, depleted $U_3O_8$ and natural $U_3O_8$ were produced;

(iii) the waste storage at Esfahan and at Anarak, in a timely manner;

(iv) the pilot enrichment facility at the Kalaye Electric Company workshop;

(v) the laser enrichment plants at TNRC and Lashkar Ab'ad, and locations where resulting wastes were processed and stored, including the waste storage facility at Karaj; and

(vi) TRR, with respect to the irradiation of uranium targets, and the facility at TNRC where plutonium separation took place, as well as the waste handling facility at TNRC.

d. Failure on many occasions to cooperate to facilitate the implementation of safeguards, as evidenced by extensive concealment activities.

87. As corrective actions, Iran has submitted inventory change reports (ICRs) relevant to all of these activities, provided design information with respect to the facilities where those activities took place, and presented all declared nuclear material for Agency verification, and it undertook in October 2003 to implement a policy of cooperation and full transparency.

88. Further corrective actions may be identified by the Agency as a consequence of assessments that are still ongoing.

# B. Cooperation

## B.1. Cooperation in the Implementation of the Safeguards Agreement and Additional Protocol

89. As indicated above, Iran's cooperation up to October 2003 was marked by extensive concealment, misleading information and delays in access to nuclear material and facilities, for example, in connection with its imports of nuclear material and its enrichment activities at the Kalaye Electric Company workshop and at Lashkar Ab'ad.

90. As also indicated above, following the adoption of the Board's resolution of 12 September 2003 (GOV/2003/69), Dr. Rohani informed the Director General on 16 October 2003 that a decision had been taken by Iran to provide the Agency, in the course of the following week, with a full disclosure of Iran's past and present nuclear activities. In his letter to the Director General dated 21 October 2003, Mr. Aghazadeh reaffirmed that "the Islamic Republic of Iran ha[d] decided to provide a full picture of its nuclear activities, with a view to removing any ambiguities and doubts about the exclusively peaceful character of these activities and commencing a new phase of confidence and co-operation in this field at the international level." Mr. Aghazadeh stated further in his letter that Iran was prepared "to provide, in full transparency, any additional clarifications that the Agency may deem necessary."[18] Included with the letter was extensive information on Iran's past

[18] In his letter, Mr. Aghazadeh also referred to his Government's expectation that the Agency would "take cognisance, in preparing its report, of Iran's concerns and constraints for the full disclosure of detailed information about these activities in the past, notably the concern about expansion of illegal sanctions to prevent Iran from exercising its inalienable right to nuclear technology for peaceful purposes stipulated in Article IV of the [Treaty on the Non-Proliferation of Nuclear Weapons]."

enrichment activities and its experiments in uranium conversion as well as in plutonium separation. While considerable progress has been made since then in some areas, the Agency is still in the process of assessing some of the information provided in that letter and in subsequent clarifications.

91. As had also been foreseen by Dr. Rohani on 16 October 2003, an Additional Protocol to Iran's Safeguards Agreement was signed on 18 December 2003. According to Iran, entry into force of the Additional Protocol will require, inter alia, ratification of the text, which has not yet taken place. Notwithstanding, as undertaken in its letter to the Agency of 10 November 2003, Iran has continued to act as if its Additional Protocol is in force.

92. On 21 May 2004, Iran submitted initial declarations pursuant to its Additional Protocol. In forwarding the declarations, Iran informed the Agency that they were being submitted "prior to the due date of 18 June 2004", following the Director General's request during his visit to Iran in April 2004. On 6 September 2004, Iran submitted an update of its declarations.

93. The Agency's comments on Iran's declarations were discussed with Iran in July, August and October 2004. These discussions have also provided an opportunity for the Agency to respond to requests for clarification sought by Iran on the interpretation of some of the provisions of the Additional Protocol. At the request of the Agency, a number of revisions have been submitted by Iran.

94. Since October 2003, Iran's cooperation has improved appreciably, although information has continued in some cases to be slow in coming and provided in reaction to Agency requests. Since December 2003, Iran has facilitated in a timely manner Agency access under its Safeguards Agreement and Additional Protocol to nuclear materials and facilities, as well as other locations in the country, and has permitted the Agency to take environmental samples as requested by the Agency.

95. Iran has, however, applied broad restrictions on the Agency's use of its own equipment to take photographs and the removal of photographs from Iran to Vienna (for use in assessment and as inspection baseline documentation). While the Agency would also like to record its meetings in Iran, Iran has agreed to make copies of its own tapes for the Agency, and to keep them under Agency seal in Iran. These constraints have made it more difficult for the Agency, at its Headquarters in Vienna, to conduct subsequent analysis and accurate assessments of the results of meetings in Iran.

## B.2. Transparency Visits and Discussions

96. In line with its announced policy to provide, in full transparency, any additional clarifications that the Agency may deem necessary, Iran has, since October 2003, provided the Agency, on a voluntary basis, with access to certain additional information and locations requested by the Agency, in the interest of confidence building.

97. On 5 October 2003, the Agency visited three locations at an industrial complex in Kolahdouz in western Tehran that had been mentioned in open source reports as relevant to enrichment activities. While no work was seen at those locations that could be directly linked to uranium enrichment, environmental samples were taken. The results did not reveal any indications of activities involving the use of nuclear material.

98. During the June 2004 meeting of the Board of Governors, the Agency asked Iran to provide, in the interest of transparency, access to the Lavisan-Shian site, in view of the reference made during the Board meeting to that site in connection with alleged nuclear related activities carried out at that site (including the presence of whole body counters) and the possibility of a concealment effort by Iran to hide these activities through the removal of all of the buildings from the site after November 2003.

99. Iran has stated that the site had been razed in response to a decision ordering the return of the site to the Municipality of Tehran in connection with a dispute between the Municipality and the Ministry

of Defence. In response to a request by the Agency, Iran provided additional documentation in support of this explanation, which is currently being assessed. Between 28 and 30 June 2004, the Agency visited the Lavisan-Shian site, where it took environmental samples. The Agency also took environmental samples from two whole body counters (one formerly located at Lavisan-Shian, the other located at Esfahan), and a trailer said to have contained one of the counters while it was located at Lavisan-Shian. Though Iran's description of events concerning the whole body counters, as related to this site, appears to be plausible, the trailer said to have contained the other counter still remains to be presented for sampling.

100. Iran provided a description and chronology of three organizations that had been located at Lavisan-Shian between 1989 and 2004. As described by Iran, the Physics Research Centre (PHRC) had been established at that site in 1989, the purpose of which had been "preparedness to combat and neutralization of casualties due to nuclear attacks and accidents (nuclear defence) and also support and provide scientific advice and services to the Ministry of Defence." Iran provided a list of eleven activities conducted at the PHRC, but, referring to security concerns, declined to provide a list of the equipment used at the Centre. In a letter to the Agency dated 19 August 2004, Iran stated further that "no nuclear material declarable in accordance with the Agency's safeguard[s] was present" and reiterated its earlier statement that "no nuclear material and nuclear activities related to fuel cycle were carried out at Lavisan-Shian."

101. Iran explained that the activities of the PHRC at Lavisan had been stopped in 1998, and that the Centre had been changed to the Biological Study Centre, which was involved in biological R&D and "radioprotection" activities. According to Iran, in 2002, the Applied Physics Institute was also located at that site, and although some of the biological activities continued there, the main objective was to use the capabilities of universities in the country (in particular, at the Malek Ashtar University near Esfahan) for the education and R&D needs of the Ministry of Defence.

102. The vegetation and soil samples collected from the Lavisan-Shian site have been analysed, and reveal no evidence of nuclear material. It should be borne in mind, however, that detection of nuclear material in soil samples would be very difficult in light of the razing of the site. In addition, given the removal of the buildings, the Agency is not in a position to verify the nature of activities that have taken place there.

103. In October 2004, Iran provided some information to the Agency in response to its request for information concerning efforts by the PHRC to acquire dual use materials and equipment that could be useful in uranium enrichment or conversion activities. The Agency is awaiting additional information and clarifications from Iran regarding this matter.

104. In accordance with Agency practice in connection with its evaluation of other States' nuclear programmes, the Agency has discussed with the Iranian authorities open source information relating to dual use equipment and materials which have applications in the conventional military area and in the civilian sphere as well as in the nuclear military area.

105. The acquisition of such equipment and materials by Iran was again discussed with Iranian officials in October 2004, at which time the Agency reiterated its request, in the interest of transparency, for a visit to a site located at Parchin in order to provide assurance regarding the absence of undeclared nuclear material and activities at that site. In order to respond to Iran's concerns about such a transparency visit, the Agency sent on 25 October 2004 a note outlining modalities under which the visit could take place.

# C. Current Overall Assessment

106. Iran has made substantial efforts over the past two decades to master an independent nuclear fuel cycle. To that end, Iran has conducted experiments to acquire the know-how for almost every aspect of the fuel cycle. Iran's current nuclear programme, as the Agency understands it, is aimed, upon completion, at an independent front end of the nuclear fuel cycle, including uranium mining and milling, conversion, enrichment, fuel fabrication, a light water reactor, heavy water production, a heavy water research reactor and associated R&D facilities. Iran has also performed some laboratory scale experiments related to the reprocessing of irradiated fuel, and is carrying out R&D in the treatment, storage and disposal of radioactive waste.

107. Many aspects of Iran's nuclear fuel cycle activities and experiments, particularly in the areas of uranium enrichment, uranium conversion and plutonium separation, were not declared to the Agency in accordance with Iran's obligations under its Safeguards Agreement. Iran's policy of concealment continued until October 2003, and has resulted in many breaches of its obligation to comply with that Agreement. Since that time, good progress has been made in Iran's correction of those breaches and in the Agency's ability to confirm certain aspects of Iran's current declarations, which will be followed up as a routine safeguards implementation matter.

108. There remain two important issues relevant to the Agency's investigation in order to provide assurance that there are no undeclared enrichment activities in Iran: the origin of LEU and HEU particle contamination found at various locations in Iran; and the extent of Iran's efforts to import, manufacture and use centrifuges of both the P-1 and P-2 designs.

109. With respect to the first issue, contamination, since the issuance of the last report to the Board, the Agency and the State from which most of the imported P-1 centrifuges originated have, in a cooperative effort, continued to share their respective analytical results. These results generally do not contradict the results from samples taken in Iran. The Agency's current overall assessment with respect to this issue is that the environmental sampling data available to date tends, on balance, to support Iran's statement about the foreign origin of much of the observed contamination. However, other possible explanations cannot be excluded at this point in time, and the Agency is continuing this investigation in an effort to confirm the actual source of contamination. Independent sampling and analysis may enable the Agency to confirm the correctness of statements made by Iran in this regard. Consultations with the State concerned on this matter are progressing, and agreement can be expected shortly on the appropriate modalities for such sampling.

110. With respect to the second issue, further investigation is required into the clandestine supply network in order for the Agency to be able to conclude its assessment on the extent of Iran's centrifuge enrichment programme, taking into account additional information that Iran has provided on its meetings with network intermediaries. A number of States have provided significant support to the Agency through the supply of information on Iran's use of intermediaries for procurement. In addition, consultations are under way with the State from which the P-1 and P-2 centrifuge technology obtained by Iran originated. One aspect of this investigation is related to Iran's statement that it did not pursue any work on the P-2 design between 1995 and 2002, as the reasons given by Iran for the apparent gap do not provide sufficient assurance that there were no related activities carried out during that period.

111. The Agency is still assessing other aspects of Iran's past nuclear programme, including statements made by it about plutonium separation experiments, in particular with respect to the dates they were carried out. In addition, while Iran has provided preliminary design information on the IR-40 heavy water research reactor, the construction of which should commence in 2004, the Agency has raised some questions regarding Iran's attempts to acquire manipulators and lead glass windows for

the hot cells. With respect to the latter issue, in October and November 2004, Iran provided some clarifications, which are now being assessed.

112. All the declared nuclear material in Iran has been accounted for, and therefore such material is not diverted to prohibited activities. The Agency is, however, not yet in a position to conclude that there are no undeclared nuclear materials or activities in Iran. The process of drawing such a conclusion, after an Additional Protocol is in force, is normally a time consuming process. In view of the past undeclared nature of significant aspects of Iran's nuclear programme, and its past pattern of concealment, however, this conclusion can be expected to take longer than in normal circumstances. To expedite this process, Iran's active cooperation in the implementation of its Safeguards Agreement and Additional Protocol, and full transparency, are indispensable. The assistance and cooperation of other States, as indicated above, is also essential to the resolution of the outstanding issues.

113. The Agency continues to follow up on open source reports relevant to Iran's nuclear programme. In this regard, it should be noted that the focus of Agency Safeguards Agreements and Additional Protocols is nuclear material, and that, absent some nexus to nuclear material, the Agency's legal authority to pursue the verification of possible nuclear weapons related activity is limited. However, in accordance with its practice in connection with its evaluation of other States' nuclear programmes, the Agency has continued to pursue, with Iran's cooperation, open source reports relating to dual use equipment and materials which have applications in the conventional military area and in the civilian sphere as well as in the nuclear military area. Iran has permitted the Agency, as a confidence building measure, to visit a number of defence related sites, including Kolahdouz and Lavisan. While the Agency found no nuclear related activities at Kolahdouz, it is still assessing information (and awaiting some additional information) in relation to the Lavisan site. The Agency is also still waiting to receive permission to visit the Parchin site.

114. The Secretariat will continue its investigation of all remaining outstanding issues relevant to Iran's nuclear programme, and the Director General will continue to report to the Board as appropriate.

# II. OTHER REQUESTS BY THE BOARD: SUSPENSION

115. As reflected in paragraph 8 of GOV/2004/79, the Board of Governors has requested the Director General to submit a report on "Iran's responses to the requests made of it by the Board in previous resolutions, especially requests relating to full suspension of all enrichment related and reprocessing activities".

116. The Board of Governors has adopted five resolutions[19], and approved one summary of the Chairman[20], in which it has made a number of requests of Iran. These requests may be summarized as falling within one or more of the following:

a. Requests that Iran comply with its obligations under its Safeguards Agreement, resolve all outstanding issues (including those related to LEU and HEU contamination, the nature and scope of Iran's P-2 centrifuge and laser enrichment programmes and the Po-210

[19] The resolutions of the Board in connection with the implementation of the NPT Safeguards Agreement in Iran are reproduced in: GOV/2004/79, dated 18 September 2004; GOV/2004/49, dated 18 June 2004; GOV/2004/21, dated 13 March 2004; GOV/2003/81, dated 26 November 2003; and GOV/2003/69, dated 12 September 2003.

[20] GOV/OR.1072 (19 June 2003), paras 52–58.

experiments), take corrective measures and provide the access to locations and personnel and to information required of it under its Safeguards Agreement, including by providing full declarations on its past and present nuclear programme, in particular its enrichment programme and with respect to its conversion experiments, and by permitting environmental sampling;

b. Requests that Iran sign, ratify and fully implement a Protocol Additional to its Safeguards Agreement, based on the Model Additional Protocol, and, as a confidence-building measure, to act in accordance with the Additional Protocol pending its entry into force, including by complying with the deadline for declarations envisaged in Article 3 of the Protocol;

c. Requests for transparency and cooperation with the Agency; and

d. Requests that Iran suspend all enrichment related and reprocessing activities, including that it reconsider its decisions to begin production testing at UCF; associated with these requests are the Board's requests that Iran not introduce nuclear material into PFEP and that it reconsider its decision to begin production testing at UCF and its decision to start construction of a heavy water research reactor.[21]

117. Section I of this report addresses Iran's response to the requests referred to in sub-paragraphs (a) through (c) above. In Section II, Iran's responses to the requests of the Board in connection with the suspension by Iran of enrichment related and reprocessing activities, summarized in sub-paragraph (d) above, are discussed.

# A. Scope of suspension

118. As reflected in the Chairman's summary of the Board's deliberations on this matter in June 2003, the Board at that time "encouraged Iran, pending the resolution of related outstanding issues, not to introduce nuclear material at the pilot enrichment plant as a confidence building measure." On 12 September 2003, in resolution GOV/2003/69, the Board reiterated this statement and, in that context, called on Iran "to suspend all further uranium enrichment related activities, including the further introduction of nuclear material into Natanz, and, as a confidence building measure, any reprocessing activities, pending provision by the Director General of the assurances required by Member States, and pending satisfactory application of the provisions of the additional protocol."

119. On 10 November 2003, the Iranian Government informed the Director General that it had decided to suspend, with effect from that date, all enrichment related and reprocessing activities in Iran, and specifically: to suspend all activities on the site of Natanz, not to produce feed material for enrichment processes and not to import enrichment related items.

120. In its resolution GOV/2003/81, adopted on 26 November 2003, the Board welcomed Iran's decision voluntarily to suspend all enrichment related and reprocessing activities, requested Iran to adhere to it in a complete and verifiable manner, and endorsed the Director General's acceptance of Iran's invitation to verify implementation of that decision and report thereon.

---

[21] GOV/OR.1072, para. 54; GOV/2003/69, para. 3; GOV/2003/81, para. 10; GOV/2004/21, para. 3; GOV/2004/49, paras 7 and 8; and GOV/2004/79, paras 3 and 4.

121. In a Note Verbale dated 29 December 2003, Iran informed the Agency that:

- it would suspend the operation and/or testing of any centrifuges, either with or without nuclear material, at PFEP;
- it would suspend further introduction of nuclear material into any centrifuges;
- it would suspend installation of new centrifuges at PFEP and installation of centrifuges at the FEP; and
- it would withdraw nuclear material from any centrifuge enrichment facility if and to the extent practicable.

122. In its Note Verbale, Iran stated further: that it did not currently have any type of gas centrifuge enrichment facility at any location in Iran other than the facility at Natanz that it was now constructing, nor did it have plans to construct, during the suspension period, new facilities capable of isotopic separation; that it had dismantled its laser enrichment projects and removed all related equipment; and that it was not constructing or operating any plutonium separation facility.

123. Iran also stated in its Note Verbale that, during the period of suspension: Iran did not intend to make new contracts for the manufacture of centrifuge machines and their components; the Agency could fully supervise storage of all centrifuge machines assembled during the suspension period; Iran did not intend to import centrifuge machines or their components, or feed material for enrichment processes, during the suspension period; and "[t]here is no production of feed material for enrichment processes in Iran."

124. On 24 February 2004, Iran informed the Agency that instructions would be issued by the first week of March to implement the further decisions voluntarily taken by Iran to: (i) suspend the assembly and testing of centrifuges, and (ii) suspend the domestic manufacture of centrifuge components, including those related to the existing contracts, to the furthest extent possible. Iran also informed the Agency that any components that were manufactured under existing contracts that could not be suspended would be stored and placed under Agency seal. Iran invited the Agency to verify these measures. Iran also confirmed that the suspension of enrichment activities applied to all facilities in Iran.

125. In resolution GOV2004/21, adopted on 13 March 2004, the Board called on Iran to extend the application of its commitment on suspension to "all enrichment related and reprocessing activities throughout Iran, and requested the Director General to verify the full implementation of these steps."

126. On 15 March 2004, Iran notified the Agency that the Agency's verification of the suspension of centrifuge component production could begin as of 10 April 2004. However, due to disputes between the AEOI and some of its private contractors, three private companies would continue with centrifuge component production.

127. In a letter dated 29 April 2004, Iran informed the Agency that it intended to conduct hot tests of the $UF_6$ production line at UCF. On 7 May 2004, the Agency wrote to Iran, informing it that, given the amounts of nuclear material involved, the hot testing of UCF with $UF_6$ gas would technically amount to the production of feed material for enrichment processes. In a letter dated 18 May 2004, Iran informed the Agency that "Iran has not, at any time, made any undertaking not to produce feed material for the enrichment process. The decision taken for voluntary and temporary suspension is based on clearly defined scope which does not include suspension of production of $UF_6$."

128. On 21 May 2004, Iran and the Agency were able to reach agreement on the Agency's proposal regarding the frequency of visits during the following twelve months for Agency verification of the

suspension of the production of gas centrifuge enrichment components at the nine sites declared by Iran as having been engaged in such activities.

129. On 18 June 2004, in resolution GOV/2004/49, the Board called on Iran "immediately to correct all remaining shortcomings, and to remove the existing variance in relation to the Agency's understanding of the scope of Iran's decisions regarding suspension, including by refraining from the production of $UF_6$ and from all production of centrifuge components, as well as to enable the Agency to verify fully the suspension." In the context of Iran's voluntary decisions to suspend all enrichment related and reprocessing activities, the Board also called on Iran, "as a further confidence building measure, voluntarily to reconsider its decision to begin production testing at [UCF] and also, as an additional confidence building measure, to reconsider its decision to start construction of a research reactor moderated by heavy water, as the reversal of those decisions would make it easier for Iran to restore international confidence undermined by past reports of undeclared nuclear activities in Iran."

130. On 23 June 2004, the Director General received a letter from Iran informing him that Iran "plan[ned] to suspend implementation of the expanded voluntary measures conveyed in [its] Note dated 24 February 2004" and that Iran "thus, intend[ed] to resume, under IAEA supervision, manufacturing of centrifuge components and assembly and testing of centrifuges as of 29 June 2004." In the letter, Iran requested the Agency "to take steps that may be necessary to enable resumption of such operations as of 29 June." On 29 June 2004, the Agency received a letter forwarding a list of seals which would be removed from material, components and equipment related to centrifuge component manufacturing and assembling. In a letter dated 29 June 2004, the Agency acknowledged receipt of Iran's letter and agreed to the removal of the seals by the operator in the absence of Agency inspectors.

131. On 18 September 2004, the Board of Governors adopted resolution GOV/2004/79, in which it requested Iran, inter alia, to "immediately suspend all enrichment-related activities, including the manufacture or import of centrifuge components, the assembly and testing of centrifuges and the production of feed material, including through tests or production at the UCF, under Agency verification." The Board also called again on Iran "as a further confidence building measure, voluntarily to reconsider its decision to start construction of a research reactor moderated by heavy water."

132. In a letter dated 14 November 2004, the Government of Iran notified the Director General that, in the context of an agreement reached on 14 November 2004 between the Government of Iran and the Governments of France, Germany and the United Kingdom, and the High Representative of the European Union, Iran had "decided, on a voluntary basis and as further confidence building measure, to continue and extend its suspension to include all enrichment related and reprocessing activities, and specifically: the manufacture and import of gas centrifuges and their components; the assembly, installation, testing or operation of gas centrifuges; and all tests and production for conversion at any uranium conversion installation". In its letter, Iran "recall[ed] and reconfirm[ed] that Iran does not have any reprocessing activity" or "any activity for undertaking plutonium separation, or for constructing or operating any plutonium separation installation". In addition, Iran stated that "material at Isfahan UCF will be brought to a safe, secure and stable state, not beyond $UF_4$, in coordination with the Agency." Iran invited the Agency to verify this suspension starting from 22 November 2004.

# B. Monitoring activities

133. The Agency has continued its monthly monitoring activities at PFEP, most recently from 9 to 11 October 2004, to ensure that the suspension of enrichment activities at PFEP is fully implemented. The surveillance records from the cascade hall have been reviewed to ensure that no additional centrifuge machines were installed. The seals on the equipment and nuclear material have been verified to ensure that they have not been tampered with, then replaced. The cascade hall continues to be under Agency surveillance and all the previously declared $UF_6$ feed material remains under Agency seal. Other activities conducted by the Agency in connection with the monitoring of Iran's suspension undertakings have included:

- DIV at FEP;
- monitoring of the decommissioned status of the AVLIS pilot plant at Lashkar Ab'ad through complementary access;
- inspections at JHL; and
- visits to several workshops where centrifuge components had been manufactured and/or stored, including the Kalaye Electric Company workshop.

134. The seals that had been used by the Agency as one of the measures for monitoring Iran's suspension of the manufacture, assembly and testing of centrifuge components at Natanz, Pars Trash and Farayand Technique were removed by Iran and returned to the Agency during its visit to Iran between 6 and 18 July 2004. As of mid-August 2004, about 70 rotors had been newly assembled and tested, and were shown to the Agency; by 10 October 2004, a total of 135 new rotors had been assembled, bringing the total number of assembled rotors at Natanz to 1274. The Agency is currently discussing with Iran the necessary arrangements for the Agency to monitor the manufacturing of centrifuge components and the assembly and testing of centrifuges, as contemplated in Iran's letter of 23 June 2004. In that regard, the Agency has proposed that it seal the tested rotors, a measure which Iran has not accepted to date. It must be noted that, in the absence of such seals, the Agency's monitoring of these activities cannot be considered effective.

135. During the Agency's October 2004 visit to UCF, the operator stated that 22.5 t out of 37 t of yellowcake had been fed into the process and that, by 14 October 2004, approximately 2 t of $UF_4$ had been produced. This $UF_4$ has not yet been verified by the Agency. However, there was no indication, as of the Agency's last visit there, that $UF_6$ had been produced during this campaign. The fluorine production building was visited by the Agency during this visit as well, during which it was confirmed that five of ten cells for fluorine production had been installed, of which one was ready for operation and four would soon be ready for operation.

136. As of July 2004, construction of the heavy water research reactor, IR-40, had not commenced. However, the Agency has received no communication from Iran specifically addressing the Board's request that Iran reconsider its decision to start construction of such a facility.

137. In accordance with Iran's invitation in its letter of 14 November 2004, the Agency will make arrangements to begin verification of Iran's suspension as of 22 November 2004.

138. The Director General will continue to report to the Board as appropriate.

**ANNEX 1**

# LIST OF LOCATIONS RELEVANT TO THE IMPLEMENTATION OF SAFEGUARDS IN IRAN

| LOCATION | AS OF NOVEMBER 2004 | STATUS |
|---|---|---|
| **TEHRAN NUCLEAR RESEARCH CENTRE** | Tehran Research Reactor (TRR) | Operating |
| | Molybdenum, Iodine and Xenon Radioisotope Production Facility (MIX Facility) | Constructed, but not operating |
| | *****Jabr Ibn Hayan Multipurpose Laboratories (JHL) | Operating |
| | *****Waste Handling Facility (WHF) | Operating |
| **TEHRAN** | *****Kalaye Electric Company | Dismantled pilot enrichment facility; being converted to centrifuge enrichment R&D |
| **BUSHEHR** | Bushehr Nuclear Power Plant (BNPP) | Under construction |
| **ESFAHAN NUCLEAR TECHNOLOGY CENTRE** | Miniaturized Neutron Source Reactor (MNSR) | Operating |
| | Light Water Sub-Critical Reactor (LWSCR) | Operating |
| | Heavy Water Zero Power Reactor (HWZPR) | Operating |
| | Fuel Fabrication Laboratory (FFL) | Operating |
| | Uranium Chemistry Laboratory (UCL) | Closed down |
| | Uranium Conversion Facility (UCF) | Hot testing/commissioning stage |
| | Graphite Sub-Critical Reactor (GSCR) | Decommissioned |
| | *****Fuel Manufacturing Plant (FMP) | In detailed design stage, construction to begin in 2004 |
| | *Zirconium Production Plant (ZPP) | Under construction |
| **NATANZ** | *****Pilot Fuel Enrichment Plant (PFEP) | Operational; currently suspended |
| | *****Fuel Enrichment Plant (FEP) | Under construction; currently suspended |
| **KARAJ** | *Radioactive Waste Storage | Partially operating |

| | | |
|---|---|---|
| **LASHKAR AB'AD** | *Pilot Uranium Laser Enrichment Plant | Dismantled |
| **ARAK** | ***Iran Nuclear Research Reactor (IR-40) | In detailed design phase |
| | *Hot cell facility for production of radioisotopes | Declared as no longer being under consideration |
| | *Heavy Water Production Plant (HWPP) | Under construction |
| **ANARAK** | *Waste storage site | Waste to be transferred to JHL |

* Declared in 2003

**ANNEX 2**

# ABBREVIATIONS AND TERMS

| | |
|---|---|
| AEOI | Atomic Energy Organization of Iran |
| AUC | ammonium uranyl carbonate |
| AVLIS | atomic vapour laser isotope separation |
| BNPP | Bushehr Nuclear Power Plant, Bushehr |
| CSL | Comprehensive Separation Laboratory, TNRC and Lashkar Ab'ad |
| CVL | copper vapour laser |
| DIV | design information verification |
| ENTC | Esfahan Nuclear Technology Centre |
| FEP | Fuel Enrichment Plant, Natanz |
| FFL | Fuel Fabrication Laboratory, ENTC |
| FMP | Fuel Manufacturing Plant, ENTC |
| g | gram |
| GSCR | Graphite Sub-Critical Reactor, ENTC |
| HEU | high enriched uranium |
| HWPP | Heavy Water Production Plant, Arak |
| HWZPR | Heavy Water Zero Power Reactor, ENTC |
| ICR | inventory change report |
| IR-40 | Iran Nuclear Research Reactor, Arak |
| JHL | Jabr Ibn Hayan Multipurpose Laboratories, TNRC |
| kg | kilogram |
| LEU | low enriched uranium |
| LSL | Laser Separation Laboratory, TNRC and Lashkar Ab'ad |
| LWR | light water reactor |
| LWSCR | Light Water Sub-Critical Reactor, ENTC |
| mg | milligram |
| MIX | molybdenum, iodine and xenon |
| MLIS | molecular laser isotope separation |
| MNSR | Miniaturized Neutron Source Reactor, ENTC |

| | |
|---|---|
| NRCAM | Nuclear Research Centre for Agriculture and Medicine, Karaj |
| PFEP | Pilot Fuel Enrichment Plant, Natanz |
| PHRC | Physics Research Centre |
| RTG | radioisotope thermoelectric generator |
| SWU | separative work units |
| t | metric ton; tonne |
| TBq | terabecquerel |
| TNRC | Tehran Nuclear Research Centre |
| TRR | Tehran Research Reactor, Tehran |
| UCF | Uranium Conversion Facility, ENTC |
| UCL | Uranium Chemistry Laboratory, ENTC |
| $UF_4$ | uranium tetrafluoride |
| $UF_6$ | uranium hexafluoride |
| $UO_2$ | uranium dioxide |
| $UO_3$ | uranium trioxide |
| $U_3O_8$ | urano-uranic oxide |
| UOC | uranium ore concentrate |
| ZPP | Zirconium Production Plant, Esfahan |