

Board of Governors

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Final Assessment on Past and Present Outstanding Issues regarding Iran's Nuclear Programme

Report by the Director General

A. Introduction

1. This report by the Director General to the Board of Governors, in line with the Road-map for the clarification of past and present outstanding issues regarding Iran's nuclear programme (Road-map),¹ includes the final assessment of all past and present outstanding issues, as set out in the Director General's report in November 2011 (GOV/2011/65).² This assessment is based on all safeguards-relevant information available to the Agency, including that acquired through the implementation of Iran's NPT Safeguards Agreement,³ the Framework for Cooperation,⁴ including the Road-map, and the Joint Plan of Action (JPA).⁵

A.1. The Agency's concerns

2. From 2002 onwards, the Agency became increasingly concerned about the possible existence in Iran of undisclosed nuclear related activities involving military related organizations, including activities related to the development of a nuclear payload for a missile.⁶ Reports by the Director General identified outstanding issues related to possible military dimensions to Iran's nuclear

¹ GOV/INF/2015/14.

² The Annex to GOV/2011/65 is hereafter referred to as the "2011 Annex".

³ The Agreement between Iran and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/214), which entered into force on 15 May 1974.

⁴ GOV/INF/2013/14.

⁵ GOV/2015/65, para. 13.

⁶ GOV/2011/65, para. 38.

programme and the actions required of Iran to resolve these.⁷ The 2011 Annex provided a detailed analysis of the information then available to the Agency. The information indicated that Iran had carried out activities relevant to the development of a nuclear explosive device. The information also indicated that prior to the end of 2003, these activities took place under a structured programme, and that some activities may still have been ongoing.⁸

3. The information consolidated and presented in that Annex came from a wide variety of independent sources, including from the Agency's own efforts and from a number of Member States, including Iran itself. It was consistent in terms of technical content, individuals and organizations involved, and timeframes. Based on these considerations, and in light of the Agency's general knowledge of Iran's nuclear programme and its historical evolution, the Agency found the information upon which the Annex was based to be, overall, credible.⁹

4. The Agency requested¹⁰ that Iran engage substantively with the Agency without delay for the purpose of providing clarifications regarding possible military dimensions to its nuclear programme as identified in the 2011 Annex.

A.2. Past Resolutions of the Board of Governors and the Security Council

5. The United Nations (UN) Security Council ('Security Council') has affirmed that the steps required by the Board of Governors in its resolutions¹¹ are binding on Iran.¹² Between 2006 and 2010, six Security Council resolutions¹³ were adopted under Chapter VII of the UN Charter and are mandatory, in accordance with the terms of those resolutions.¹⁴

6. In particular, in its resolution of June 2010 (1929), the Security Council reaffirmed Iran's obligations, *inter alia*, to cooperate fully with the Agency on all outstanding issues, particularly those which gave rise to concerns about the possible military dimensions to Iran's nuclear programme, including by providing access without delay to all sites, equipment, persons and documents requested by the Agency.¹⁵

7. Following the issuance of the Director General's report of November 2011, the Board of Governors, in its resolution of November 2011 (GOV/2011/69), *inter alia*, stressed that it was essential for Iran and the Agency to intensify their dialogue aimed at the urgent resolution of all outstanding issues, including those which gave rise to concerns about the possible military dimensions to Iran's nuclear programme, for the purpose of providing clarifications regarding those issues.¹⁶

⁷ For example: GOV/2011/29, para. 35; GOV/2011/7, Attachment; GOV/2010/10, paras 40–45; GOV/2009/55, paras 18–25; GOV/2008/38, paras 14–21; GOV/2008/15, paras 14–25 and Annex; GOV/2008/4, paras 35–42.

⁸ GOV/2011/65, para. 53.

⁹ GOV/2011/65, para. 42 and Annex, para.16.

¹⁰ GOV/2011/65, para. 54.

¹¹ Between September 2003 and September 2012, the Board of Governors adopted 12 resolutions in connection with the implementation of safeguards in Iran (see GOV/2013/56, footnote 2).

¹² Security Council resolution 1929 (2010).

¹³ Security Council resolutions 1696 (2006), 1737 (2006), 1747 (2007), 1803 (2008), 1835 (2008) and 1929 (2010).

¹⁴ Part I.A of the Agency's Relationship Agreement with the United Nations (INFCIRC/11).

¹⁵ Security Council resolution 1929 (2010), paras 2 and 3.

¹⁶ Paras 1 and 2.

8. Further to the Director General's report of August 2012 (GOV/2012/37), the Board of Governors, in its resolution of September 2012 (GOV/2012/50), inter alia, decided that Iran's cooperation with Agency requests aimed at the resolution of all outstanding issues was essential and urgent in order to restore international confidence in the exclusively peaceful nature of Iran's nuclear programme.¹⁷

B. Efforts to address the Agency's concerns since November 2011

B.1. Structured Approach

9. Between January 2012 and May 2013, the Agency and Iran held ten rounds of talks in Vienna and Tehran, aimed at reaching agreement on a 'structured approach' document for resolving outstanding issues related to Iran's nuclear programme. However, no concrete results were achieved during those talks. In October 2013, the Agency and Iran concluded that, as the negotiations had become deadlocked and there was no prospect for agreement on the document, a new approach aimed at ensuring the exclusively peaceful nature of Iran's nuclear programme should be developed.¹⁸

B.2. Framework for Cooperation

10. On 11 November 2013, the Agency and Iran signed a 'Joint Statement on a Framework for Cooperation' (Framework for Cooperation), in which they agreed to cooperate further with respect to verification activities to be undertaken by the Agency to resolve all present and past issues, and to proceed with such activities in a step by step manner.

11. Within the Framework for Cooperation, the Agency and Iran agreed on a series of steps, each containing a number of practical measures to be implemented by Iran. Fifteen of the eighteen practical measures agreed were related to different aspects of Iran's declared nuclear programme, all of which Iran implemented before the end of 2014. The other three practical measures related to possible military dimensions to Iran's nuclear programme, each of which was aimed at clarifying areas of concern to the Agency, as set out in the 2011 Annex. By July 2015, Iran had implemented the first of these three practical measures¹⁹ and technical discussions had been held with the Agency concerning the other two.²⁰

12. On 14 July 2015, the Director General and the Vice-President of Iran and President of the Atomic Energy Organization of Iran (AEOI), HE Ali Akbar Salehi, signed the Road-map.²¹ The Agency and Iran agreed, in continuation of their cooperation under the Framework for Cooperation, to accelerate and strengthen their cooperation and dialogue aimed at the resolution, by the end of 2015, of all past and present outstanding issues that had not already been resolved by the Agency and Iran. The actions agreed under the Road-map are listed in Annex I.

¹⁷ Para. 4.

¹⁸ GOV/2013/56, paras 4 and 5.

¹⁹ GOV/2014/43, paras 9 and 11.

²⁰ GOV/2015/34, para. 9.

²¹ GOV/INF/2015/14.

B.3. Security Council Resolution 2231

13. On 20 July 2015, the Security Council adopted resolution 2231 (2015),²² in which, *inter alia*, it reaffirmed that Iran “shall cooperate fully as the IAEA requests to be able to resolve all outstanding issues, as identified in IAEA reports”.²³

C. Implementation of the Road-map

14. In the Road-map, the Agency and Iran agreed to aim to resolve, by the end of 2015, all past and present outstanding issues, as set out in the 2011 Annex. Upon commencement of the implementation of the Road-map, the Agency was already in possession of a substantial body of information indicating that Iran had carried out activities relevant to the development of a nuclear explosive device. This information comprised that reflected in the 2011 Annex, which the Agency had assessed to be “overall, credible”, as well as information received in the period since November 2011, which further contributed to the analysis contained in that Annex.²⁴

15. As agreed in the Road-map, on 15 August 2015, Iran provided to the Agency its explanations in writing and related documents, on past and present outstanding issues.²⁵ On 8 September 2015, the Agency submitted questions to Iran on ambiguities regarding the information provided to it by Iran on 15 August 2015.²⁶ The questions were aligned with sections C.1–12 of the 2011 Annex and a common structure was used to present the questions for each of the sections, as follows: the indicators derived from the text of the 2011 Annex were listed as a basis for seeking clarification; the Agency’s review of information available to it since November 2011 from its own safeguards activities, from Iran and from other Member States, and any implications regarding the indicators; and the Agency’s questions.

16. To remove the ambiguities regarding the information Iran had provided to the Agency on 15 August 2015, the Agency and Iran held technical-expert meetings and discussions in Iran on 15, 16, 17, 29 and 30 September 2015 and 10 and 14 October 2015, and the Agency conducted safeguards activities at particular locations of interest to the Agency in Iran on 18, 19 and 20 September 2015 and 9 and 15 October 2015.

17. On 20 September 2015, the Director General and Deputy Director General and Head of the Department of Safeguards visited the particular location at the Parchin site of interest to the Agency.

18. All the activities in the Road-map were implemented in accordance with the agreed schedule and, on 24 November 2015, the Agency and Iran held a “wrap up technical meeting” in Vienna.

²² Security Council resolution 2231 (2015) makes provision for the termination of Security Council resolutions 1696 (2006), 1737 (2006), 1747 (2007), 1803 (2008), 1929 (2010) and 2224 (2015) in accordance with its terms. Upon termination of the above referenced Security Council resolutions, the Board of Governors may wish to consider parallel action in regard to its decision (see GOV/2007/7 and GOV/OR.1181, paras 40 and 41) and consequential decisions on technical cooperation provided to Iran, which were taken through the Agency’s Technical Assistance and Cooperation Committee (based on GOV/2008/47/Add.3, GOV/2009/65, GOV/2011/58/Add.3 and GOV/2013/49/Add.3).

²³ Security Council resolution 2231 (2015), para 3.

²⁴ See, for example, GOV/2014/28, para. 54.

²⁵ GOV/2015/50, paras 8 and 62.

²⁶ GOV/2015/65, para.7.

D. Methodology

19. In November 2011, the Agency provided its “analysis of the information available to it in the context of relevant indicators of the existence or development of processes associated with nuclear-related activities, including weaponization”.²⁷ Since November 2011, the Agency has acquired more information through activities under the Framework for Cooperation, including the Road-map and the JPA, through the Agency’s own efforts, and from Member States, including Iran. As additional information has become available to the Agency, the Agency has been able to refine its analysis of possible military dimensions to Iran’s nuclear programme.

20. In order to perform the final assessment, the Agency has analysed all the information available to it in relation to each of the 12 areas, as set out in the 2011 Annex. The Agency has also used the same information to gain an understanding of the whole picture through consideration of the nature, amount and coherence of the information over time.

E. Area Assessments

21. As previously reported,²⁸ the Agency has focused its analysis of Iran’s nuclear programme on an acquisition path involving high enriched uranium (HEU). Based on indicators observed by the Agency in connection with Iran’s nuclear activities, the Agency’s work has concentrated on an analysis pertinent to the development of an HEU implosion device.

E.1. Programme management structure

22. Information available to the Agency prior to November 2011 indicated that Iran had arranged, via a number of different and evolving management structures, for activities to be undertaken in support of a possible military dimension to its nuclear programme. According to this information, the organisational structures covered most of the areas of activity relevant to the development of a nuclear explosive device. The information indicated that activities commenced in the late 1980s within Departments of the Physics Research Centre (PHRC) and later, under the leadership of Mohsen Fakhrizadeh, became focused in the early 2000s within projects in the AMAD Plan, allegedly managed through the ‘Orchid Office’. Information indicated that activities under the AMAD Plan were brought to a halt in late 2003 and that the work was fully recorded, equipment and work places were either cleaned or disposed of so that there would be little to identify the sensitive nature of the work that had been undertaken. Eventually, according to the information, a new organization known as the Organization of Defensive Innovation and Research²⁹ was established by Mohsen Fakhrizadeh and based at the Mojdeh Site near Malek Ashtar University in Tehran.

23. In Iran’s submission of 15 August 2015 under the Road-map, Iran provided the Agency with information concerning a number of organisations described in the 2011 Annex and on their relation and functions. In this regard, Iran, inter alia, denied the existence of a coordinated programme aimed at the development of a nuclear explosive device, and specifically denied the existence of the AMAD Plan and the ‘Orchid Office’ as elements of such a programme. The Agency submitted questions to

²⁷ GOV/2011/65, Annex, para. 1.

²⁸ GOV/2011/65, Annex, para. 17.

²⁹ Known from its Farsi initials as “SPND”, (2011 Annex, Figure, p.5).

Iran on this subject on 8 September 2015, which were then discussed at technical-expert meetings in Tehran. A significant proportion of the information available to the Agency on the existence of organizational structures was confirmed by Iran during implementation of the Road-map.

24. The Agency assesses that, before the end of 2003, an organizational structure was in place in Iran suitable for the coordination of a range of activities relevant to the development of a nuclear explosive device. Although some activities took place after 2003, they were not part of a coordinated effort.

E.2. Procurement activities

25. As previously reported, Iran has stated that the AEOI encountered difficulties with procurement because of the international sanctions imposed on the country.³⁰ These restrictions on the acquisition of sensitive items made it difficult for Iran to obtain material and equipment for its nuclear programme. According to information available to the Agency prior to November 2011, Iran was able to make procurements, primarily for its nuclear fuel cycle activities, through companies not directly associated with the AEOI or Ministry of Defence Armed Forces Logistics (MODAFL), thereby disguising the final user.

26. The Agency also had indications of instances of procurements and attempted procurements of items with relevance, inter alia, to the development of a nuclear explosive device. The Agency does not have information regarding any such procurement attempts after 2007.

27. During discussions with the Agency on 16 September 2015 under the Road-map, Iran confirmed its earlier statements that although, as identified by the Agency, it had made a procurement enquiry about a specific high speed camera, the camera had been for a conventional purpose and, ultimately, Iran had not purchased it. During these discussions, Iran also reiterated its earlier denial that a named company had attempted to acquire high-speed switches.

28. The Agency has not received additional information on this topic since the 2011 Annex.

E.3. Nuclear material acquisition

29. Information available to the Agency prior to November 2011 indicated that the Gchine mine was a potential source of uranium for use in undeclared nuclear activities in the period 2000-2003. The information also indicated that preliminary activities, including the 'green salt project', were undertaken at an unknown location and were aimed at the production of uranium salts that would have been suitable either for conversion into material for uranium enrichment or into material for the direct reduction of uranium salts to pure uranium metal. This information stemmed from the alleged studies documentation³¹ and other information, from Member States, and indicated that these activities ceased when the AMAD Plan was brought to a halt in late 2003. The information indicated that the work involved was not at an advanced stage. The information indicated that preliminary work aimed at implementing this process involved the use of surrogate materials to avoid the possibility of uncontrolled contamination. Other information indicated that Iran was developing, outside its declared nuclear fuel cycle, processes for the reduction of uranium salts to pure uranium metal. Information contained in the alleged studies documentation links the uranium salts to be produced with warhead development.

³⁰ GOV/2008/4, para. 17.

³¹ GOV/2011/65, Annex, paras 6 and 12.

30. Iran declared the existence of the Gchine mine in April 2004 during its voluntary implementation of the Additional Protocol.³² Iran provided the Agency with managed access to the Gchine mine in 2014 under the Framework for Cooperation and the JPA. The Agency has assessed that the activities carried out at the site are consistent with Iran's declarations provided in connection with the Framework for Cooperation and JPA and that, in any event, no substantial amount of nuclear material could have been produced in the Gchine mine before 2006. The Agency assesses that the process design for the production of uranium salts was technically flawed and of low quality in comparison to what was available to Iran as part of its declared nuclear fuel cycle.

31. The Agency also had information from Member States that, although not used, kilogramme quantities of uranium metal were available to the AMAD Plan. As previously reported,³³ the Agency carried out a physical inventory verification (PIV) at the Jabr Ibn Hayan Multipurpose Research Laboratory (JHL) in August 2011 to verify, inter alia, the nuclear material, in the form of natural uranium metal, and process waste related to experiments to convert UF₄ into uranium metal that had been conducted at JHL in the period 1995-2000. As a result of the PIV, the Agency identified a possible discrepancy of several kilogrammes of natural uranium in the accountancy records of these experiments. The Agency re-evaluated this information in 2014 and assessed that the amount of natural uranium involved was within the uncertainties associated with nuclear material accountancy and related measurements.

32. Based on all the information available to the Agency, including from the particular verification activities specified under the Framework for Cooperation (including the managed access to the Gchine mine) and the JPA, the Agency has not found indications of an undeclared nuclear fuel cycle in Iran, beyond those activities declared retrospectively by Iran.³⁴ The Agency assesses that any quantity of nuclear material that may have been available to Iran under the AMAD Plan would have been within the uncertainties associated with nuclear material accountancy and related measurements.

E.4. Nuclear components for an explosive device

33. Information available to the Agency prior to November 2011 indicated that, in the early 1990s, Iran may have received design information for a nuclear explosive device from a clandestine nuclear supply network. Iran provided the Agency with a copy of a one-page handwritten document said to be an offer from this nuclear supply network relating to centrifuge enrichment technology. During discussions with Iran in 2005, the Agency identified a 15-page document relating to the conversion of uranium compounds into uranium metal ('uranium metal document') and the production of hemispherical enriched uranium metallic components.

34. Information available to the Agency prior to November 2011 also indicated that Iran had made progress with preparatory work aimed at developing a chemical process to reduce a uranium fluoride compound (UF₄) to uranium metal, using lead oxide as a surrogate material. Additionally, information indicated that Iran conducted preparatory work, not involving nuclear material, for the fabrication of uranium components for a nuclear explosive device. During discussions in September 2015 under the Road-map, Iran informed the Agency that it had not conducted metallurgical work specifically designed for nuclear devices, and was not willing to discuss any similar activities that did not have such an application.

³² Iran voluntarily implemented its Additional Protocol between December 2003 and February 2006.

³³ GOV/2011/65, para. 49.

³⁴ 2011 Annex, Section A.

35. Based on all the information available to it, the Agency has found no indications of Iran having conducted activities which can be directly traced to the 'uranium metal document' or to design information for a nuclear explosive device from the clandestine nuclear supply network.

E.5. Detonator development

36. The development of safe, fast-acting detonators, and equipment suitable for firing the detonators, is an integral part of a programme to develop an implosion-type nuclear explosive device. Prior to November 2011, the Agency had information indicating that Iran, in 2002-2003, developed exploding bridgewire (EBW) detonators and a high voltage firing capability which, in combination, enabled several detonators to be fired with less than microsecond simultaneity.

37. During meetings in 2014 under the Framework for Cooperation, Iran provided information to the Agency which indicated that, in December 2000, Iran's Ministry of Defence decided to improve safety requirements for certain operations involving conventional explosives by developing safer detonators. Iran stated that preliminary work on EBW detonators was undertaken by an industrial group connected to the Ministry of Defence, after which, in 2002, it started further work which culminated in the successful development of EBW detonators. Iran showed the Agency a video of experimental activities being carried out, which Iran stated were linked to its aerospace industry. The Agency notes that Iran has not provided an explanation for the activities the information indicates that it undertook during 2000-2003.

38. Iran stated that the rationale for developing EBW detonators was to help prevent explosive accidents and, during the meeting under the Framework for Cooperation on 20 May 2014, provided the Agency with a list of five such accidents. The Agency determined this information to be inconsistent with the timeframe and unrelated to the detonator development programme. At the meeting under the Road-map on 15 October 2015, Iran provided the Agency with a table listing another six accidents. The Agency notes that, although each of these was stated to have occurred in the correct timeframe and to have related to explosive accidents, at least one did not appear to be related to a detonator.

39. In the same meeting of 20 May 2014, Iran further informed the Agency that, around 2007, its oil and gas industry had identified a requirement for EBW detonators for the development of deep borehole severing devices. To support this claim, Iran presented information to the Agency, including the results of a limited number of tests in which detonators were fired with sub-microsecond simultaneity. Iran informed the Agency that in 2008, owing to concern over the interest expressed by the Agency in Iran's development of EBW detonators, the oil and gas industry's requirement was suspended. Work on single EBW detonators for applications in the oil and gas industry commenced in 2013. As previously reported by the Agency, such an application is not inconsistent with specialized industry practices.³⁵

40. The Agency assesses that EBW detonators developed by Iran have characteristics relevant to a nuclear explosive device. The Agency acknowledges that there is a growing use of EBW detonators for civilian and conventional military purposes.

E.6. Initiation of high explosives and associated experiments

41. Prior to November 2011, Member States provided the Agency with information that Iran had available to it design information on the explosives technology known as multipoint initiation (MPI)

³⁵ GOV/2014/43, para. 11.

and that it had used this for the initiation of high explosives in hemispherical geometry. The information indicated that Iran had developed of a hemispherical MPI system and conducted at least one large scale experiment in 2003, details of which were technically consistent, both internally and with publications authored by a certain 'foreign expert'. The Agency has reassessed that this experiment was conducted at a location called "Marivan", and not conducted in "the region of" Marivan.³⁶

42. After November 2011, the Agency received additional information from Member States regarding the conduct by Iran, in the early 2000s, of small scale experiments aimed at validating the initiation of high explosives, associated instrumentation, and the implementation of safety standards at various test locations in Iran.

43. Information available to the Agency in 2011 also indicated that Iran could have benefitted from the aforementioned foreign expert, who had knowledge of both MPI technology and experimental diagnostics and had worked for much of his career in the nuclear weapon programme in his country of origin. The foreign expert's presence in Iran in the period 1996-2001 has been confirmed by Iran, although it stated that his activities were related to the production of nanodiamonds.

44. In Iran's submission of 15 August 2015 under the Road-map, and during further discussions in September 2015, Iran informed the Agency that it had had a technical requirement for the development of MPI technology relating to a conventional military application stemming from the mid-1990s, and that 'operationalization' of the project had begun in 2007. Iran's submission showed how the concept of the ring wave generator was derived from the design featured in information Iran had provided to the Agency in 2008, and was apparently developed to optimise the performance of conventional munitions. During the technical-expert meeting on 30 September 2015, Iran showed the Agency examples of the ring wave generator, including several that had been filled with explosives and fired. Iran stated that the testing had been of an empirical nature to determine the performance of the explosive system. Consequently, Iran stated that it had not defined a specification for the functioning of the ring wave generator and had undertaken only limited diagnostic measurements.

45. In addition to the information indicating that Iran had worked with MPI technology in planar geometry, in the discussions of 30 September 2015, Iran indicated that it had investigated MPI technology in a cylindrical geometry for an unspecified conventional military purpose. Iran also reiterated that no work had been conducted with MPI technology in (hemi) spherical geometry.

46. The Agency assesses that the MPI technology developed by Iran has characteristics relevant to a nuclear explosive device, as well as to a small number of alternative applications.

E.7. Hydrodynamic experiments

47. Prior to November 2011, information obtained through the Agency's own efforts, as well as information provided to the Agency by Member States, indicated that Iran had manufactured simulated components for a nuclear explosive device from high density materials, and that these may have included features relevant to the dynamic compressive testing of the components, i.e. hydrodynamic testing. Such testing would involve the use of high speed diagnostic equipment to monitor the symmetry of the compressive shock of the simulated core of a nuclear explosive device.

³⁶ GOV/2011/65, Annex, para. 43.

48. As previously reported,³⁷ in relation to hydrodynamic testing, the Agency received from Member States information, including satellite imagery, which indicated that Iran made and installed a large cylinder at the Parchin military complex in 2000. Other information indicated that this cylinder matched the parameters of an explosives firing chamber (chamber) featured in publications of the foreign expert and was designed to contain the effects of detonating up to 70 kg of high explosives (a quantity suitable for conducting hydrodynamic experiments with high explosives). The information indicated that Iran had first installed the chamber and then constructed a building around it, and that this building (the main building of interest to the Agency) was in use until late 2003.

49. After November 2011, the Agency received additional information from Member States regarding the equipment located at the Parchin site and commercially acquired numerous satellite images of the site.

50. The Agency asked Iran to clarify its activities relating to scientifically monitored explosive research capabilities which were the basis for certain of the Agency's concerns in the 2011 Annex. Iran did not provide any clarification.

51. Since the Agency's first request to Iran for access to the particular location of interest to it at the Parchin site in February 2012, extensive activities have taken place at this location. These activities, observed through commercial satellite imagery, appeared to show, inter alia, shrouding of the main building, the removal/replacement or refurbishment of its external wall structures, removal and replacement of part of the roof, and large amounts of liquid run-off emanating from the building. Commercial satellite imagery also showed that five other buildings or structures at the location were demolished in this period and that significant ground scraping and landscaping were undertaken over an extensive area at and around the location.³⁸

52. Under the Road-map, the Agency and Iran agreed on an arrangement regarding the issue of Parchin. This arrangement involved visual observation and environmental sampling at the location of interest to the Agency. These activities were completed on 20 September 2015. To confirm the authenticity of the activities and samples, the Agency ensured that the samples were taken at the location of interest and maintained the chain of custody for the samples in line with the Agency's established safeguards practices.

53. When the Director General and Deputy Director General for Safeguards³⁹ visited the main building of interest to the Agency at the Parchin site on 20 September 2015, they did not observe a chamber or any associated equipment inside the building. They did observe, inter alia, recent signs of internal refurbishment, a floor with an unusual cross-section and a ventilation system which appeared incomplete.

54. Iran stated during discussions at technical-expert meetings under the Road-map that the building had always been used for the storage of chemical material for the production of explosives.

³⁷ GOV/2011/65, Annex, para. 49.

³⁸ See, for example, GOV/2012/37, para. 42, GOV/2014/28, para. 59 and GOV/2014/43, para. 67.

³⁹ GOV/2015/59, para. 5.

55. The Agency has analyzed the environmental samples. The Agency did not detect explosive compounds or their precursors that would have indicated that the building had been used for the long-term storage of chemicals for explosives.⁴⁰

56. Following the completion of the technical-expert meeting on 14 October 2015, in which Iran contested the Agency's satellite imagery by showing an aerial photograph taken by Iran, the Agency acquired new satellite imagery from different sources, including a commercial source, which supported previous indications of the presence of a large cylindrical object at the location of interest to the Agency at the Parchin site in the summer of 2000.

57. The information available to the Agency, including the results of the sampling analysis and the satellite imagery, does not support Iran's statements on the purpose of the building. As a result of activities implemented under the Road-map, the Agency has established that, as of 20 September 2015, the cylinder was not in the main building of interest. The Agency assesses that the extensive activities undertaken by Iran since February 2012 at the particular location of interest to the Agency seriously undermined the Agency's ability to conduct effective verification.

E.8. Modelling and calculations

58. By November 2011, the Agency had received information from Member States indicating that, prior to 2004 and between 2005 and 2009, Iran had undertaken computer modelling studies of various component arrangements, which were only specific to nuclear explosive configurations based on implosion technology. Open source information also indicated that Iran had conducted additional studies relating to high explosives modelling, which the Agency also considered significant in the context of both hydrodynamic simulation and code development studies. The modelling described above has a number of possible applications, some of which are exclusively for a nuclear explosive device.

59. Additional information received by the Agency from Member States since November 2011 is consistent with the information previously available to the Agency. Additional information was also received by the Agency from a Member State regarding a project in 2009 to determine equations of state for materials of concern.

60. In October 2014, the Agency discussed with Iran a number of these issues, including those referring to relevant Iranian open source publications. With regard to the open source publications related to neutronic calculations, Iran explained that the publications identified by the Agency were based upon past and present work undertaken by a named individual who had completed a thesis for a doctoral degree. In April 2015, Iran showed this thesis (in Farsi) to the Agency for examination. With regard to the modelling of nuclear explosive device configurations, Iran stated that such studies had never taken place in Iran. The Agency notes some similarity between the Iranian open source publications and the studies featured in the information from Member States, in terms of textual matches, and certain dimensional and other parameters used.

61. With reference to the modelling studies on high explosives, in its submission to the Agency of 15 August 2015 under the Road-map, Iran referred to the applicability of hydrodynamic modelling to conventional military applications and stated that such applications were of no relevance to the Agency's concern. During subsequent technical-expert meetings, Iran indicated that, in view of the

⁴⁰ The results identified two particles that appear to be chemically man-modified particles of natural uranium. This small number of particles with such elemental composition and morphology is not sufficient to indicate a connection with the use of nuclear material.

strong conventional military dimensions associated with this work, it was not in a position to discuss them.

62. Based on all the information available to the Agency, including from the implementation of the Road-map, the Agency assesses that Iran conducted computer modelling of a nuclear explosive device prior to 2004 and between 2005 and 2009. The Agency notes, however, the incomplete and fragmented nature of those calculations. The Agency also notes the applicability of some hydrodynamic modelling to conventional military explosive devices.

E.9. Neutron initiator

63. Information provided to the Agency by Member States prior to November 2011 indicated that Iran considered practical measures to ensure the neutron initiation of an implosion-type nuclear explosive device by experimenting with materials and configurations which could generate neutrons under shock compression. Prior to the implementation of the Road-map, the Agency assessed that one of the indicators of the manufacture of shock-driven neutron sources was weaker than previously considered.

64. Additional information provided by a Member State prior to November 2011 indicated that activity in this area may have continued in Iran after 2004, and that, from around 2006 onwards, Iran embarked on a four-year programme on the validation of shock-driven neutron source design, including through the use of non-nuclear material to avoid contamination. Iran stated during a technical-expert meeting in September 2015 that it had carried out no activity, practical or theoretical, related to shock-driven neutron sources.

65. Iran's submission to the Agency of August 2015 under the Road-map contained information on general neutron generation studies and identified relevant non-Iranian open source publications. Iran confirmed that research had been undertaken at an institution in Iran where plasma focus equipment was used to generate short neutron pulses and to develop and test suitable detectors. In the course of a technical visit to an institution in Iran on 9 October 2015, Iran showed the Agency neutron research capabilities at that institution.

E.10. Conducting a test

66. Information provided to the Agency by a Member State prior to November 2011 indicated that in 2002-2003 Iran may have planned and undertaken preparatory experimentation relevant to testing a nuclear explosive device. The Agency also had information that Iran had conducted a number of practical tests to see whether its EBW detonator firing component would function satisfactorily over a long distance between the firing point and a test device located down a deep shaft.

67. Additional information, from the alleged studies documentation, indicated that Iran was in possession of documentation identified as being relevant to explosive safety arrangements inherent to the testing of a nuclear explosive device.

68. The Agency has not received additional information on this area since the 2011 Annex.

E.11. Integration into a missile delivery vehicle

69. Extensive information provided to the Agency within the alleged studies documentation prior to November 2011 indicated detailed project work conducted in Iran in 2002-2003 to examine how to integrate a new spherical payload into the existing payload chamber of the re-entry vehicle for the Shahab 3 missile so that such a payload would survive the severe launch and re-entry environments, and remain functional until it reached its target. According to this information, these engineering

studies, which included practical, theoretical and design considerations, also utilised a number of workshops where components and mock-up model parts were made. The information also indicated that details of the project work were recorded in reports.

70. In the course of Road-map implementation, Iran was requested by the Agency, inter alia, to arrange visits to the workshops identified by the Agency as those featured in the alleged studies documentation.

71. On 30 September 2015, the Agency was shown a short video by Iran of each of the three workshops identified in the alleged studies documentation. Two of these videos were said to have been filmed inside the two workshops which were still operating, while the third was said to have been filmed from outside the workshop which was no longer in business. On 15 October 2015, the Agency was invited to visit the two operational workshops. From these videos and visits, the Agency has verified that the workshops are those described in the alleged studies documentation. Further, the workshop's features and capabilities are consistent with those described in the alleged studies documentation.

72. The Agency has verified the existence in Iran of two of the workshops referred to in the alleged studies documentation, but has not received any other information on this area since the 2011 Annex.

E.12. Fuzing, arming and firing system

73. Prior to November 2011, the Agency had a number of documents from the alleged studies documentation which referred to the development of a prototype firing system that would enable the newly⁴¹ designed payload for a Shahab 3 missile to explode in the air above a target or upon impact with the ground.

74. The information available to the Agency from the alleged studies documentation indicated that Iran considered a number of technical options for a fuzing, arming and firing system that would ensure that the new Shahab 3 missile spherical payload would remain safe until the re-entry vehicle reached its designated target, and that the payload would then function correctly.

75. The Agency has not received additional information on this area since the 2011 Annex.

F. Overall Assessment

76. This overall assessment results from the analysis of all the information available to the Agency in relation to each of the 12 areas, as set out in the 2011 Annex.

77. Based on all the information available to the Agency relating to nuclear material acquisition, including from the particular verification activities specified under the Framework for Cooperation (including the managed access to the Gchine mine) and the JPA, the Agency has not found indications of an undeclared nuclear fuel cycle in Iran, beyond those activities declared retrospectively by Iran. The Agency assesses that any quantity of nuclear material that may have been available to Iran under the AMAD Plan would have been within the uncertainties associated with nuclear material accountancy and related measurements.

⁴¹ As of 2003.

78. Based on all the information available to it relating to nuclear components for an explosive device, the Agency has found no indications of Iran having conducted activities which can be directly traced to the 'uranium metal document' or to design information for a nuclear explosive device from the clandestine nuclear supply network.

79. The Agency assesses that explosive bridgewire (EBW) detonators developed by Iran have characteristics relevant to a nuclear explosive device. The Agency acknowledges that there is a growing use of EBW detonators for civilian and conventional military purposes. The Agency also assesses that the multipoint initiator (MPI) technology developed by Iran has characteristics relevant to a nuclear explosive device, as well as to a small number of alternative applications.

80. Information available to the Agency in relation to hydrodynamic testing indicated that Iran made and installed a large cylinder at the Parchin military complex in 2000. Other information indicated that this cylinder matched the parameters of an explosives firing chamber featured in publications of the foreign expert. The information available to the Agency, including the results of the analysis of the samples and the satellite images, does not support Iran's statements on the purpose of the building. Activities implemented under the Road-map have established that the cylinder is not in the main building of interest. The Agency assesses that the extensive activities undertaken by Iran since February 2012 at the particular location of interest to the Agency seriously undermined the Agency's ability to conduct effective verification.

81. Based on all the information available to the Agency on modelling and calculations, including from the implementation of the Road-map, the Agency assesses that Iran conducted computer modelling of a nuclear explosive device prior to 2004 and between 2005 and 2009. The Agency notes, however, the incomplete and fragmented nature of those calculations. The Agency also notes the applicability of some hydrodynamic modelling to conventional military explosive devices.

82. The Agency has verified the existence in Iran of two of the workshops referred to in the alleged studies documentation on the integration into a missile delivery vehicle, but has not received any other information on this area since the 2011 Annex.

83. The Agency has not received information additional to that contained in the alleged studies documentation on conducting a test or on fuzing, arming and firing systems since the 2011 Annex.

84. The Agency assesses that, before the end of 2003, an organizational structure was in place in Iran suitable for the coordination of a range of activities relevant to the development of a nuclear explosive device. Although some activities took place after 2003, they were not part of a coordinated effort.

85. The Agency's overall assessment is that a range of activities relevant to the development of a nuclear explosive device were conducted in Iran prior to the end of 2003 as a coordinated effort, and some activities took place after 2003. The Agency also assesses that these activities did not advance beyond feasibility and scientific studies, and the acquisition of certain relevant technical competences and capabilities. The Agency has no credible indications of activities in Iran relevant to the development of a nuclear explosive device after 2009.

G. Summary

86. All the activities contained in the Road-map were implemented in accordance with the agreed schedule. Iran provided explanations in writing and related documents on past and present outstanding issues, the Agency submitted questions on ambiguities relating to Iran's explanations and

technical-expert meetings were held. The Agency conducted safeguards activities at particular locations of interest to the Agency, including at the Parchin site, and a wrap-up meeting was held. The implementation of the Road-map facilitated a more substantive engagement between the Agency and Iran.

87. The Agency assesses that a range of activities relevant to the development of a nuclear explosive device were conducted in Iran prior to the end of 2003 as a coordinated effort, and some activities took place after 2003. The Agency also assesses that these activities did not advance beyond feasibility and scientific studies, and the acquisition of certain relevant technical competences and capabilities. The Agency has no credible indications of activities in Iran relevant to the development of a nuclear explosive device after 2009.

88. The Agency has found no credible indications of the diversion of nuclear material in connection with the possible military dimensions to Iran's nuclear programme.

Annex I

Road-map for the clarification of past and present outstanding issues regarding Iran's nuclear programme

The International Atomic Energy Agency (IAEA) and the Islamic Republic of Iran (Iran) agree, in continuation of their cooperation under the Framework for Cooperation, to accelerate and strengthen their cooperation and dialogue aimed at the resolution, by the end of 2015, of all past and present outstanding issues that have not already been resolved by the IAEA and Iran.

In this context, Iran and the Agency agreed on the following:

1. The IAEA and Iran agreed on a separate arrangement that would allow them to address the remaining outstanding issues, as set out in the annex of the 2011 Director's General report (GOV/2011/65). Activities undertaken and the outcomes achieved to date by Iran and the IAEA regarding some of the issues will be reflected in the process.
2. Iran will provide, by 15 August 2015, its explanations in writing and related documents to the IAEA, on issues contained in the separate arrangement mentioned in paragraph 1.
3. After receiving Iran's written explanations and related documents, the IAEA will review this information by 15 September 2015, and will submit to Iran questions on any possible ambiguities regarding such information.
4. After the IAEA has submitted to Iran questions on any possible ambiguities regarding such information, technical-expert meetings, technical measures, as agreed in a separate arrangement, and discussions will be organized in Tehran to remove such ambiguities.
5. Iran and the IAEA agreed on another separate arrangement regarding the issue of Parchin.
6. All activities, as set out above, will be completed by 15 October 2015, aimed at resolving all past and present outstanding issues, as set out in the annex of the 2011 Director General's report (GOV/2011/65).
7. The Director General will provide regular updates to the Board of Governors on the implementation of this Road-map.
8. By 15 December 2015, the Director General will provide, for action by the Board of Governors, the final assessment on the resolution of all past and present outstanding issues, as set out in the annex of the 2011 Director General's report (GOV/2011/65). A wrap up technical meeting between Iran and the Agency will be organized before the issuance of the report.
9. Iran stated that it will present, in writing, its comprehensive assessment to the IAEA on the report by the Director General.
10. In accordance with the Framework for Cooperation, the Agency will continue to take into account Iran's security concerns.