FOUNDATION FOR DEFENSE OF DEMOCRACIES

Strengthening the Verification and Implementation of the Joint Comprehensive Plan of Action

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Table of Contents

Introduction

The Joint Comprehensive Plan of Action (JCPOA)[1] puts Iran's nuclear program under greater scrutiny than before and reduces the likelihood of an overt dash to the bomb for the next 10 years. But the agreement contains a number of notable weaknesses—particularly regarding undeclared nuclear activity and weapons-related research—that should be mitigated by adopting stronger verification measures.

Under the JCPOA, Iran will retain a sizable nuclear infrastructure and the capacity to rapidly expand its atomic program. Tehran will retain a substantial uranium enrichment capacity and is permitted to augment its nuclear activity after 10 years, even though there is no technical or economic reason for it to do so.

The JCPOA undoubtedly places Iran's nuclear program under broader and stricter safeguards than existed before the accord. From a verification perspective, the agreement contains strong points, but it also has weaknesses. It reduces and limits what Iran can produce, enrich, and stockpile. It carries particularly strong provisions concerning Iran's Arak reactor—Iran's "plutonium path" to a nuclear bomb—for the next 15 years. Its mechanisms to monitor declared nuclear material at declared facilities are robust. The JCPOA also puts the entire nuclear fuel cycle—from mining through enrichment to fuel fabrication and spent fuel—under monitoring and verification.

The agreement, however, is not without its vulnerabilities and challenges: 1) verification mechanisms to detect undeclared activities and sites remain limited; 2) mechanisms to detect barred weaponization research are likely insufficient; and 3) after a decade, the additional transparency measures will fade away—at the same time that Iran is able to start expanding its program—presenting additional verification challenges.

Central to a strong verification regime is the proper resolution of the issue concerning the Possible Military Dimensions (PMDs) of Tehran's nuclear research. The importance of understanding and resolving this issue is not a matter for historians. In order to ensure that Iran cannot reconstitute a weapons program in the future, it is important to understand how far the Islamic Republic has progressed in weaponization. Without a complete understanding of the PMDs of Iran's research, it will not be possible to design verification protocols that effectively allow for early detection.

However, the agreement leaves the resolution of PMDs to the International Atomic Energy Agency (IAEA). Its inspections need to maintain a high bar and be carried out without undue interference that could dilute or compromise their integrity and that of other verification procedures. The IAEA's reports on the inspection of the Parchin military complex still do not mitigate concerns about the verification and sample-taking process. The IAEA-Iran agreement regarding Parchin has deviated significantly from well-established safeguards practices, which involve the full physical presence of inspectors on location, the integrity of the samples they take themselves, and the ability of the IAEA to draw definitive conclusions with the requisite level of assurances.[2]

Resolving these issues in a satisfactory way is crucial. Otherwise, the IAEA and the permanent members of the Security Council risk opening up a confidence

1. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/iran_joint-comprehensive-plan-of-action_en.pdf)

2. David Albright, Olli Heinonen, & Serena Kelleher Vergantini, "IAEA Visit to the Parchin Site," *Institute for Science and International Security,* September 22, 2015. (http://isis-online.org/uploads/isis-reports/documents/IAEA_Visit_to_the_Parchin_Site_September_22_2015_Final_1.pdf)

deficit about verifying Parchin and, as important, other sensitive sites in the Islamic Republic. Parchin appears to have already established a problematic precedent, not only for verification at other sites in Iran but for other nations with nuclear aspirations. The JCPOA obviously has implications for efforts to prohibit nuclear proliferation, especially in the Middle East. At a minimum, this means that as the JCPOA is implemented over the next several months, the IAEA needs to demonstrate that it can access Iranian sites of concern, including military bases, and conduct effective verification into the allegations of past nuclear-weapons work.

It is important to remember that what led to the international community's concern about the Islamic Republic's nuclear program was not "just" uranium enrichment. Rather, it was because Iran has consistently tried to hide its nuclear program, failed to address concerns about PMD activities, and obfuscated verification efforts. To this day, Iran remains a country where the IAEA is unable to provide assurances that all nuclear activities are accounted for and in peaceful use, despite several U.N. Security Council calls to rectify the situation. As this report explains, additional measures are needed now in order to discourage further spread of sensitive technologies and procedures.

Summary and Recommendations

Since Iran can develop a much more advanced nuclear program down the road, its breakout time via enriched uranium could gradually fall to around three months and may further decrease to as little as a couple of weeks after 15 years.[3] Its plutonium path to a bomb will also open up. So, while the international community will continue to have monitoring in Iran with the Additional Protocol (AP),[4] if breakout time shrinks to only a couple of weeks, the AP in itself will not necessarily stop an Iranian build-up of a nuclear-weapon capability at monitored sites or a dash to the bomb. This is a worrying scenario.

Verification in Iran will involve concurrent implementation of the NPT Safeguards Agreement, the Additional Protocol, additional transparency undertakings by Iran agreed in the JCPOA, and the IAEA-Iran Road-map—all of which have differing commitments that complement one another. The sum of these parts is intended to block all pathways for Iran to get a bomb by keeping Iran a year away from breakout.[5] The international community in general and in particular the U.S. need to make sure that the JCPOA's provisions and implementation actions measure up to this goal.

With this in mind, this report poses questions and suggests a number of provisions that would strengthen verification and could be undertaken without violating the text or the spirit of the JCPOA:

3. David Albright, Houston Wood, & Andrea Stricker, "Breakout Timelines Under the Joint Comprehensive Plan of Action" *Institute for Science and International Security*, August 18, 2015. (http://isis-online.org/uploads/isis-reports/documents/Iranian_Breakout_Timelines_and_Issues_18Aug2015_final.pdf)

4. A copy of the Additional Protocol is available at: International Atomic Energy Agency, "Model Protocol to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards," INFCIRC/540, Article 7. (https://www.iaea.org/sites/default/files/infcirc540.pdf)

5. Breakout is understood as the time at which Iran has accumulated enough weapons-grade uranium (WGU) for one or more nuclear weapons. The amount of WGU needed for a nuclear weapon is one significant quantity (SQ), which is commonly defined as 25 kilograms of 90-percent enriched uranium. Breakout time is thus the amount of time required to produce WGU for one or more nuclear bombs.

1. **Credible Baseline:** *How can the JCPOA provide solid assurances that Iran has not secreted away centrifuges and relevant material needed for building a nuclear weapon?*

Since the detection of undeclared nuclear material and activities is the Achilles heel of the JCPOA's verification scheme, a credible baseline for monitoring and verification procedures needs to be established. The JCPOA's language does not appear to require a comprehensive declaration by Iran. **The P5+1 and the IAEA should request a complete declaration from Iran of all of its nuclear activities, including past activities, before Implementation Day**. Such a declaration, which was one of the cornerstones of the EU3-Iran brokered agreement in 2003, should also include the status of equipment and material from dismantled installations and retired parts. Having a comprehensive baseline will be crucial for inspectors to develop a meaningful, comprehensive inspection process. Understanding the history of Iran's nuclear effort also provides a higher probability of detecting "sneak out," particularly when Iran escapes from its current nuclear restrictions. A comprehensive declaration should have been a fundamental part of the declarations required by the JCPOA. However, it was not explicitly required by the JCPOA. Arguably, however, it could be provided for under a broad interpretation of the Additionally Protocol. The P5+1 should require Iran to submit such an expanded declaration.

2. **Access to Suspected and Undeclared Sites:** *How can the United States use the majority-vote adjudication mechanism of the JCPOA to secure access to suspected sites promptly?*

The JCPOA creates a 24-day adjudication process to address IAEA requests for access to suspect sites. While the U.S. administration has correctly argued that Iran cannot cover up certain kinds of nuclear activity in 24 days,[6] the adjudication process does not take into account all plausible scenarios. It is clear that a large facility cannot simply be erased in three weeks without leaving traces. But any violations, at least early in the agreement, are likely to be small in scale. Yet these could be critical in the weapon manufacturing process, such as the manufacturing of uranium components for an atomic weapon. Furthermore, certain weaponization experimentation and modeling do not leave radioactive signatures. A 24-day process reduces detection probabilities exactly where the system is weakest and where prompt access is most valued: detecting undeclared facilities, materials, and activities.

It is also important to note that the 24-hour access rationale under the Additional Protocol was to account for administrative delays—it was not to be used as a negotiating chip. But that is exactly how Iran could use such a lengthy delay. **To reinforce the importance of prompt access, U.S. officials should state their understanding that a 24-hour period is the standard for granting access. The adjudication process must not become a license for Iran to use 24 days as the default. Twenty-four hours, not 24 days, should be the expected amount of time between a request and access.** To further reduce the attraction for Iran to punt requests to the dispute-resolution process, it should be considered a violation of the spirit of the JCPOA, and have consequences, if Iran uses the 24-day process as a rule rather than as an exception. Establishing this as a violation that would provoke the re-imposition of serious sanctions would also test the utility of "snapback" sanctions as a means of effective coercion by the JCPOA.

6. For example, see John Kerry & Ernest Moniz, "The Case for the Nuclear Deal with Iran," *The Washington Post*, July 22, 2015. (https://www.washingtonpost.com/opinions/the-case-for-the-nuclear-deal-with-iran/2015/07/21/4b48980a-2fea-11e5-8f36-18d1d501920d_story.html)

3. **IAEA-Iran Road-map:** *How can the international community ensure that Iran meets its commitment to satisfy the IAEA's concerns on questions relating to Possible Military Dimensions?*

By December 15, the IAEA is required to make a determination on the status of the outstanding PMD questions listed in the IAEA's November 2011 report.[7] However, the IAEA will be hard pressed to undertake a thorough accounting of PMD issues within the three-to-four months' time allocated by the JCPOA. Even with full Iranian cooperation, IAEA verification work into PMDs requires a time-consuming and complex process to corroborate Iran's answers. It includes interviews, analysis of samples, and checking the veracity of the information provided by Iran. Officials from the P5+1 have stated that PMD issues will be resolved before Implementation Day, and the December 15 deadline would support that timeline. However, the JCPOA is not clear on what will happen if the IAEA is not able to resolve all of the issues prior to December 15. And if Tehran fails to provide sufficient answers to all of the IAEA's questions, the JCPOA stipulates no explicit consequences for Iran. **Thus, the P5+1 should state explicitly that the JCPOA requires that the resolution of PMD issues precedes substantial sanctions relief, and that sanctions thus will not be lifted until after all outstanding concerns are resolved.**

4. **Verifying Parchin:** *How should the IAEA and the international community move beyond Parchin and ensure that meaningful assurances are provided so that PMD issues are correctly and comprehensively resolved?*

The IAEA-Iran Road-map has two separate side arrangements,[8] which have not been shared with the IAEA Board of Governors nor with the public. News reports on the arrangements for Parchin appear problematic, and the actual visit and sample taking by the IAEA in September 2015 departed significantly from well-established and proven safeguards practices that have been applied in the past, including at Iran's military sites. More specifically, the procedures at Parchin departed from the standard inspection processes involving control of the chain of verification work, as well as the physical absence of IAEA inspectors during sample-taking collection and inspection of the site under investigation. The IAEA has always deemed it essential that in order to design an effective sampling plan for any site under question, inspectors must personally assess the premises, verifying the physical structure of the investigated object and its surroundings. The Parchin procedures have understandably led to concerns in Congress and within the expert community about the IAEA's ability to fully apply verification requirements in ways that will not compromise its conclusions.

The IAEA should be expected to detail its approach and provide explanations—to its Board as well as through its reports—that will justify any conclusions drawn. The best way forward is for Washington to support the release of the Parchin-related side letter from the IAEA, through an IAEA Board process.

7. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran," GOV/2011/65, November 8, 2011. (https://www.iaea.org/sites/default/files/gov2011-65.pdf)

8. The first separate arrangement describes modalities—access to people, sites, and information—to address the remaining outstanding issues, as set out in the annex of the 2011 IAEA report. The second one describes the inspection modalities for the IAEA to visit the high explosive testing chamber and site at Parchin.

5. **Addressing Sanitization Efforts:** *What happens if Iran alters a suspect site after the IAEA has requested access?*

Commercial satellite images in July showed renewed activity at the Parchin military complex, a site at which Iran may have previously engaged in high-explosive work on nuclear weapons.[9] Iran has conducted clean-up efforts at this site in the past. What makes things different this time is that activities occurred *after* the IAEA and Iran reached an agreement regarding access to Parchin. Situations in which changes to a requested area are permitted to occur after questions have been raised obviously challenge and complicate any safeguards process. The IAEA has repeatedly raised its concerns that "the activities that have taken place at this location since February 2012 are likely to have undermined the Agency's ability to conduct effective verification."[10] These concerns grew after IAEA Director General Yukiya Amano's September 20, 2015 visit when the IAEA found the building where high-explosive work took place empty.[11]

Any policy allowing or acquiescing to alterations by Iran following a request to access a suspect site would have significant effects on verification. Concerns about Iran's nuclear activities originally arose because of Iranian efforts to hide, remove, sanitize, and prevaricate on its nuclear activities. Permitting clean-up activities to occur after the IAEA requests access would be acquiescing to Iran's violations of the spirit, if not the letter, of international inspections standards. Another point to bear in mind is that Parchin is an above-ground, controlled, and relatively isolated complex that can be more easily monitored by satellite imagery. This is not always the case for suspect sites, where it may be much easier for the Iranians to conceal their efforts to alter or sanitize facilities and their contents. **The P5+1 should therefore unequivocally state that once the IAEA makes a request, no activities may occur at a suspected site and that any clean-up efforts will be viewed as a violation of the JCPOA.**

6. **Enrichment Capacity:** *In accordance with U.S. policy that all of Iran's routes to acquire nuclear weapons will be blocked, how can the international community ensure that Iran is not able to acquire the high-enriched uranium necessary for a nuclear device?*

Given the sizable nuclear infrastructure Iran retains under the JCPOA, **Iran should be required to prepare a long-term public energy plan to complete the picture on its practical needs**. Iran should provide this plan to the P5+1 and the IAEA by Implementation Day and detail its enriched uranium needs. This plan would allow the international community to assess whether Iran's nuclear program is truly designed to meet its practical needs. This is especially significant after year 10, when restrictions on Iran's nuclear capacity start to fall away and Iran is free to expand its nuclear program. Such a plan would be submitted as a part of the Additional Protocol declaration to support the nuclear R&D plan foreseen in the JCPOA.

Additionally, the United States and its partners should state that they do not see any economic or technical justification for Iran to increase its enrichment capacity after 10 years in order to produce enriched uranium for nuclear power plants.

9. David Albright & Serena Kelleher-Vergantini, "Renewed Activity at the Parchin Site in Iran," *Institute for Science and International Security*, August 5, 2015. (http://www.isis-online.org/uploads/isis-reports/documents/Renewed_Activity_at_Parchin_August_4_2015_FINAL.pdf)
10. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," GOV/2015/50, August 27, 2015. (http://www.isis-online.org/uploads/isis-reports/documents/GOV_2015_50.pdf)
11. Yukiya Amano, "IAEA Director General's Remarks to the Press on Visit to Iran," *Vienna, Austria*, September 21, 2015. (https://www.iaea.org/newscenter/statements/iaea-director-generals-remarks-press-visit-iran)

To complement Iran's declaration, the U.S., with its partners and reactor vendors, would agree to provide Iran with long-term assurances for fuel supplies. These assurances should also be negotiated as part of any power- or reactor-delivery agreement and would, for example, form part of the understanding of current negotiations Iran is conducting with China and Russia, and cover any future reactor delivery contracts with the Islamic Republic.

It also follows that Iran should not enrich uranium above 3.67 percent, as this enrichment level meets the future needs of the Arak reactor. Should Iran need uranium of a higher enrichment level for its research reactors or medical and industrial isotope production, the U.S. and its partners should commit to providing the necessary assurances of supply. These assurances would mitigate any foreseeable excuse for Iran to enrich uranium above 3.67 percent, even after restrictions lapse. If Iran were to choose to enrich to higher levels despite these assurances, this logically calls into question Tehran's commitment to a peaceful nuclear program. Enrichment levels of 20 percent and higher under a more advanced and upgraded nuclear program would put the Islamic Republic too close to the nuclear-bomb threshold, thereby reducing the time for the United States and its allies to stop a dash to a weapon.

7. **Procurement Channel:** *How can the weaknesses of the procurement channel mapped out in the JCPOA be remedied?*

The JCPOA establishes a Procurement Channel to monitor imports of single- and dual-use items to Iran. The channel also monitors certain Iranian nuclear exports and seeks to block outsourcing of some nuclear activities by Tehran to foreign states. However, there are several loopholes in the process.[12] The most challenging aspect is the JCPOA's decision to include all non-nuclear civil-industry procurement of dual-use items as part of the certification process instead of a cleaner approach: a blanket ban, with the exception of approved items for the Islamic Republic's nuclear program. Beyond implementation concerns, this allows legitimate build-up of new technologies and dual-use equipment in Iran.

As an immediate step, **the P5+1 should prepare detailed implementation procedures for procurement and make them available to all U.N. members** to facilitate effective implementation of U.N. Security Council Resolution 2231 (2015). Additionally, to rectify the longer term and urgent concern regarding dual-use equipment, **the P5+1 should set up an ad-hoc, multiple-inspection certification of the end user of the equipment for the equipment's lifetime that is not tied to the sunset of the JCPOA's procurement channel**. That is, if the equipment is in use beyond the 10-year timeline of the procurement channel, the inspection procedures would still continue for that equipment. This can be covered under the JCPOA's transparency and access provisions. This would go some way to lessen concerns about the possibility of amassing a nuclear-weapons capability after the channel's 10-year expiration date.

12. For a detailed analysis of the procurement channel and proposed remedies, see David Albright & Andrea Stricker, "Preliminary Assessment of the JCPOA Procurement Channel: Regulation of Iran's Future Nuclear and Civil Imports and Considerations for the Future," *Institute for Science and International Security*, August 31, 2015. (http://www.isis-online.org/uploads/isis-reports/documents/Procurement_Channel_JCPOA_analysis_31Aug2015_final_1.pdf)

8. **Pursuing Sooner Ratification of the Additional Protocol:** *In which areas of the JCPOA would quicker ratification of the Additional Protocol be useful for the IAEA's ability to verify the agreement?*

Under the JCPOA, Iran will "seek" ratification of the AP after eight years or following the IAEA's broader conclusion on the peaceful nature of Iran's nuclear program, whichever is earlier.[13] Iran is not obligated to ratify the AP by a certain date, only to seek ratification. This contradicts current safeguards practices. Broader conclusions have only been drawn by the IAEA when an AP is in force and ratified. It is not a matter that can be easily dismissed but rather adds potential complications down the road should Iran choose to leverage, pull back, or dilute some of its obligations under its "provisional" status. **Iran should be persuaded to ratify the Additional Protocol before Implementation Day.** Previously, Iran provisionally applied the AP during negotiations with the EU3, but discontinued the implementation as negotiations fell apart. If Iran is not required to ratify the AP, there is a risk that this might occur again.

Iran should also be persuaded to confirm as soon as possible that it will adhere to Code 3.1 regarding the early provision of design information of new facilities, and that this undertaking is legally binding starting no later than Implementation Day. Currently, the JCPOA does not specify the date when this commitment by Iran becomes legally binding. Code 3.1 specifies when an IAEA member state must report a new facility to the Agency.[14] To give meaning to the implementation process, **Iran must submit all pending or present design plans to the IAEA so proper safeguards can be carried out**. In terms of the broader context, however, it is important to be mindful that there is no practical and economic need for Iran to build enrichment facilities.

9. **Foregoing Reprocessing:** *After binding restrictions on reprocessing sunset in 15 years, how can Iran be persuaded to maintain its non-binding commitment not to engage in these activities? How can the international community ensure that Iran does not engage in reprocessing of nuclear fuel?*

The JCPOA's physical limits constraining weapons-grade plutonium production are strong and irreversible for the first 15 years. Beyond this, however, the JCPOA simply states that it is Iran's *intention* not to build additional heavy-water reactors in the future and not to conduct reprocessing. This still leaves the door open for future reprocessing, which, again, does not have any economic justification.

The United States and its partners should state that they do not see any justification for Iran to engage in reprocessing and related R&D after 15 years. With its partners, the U.S. and reactor vendors could provide Iran with long-term assurances for fuel supplies and the return of spent fuel. These assurances should also be negotiated as part of any new power or reactor delivery agreement.

13. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex V, paragraph 22. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_5_implementation_plan_en.pdf)

14. Code 3.1 is part of the Subsidiary Arrangements to the Iran's safeguards agreement with the IAEA. According to the original version of Code 3.1, agreed in the 1970s, the state was obligated to report a new facility no fewer than 180 days before the introduction of nuclear material. In 1992, the IAEA Board of Governors recognized this as a weakness in the verification system, and the code was modified. Under the revised code, the state has to submit preliminary design information as soon as a decision has been made to construct a nuclear facility. This information is then updated as the construction proceeds. Having this information early, the IAEA can develop a safeguards approach, which can then be incorporated in the design and construction of the facility.

Table 1: Nuclear Milestones

July 14, 2015, Finalization Day: The negotiations between the P5+1 and Iran concluded with an announcement of the JCPOA.

Additionally, Iran and the IAEA agreed to the "Road-map for Clarification of Past and Present Outstanding Issues" to address issues related to the Possible Military Dimensions of Iran's nuclear program.

July 20, 2015: U.N. Security Council adopted Resolution 2231 (2015) endorsing the JCPOA.

October 18, 2015, Adoption Day: 90 days after endorsement of the JCPOA by the Security Council. The JCPOA and its commitments entered into effect, and the U.S. and the EU announced the waivers and framework to prepare sanctions relief that will take effect on Implementation Day.[15]

Iran also started its provisional implementation of the Additional Protocol and agreed to provide early design information on new nuclear facilities it constructs (Code 3.1).[16]

December 15, 2015: The IAEA will provide its final assessment on the resolution of all past and present outstanding issues according to the Road-map. These outstanding issues were set out in the November 2011 IAEA report.[17]

July 2016 (estimated), Implementation Day: Simultaneously with the IAEA report verifying Iran's fulfillment of its nuclear-related obligations, the suspension of EU, U.S., and U.N. sanctions takes effect.

The nuclear-related measures undertaken by Iran under the JCPOA include, inter alia, dismantlement of excess centrifuges and placing them in storage under IAEA monitoring (which also entails removing the pipework and uranium feed and withdrawal stations in Natanz and Fordow) and bringing the inventory of enriched uranium in Iran down to 300 kg of 3.67 percent, either by shipping excess material out of the country or diluting it into natural uranium.

Iran will have in Natanz 5060 IR-1 centrifuges enriching uranium up to 3.67 percent. The Fordow enrichment plant will be converted into a nuclear, physics, and technology center, which can retain 1044 IR-1 centrifuges. Centrifuges in Fordow will not be used for uranium enrichment, but some of them can be modified to produce stable isotopes other than uranium.

15. Mark Rivett-Carnac, "The U.S. Prepares Iranian Sanctions Relief After Landmark Nuclear Deal," *TIME*, October 19, 2015. (http://time.com/4077812/iran-us-nuclear-sanctions-deal/)
16. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex V, paragraph 7. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_5_implementation_plan_en.pdf)
17. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," GOV/2011/65, November 8, 2011. (https://www.iaea.org/sites/default/files/gov2011-65.pdf)

The IAEA and Iran will have to agree on the modalities of access to military-related sites. Such modalities normally include agreement on the advance notifications for such access, equipment and methods used for the inspections, provisions on sample-taking, and arrangements to protect sensitive military-related information without compromising the IAEA's verification goals.

The IAEA will monitor uranium production at mines and milling facilities. All yellowcake in Iran is subject to IAEA monitoring, and the declared inventory of all centrifuge rotors and bellows is placed under IAEA monitoring. As some of these activities go beyond the provisions of the Additional Protocol, the IAEA and Iran have to agree separately in such instances on issues such as inspection arrangements. These include the frequency of visits, verification methods and instruments to be used by the IAEA, and advance notification required for such visits.

October 18, 2023, Transition Day: Eight years after Adoption Day, or the date on which the Director General of the IAEA submits a report stating that the IAEA has reached the Broader Conclusion that all nuclear material in Iran remains in peaceful activities, whichever is earlier. On this date, the EU, U.S., and U.N. will terminate certain sanctions envisaged under the JCPOA.

From this date, Iran will "Seek, consistent with the Constitutional roles of the President and Parliament, ratification of the Additional Protocol."[18] The text is however silent on actual ratification.

End of year 2023: Iran will commence manufacturing of IR-6 and IR-8 centrifuges without rotors through year 10, at a rate of up to 200 centrifuges per year for each type.

October 18, 2025, Termination Day: Ten years after Adoption Day, U.N. Security Council Resolution 2231's provisions expire. With that, the Security Council will remove the Iranian nuclear issue from its agenda, provided that the provisions of previous resolutions have not been reinstated.

After this year, Iran is free to produce advanced centrifuges (e.g. IR-2m, IR-4, IR-6 and/or IR-8) to meet its enrichment and enrichment R&D needs, which remain subject to definition. Iran will store them at Natanz, in an above-ground location, under IAEA continuous monitoring, until they are needed for final assembly, according to the enrichment R&D plan. Iran has to submit its enrichment needs and R&D plan as part of the Additional Protocol declarations to the IAEA. The IAEA uses such information to guide its planning of verification activities and to get a fuller picture on the nuclear program. It is not certain whether the Joint Commission, which has been established by the JCPOA parties to address any disputes and to monitor the implementation of the agreement, needs to approve Iran's enrichment plans.

From this year, Iran's uranium isotope separation-related research and development or production activities will no longer be restricted exclusively based on gaseous centrifuge technology, and Iran can revitalize its laser enrichment program, if it so wishes.

18. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex V, paragraph 22. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_5_implementation_plan_en.pdf)

October 18, 2030: After 15 years, Iran can build additional enrichment plants, and restrictions on enriched uranium inventories and enrichment caps at 3.67 percent will be lifted. Although Tehran has stated that it never intends to build additional heavy-water reactors or to reprocess spent fuel, after fifteen years, the JCPOA no longer bars Iran from these activities.

The bans on the R&D, production or acquisition of plutonium, and uranium metal expire. From this date, Iran can also acquire high-enriched uranium, plutonium, or Neptuniem-237, which are fissile materials with limited civilian use.[19]

October 18, 2035: After 20 years, monitoring of the production of centrifuge rotors and bellows ceases.

October 18, 2040: After 25 years, Iran will no longer be required to provide information for the verification of the production and inventory of uranium ore concentrate.

19. The Joint Comprehensive Plan of Action bans Iran from enriching uranium above 3.67 percent for 15 years but is silent on the levels to which Iran may enrich after that time.

Historical Examples of the Diversion of Undeclared Nuclear Material

In the previous cases of the nuclear proliferation over the past two decades (Iraq, Libya, Egypt, South Korea, and Iran), states did not divert declared nuclear material; instead, the issue was the use of undeclared material, primarily at undeclared facilities.

There are a number of other lessons to be learned from earlier proliferation cases. In October 1994, the U.S. and North Korea concluded the Agreed Framework, in which North Korea agreed to dismantle its gas-cooled graphite moderate reactors and related facilities in return for two light-water reactors. This agreement also meant that North Korea would forego spent-fuel reprocessing, as stipulated in the Joint Declaration of December 1992.[20]

20. The Joint Declaration also stipulated that there would be no enrichment and reprocessing on the Korean Peninsula. "Joint Declaration of South and North Korea on the Denuclearization of the Korean Peninsula," February 19, 1992. (http://cns.miis.edu/inventory/pdfs/aptkoreanuc.pdf)

Per the agreement, IAEA inspections could only monitor the declared, frozen nuclear facilities in North Korea. In the beginning, this freeze neither included the dismantling of nuclear capabilities nor the shipment abroad of spent fuel and plutonium from earlier experiments.[21] As a result, three years after announcing its withdrawal from the Nuclear Non-Proliferation Treaty in 2003, North Korea conducted its first nuclear test in October 2006.[22] The fact that there had been no dismantling of reprocessing capabilities allowed North Korea to reconstitute its program rapidly.

In December 2003, Colonel Ghaddafi announced that Libya would give up its weapons of mass destruction programs, and that outside powers could verify their dismantlement.[23] The agreement that the U.S. and U.K. concluded with Libya provided for the shipment to

21. "1994 Agreed Framework," *GlobalSecurity.org*, last updated July 24, 2011. (http://www.globalsecurity.org/wmd/world/dprk/nuke-agreedframework.htm)
22. Kelsey Davenport, "Chronology of U.S.-North Korean Nuclear and Missile Diplomacy," *Arms Control Association*, May 2015. (https://www.armscontrol.org/factsheets/dprkchron)
23. "Libya to Give Up WMD," *BBC News*, December 20, 2003. (http://news.bbc.co.uk/2/hi/3335965.stm)

the United States of uranium-enrichment equipment, including centrifuges and their components, and clandestinely acquired UF6 feed materials. The spent fuel from the Tajoura Research Reactor was shipped to Russia, and the reactor was modified to use low-enriched uranium fuel.[24] The IAEA was permitted to visit all facilities, including military sites, and interview scientists and critical personnel as it deemed necessary. The agreement also included the removal from Libya of all documentation pertaining to the development of nuclear weapons and uranium enrichment.

In September 1991, South Africa concluded a Comprehensive Safeguards Agreement with the IAEA and submitted its initial declaration on facilities and nuclear material inventories to the IAEA. In March 1993, President F. W. de Klerk disclosed that South Africa had a nuclear-weapons program, which had been dismantled before South Africa joined the NPT.[25] Following Pretoria's disclosure, the IAEA's verification work was extended in order to confirm the dismantling of nuclear-weapons and other related infrastructure, to verify the historical production and acquisition of nuclear material, and to put in place mechanisms that would allow for early detection should the weapons program be reconstituted.[26]

To confirm the statements made by the South African authorities, and to set up a baseline to monitor the program and ensure its parts were not reconstituted, the IAEA conducted extensive debriefings of former staff personnel.[27] The aim was to understand fully all aspects of the country's military and civilian nuclear programs, using a "cradle-to-grave" process. The South African experience demonstrated that full cooperation and transparency of an inspected state are essential in resolving outstanding issues. To this end South Africa's policy on visits—any time, any place with a reason—was important for the IAEA's work. While the inventory of nuclear material and the dismantling of enrichment and weapons capabilities were successfully verified, less attention was paid to the manufacturing equipment supporting the nuclear-infrastructure of the dismantled nuclear program. Some of the companies involved in this part of the program later engaged in commerce on nuclear black markets, using materials that had not been impounded or otherwise controlled.[28] For 15 years, these companies were able to evade international controls designed to prevent such black-market nuclear trade.

In the light of these past experiences, the JCPOA should have included much stronger provisions, some of which are addressed below in more detail.

Components of Effective Implementation and Verification

Credible Baseline

It is unclear from the JCPOA to what extent Iran must fully declare its nuclear work. The agreement's language appears to rely essentially on information provided pursuant to the provisions of the safeguards agreement (or basic safeguards undertaking); but what information Tehran will provide, as required by its transparency obligations, is vague. In the 2003 agreement between

24. Kelsey Davenport, "Chronology of Libya's Disarmament and Relations with the United States," *Arms Control Association*, February 2014. (https://www.armscontrol.org/factsheets/LibyaChronology)
25. Adolf Von Baeckmann, Garry Dillon, & Demetrius Perricos, "Nuclear Verification in South Africa," *IAEA Bulletin*, 1995. (https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull37-1/37105394248.pdf)
26. Adolf Von Baeckmann, Garry Dillon, & Demetrius Perricos, "Nuclear Verification in South Africa," *IAEA Bulletin*, 1995. (https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull37-1/37105394248.pdf)
27. Ibid.
28. For example, see the case of the High Court of South Africa v. Daniel Geiges, Gerhard Wisser, and Krisch Engineering. Wisser pled guilty in a South African court to illegally exporting nuclear components from South Africa to Libya as part of the AQ Khan network. Court documents are available on the Institute for Science and International Security website. (http://www.isis-online.org/peddlingperil/southafrica) Under the JCPOA, U.S. sanctions against Wisser will be lifted after eight years.

the EU3 and the Islamic Republic,[29] Iran's transparency requirements were much more substantive: "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."[30]

In order to establish a credible baseline for the monitoring and verification process, a complete declaration of all of Iran's nuclear activities, including past ones—for example, the status of equipment and material from dismantled installations—is essential. This is particularly significant since Iran's nuclear program has been subject to several changes and has grown substantially since Iran stopped its provisional AP implementation and reduced its cooperation with the IAEA at the end of 2005.[31]

Given Iran's various statements about its current and future nuclear intentions, it is also critical to know how far any work has proceeded, the locations of those planned facilities, and, most importantly, if Iran has begun any construction work or procured or manufactured any equipment.

Access to Undeclared and Suspected Sites

To remove any ambiguities about Iran's programs, and to enforce the IAEA's requests to have access to suspected or undeclared sites, the JCPOA provides for a dispute-settlement mechanism should Iran refuse to cooperate or challenge an IAEA request. The fact that there is a process that allows for a majority vote to force Iranian compliance is not insignificant, but this does not mean that the verification process will be practicable and work effectively in real life. For example, the mechanism's guidelines regarding how evidence and information are provided are unclear and leave unanswered questions: Can the mechanism protect source intelligence and methods? What happens when a situation arises when the evidence provided does not meet the standards of all P5+1 members? In other words, the bar will be set very high to begin with and may not allow for gray areas where intelligence is not foolproof, but there is sufficient suspicion nonetheless. Non-alarming answers to suspicions may well exist in these cases, but the IAEA needs to be able to evaluate all suspicions carefully, which will require guaranteed and prompt access to sites and personnel.

Timeliness of access has always been an important concept. The IAEA's Model 1972 Comprehensive Safeguards Agreement includes a provision that "if the Board, upon report of the Director General, decides that an action by the State is essential and urgent in order to ensure verification that nuclear material subject to safeguards under the Agreement is not diverted to nuclear weapons or other nuclear explosive devices, the Board shall be able to call upon the State to take the required action without delay, irrespective of whether procedures for the settlement of a dispute have been invoked."[32]

The 24-hour notice access under the Additional Protocol was created to ensure the absence of undeclared activities in a state. The timeline is to be understood as serving

29. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2003/75, November 10, 2003. (https://www.iaea.org/sites/default/files/gov2003-75.pdf)
30. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2003/75, November 10, 2003. (https://www.iaea.org/sites/default/files/gov2003-75.pdf)
31. Iran signed the Additional Protocol and started its provisional implementation in December 2003.
32. International Atomic Energy Agency, "Agreement Between Iran and The International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons," INFCIRC/214, December 13, 1974. (https://www.iaea.org/sites/default/files/publications/documents/infcircs/1974/infcirc214.pdf)

an administrative purpose to allow a state to provide the necessary access. In announcing its full declaration and cooperation, South Africa provided "anytime, anywhere" access within reason, and inspectors gained prompt access to its requests, including to military sites. Within reason was understood to mean only that the IAEA could not request access to a facility in the middle of the night.[33]

In terms of settlement time, the JCPOA's 24-day period does not credibly account for all plausible scenarios. A facility of sizable scale—such as the Natanz and Fordow enrichment plants or the uranium conversion plant in Esfahan—cannot simply be erased in three weeks without leaving traces. But this is not the case in the likely scenarios involving small-scale facilities, which could be critical in the weapon manufacturing process. The activities at these facilities could include, for example, the manufacturing of components, such as triggering mechanisms, for a nuclear weapon.

Additionally, how does the mechanism address situations where access is provided but limitations are imposed (e.g., limited environmental sampling)? How will the P5+1 address a situation in which Iran agrees to some, but not all, of the access requests? A critical point: As straightforward as access may sound on paper, there are always issues that can complicate access to suspect sites.

The JCPOA has also substantially increased the complicating issues. The time for "scrubbing"—removal of radioactive material from surfaces by chemical decontamination or grinding—takes on special salience in nuclear-related developments without nuclear material present. While scrubbing may still leave some radioactive dust dispersed, which can be detected by environmental sampling, such sampling can be successful only insofar as the process is thorough, samples are taken at the places where traces remain, and the methods are not subject to undue restraint by Iran. For example, samples from surfaces that have been lacquered or painted over multiple times may not to turn up positive results in environmental sampling. In addition, Iran's past concealment efforts, like those carried out in 2003, left no traces to be detected through environmental sampling in the renovated areas. Traces were, however, detected elsewhere, leading Iran to disclose that nuclear work was carried out in the renovated place.[34] With the expectation of possible exposure resulting from the disclosure of activities, which Iran has until now denied, Iran will likely take all the precautions necessary to minimize the effects of exposure and find ways to complicate the IAEA getting answers, well within the 24 days. The psychological deterrence factor of the Additional Protocol's "snap inspections" is also certainly weakened under circumstances of a longer timeline.

Additionally, the JCPOA requires the IAEA to provide Iran with the information and "basis for such concerns" about undeclared or suspect activities.[35] This will have the effect of telling Iran what the IAEA knows and what it does not know—and potentially enable Iran to use this information to determine how it will respond to an access request. The 24-day adjudication timeline, together with the provision of relevant information to Iran, reduces detection probabilities exactly where the system is weakest: discovering undeclared facilities and material.

33. David Albright, "Joint Comprehensive Plan of Action (JCPOA): Non-Proliferation, Inspections, and Nuclear Constraint," *Testimony before the Senate Foreign Relations Committee*, August 4, 2015. (http://www.foreign.senate.gov/imo/media/doc/080415_Albright_Testimony.pdf)

34. David Albright, "Joint Comprehensive Plan of Action (JCPOA): Non-Proliferation, Inspections, and Nuclear Constraints," *Testimony before the Senate Foreign Relations Committee*, August 4, 2015. (http://www.foreign.senate.gov/imo/media/doc/080415_Albright_Testimony.pdf)

35. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraph 75. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)

IAEA-Iran Road-map: Resolution of the Possible Military Dimension Issues

Under the Iran-IAEA "Road-map for the Clarification of Past and Present Outstanding Issues,"[36] Iran will address issues of concern relating to its nuclear program raised in the Annex to the IAEA report of November 2011.[37]

The Road-map has two separate arrangements, which have not been shared with the IAEA Board. This lack of transparency has led to questions regarding the IAEA's ability to independently apply its verification standards so that it will not compromise its findings. Specifically, the following questions remain unresolved:

- Is the IAEA permitted to interview in-person all the scientists, engineers, and other officials, including military personnel, involved in the procurement, manufacturing, installation, and use of equipment for the experiments highlighted in the IAEA's November 2011 report? Following the initial interviews, will follow-up questions to individuals, issues, and sites be permitted?

- Do IAEA personnel have direct access to the equipment, laboratories, workshops, and other relevant locations where that equipment has been manufactured, used, or stored in order to examine the properties and to take environmental and other samples?

- Is IAEA staff permitted to take their own samples at military, suspected, or other sensitive sites? If not, what is the reason for this limitation? How is the representativeness of the samples assured? If sampling is followed, for example, through cameras, how can the inspectors select sampling spots, where decontamination activities could not have been completed?

The IAEA has thus far not released its verification approach for Parchin. This is a departure from, for example, the Work Plan of August 2007, which was distributed as a publicly available INFCIRC document.[38] Similarly, in a later discussion in 2012, detailed information about questions raised by the IAEA was distributed as a GOV/INF document, which was made available to the Members States of the IAEA Board of Governors. The latter document also showed access to the personnel involved and details associated with sample taking by the IAEA at military sites.[39] This document highlights the approach and process taken by the IAEA to resolve issues in spring 2012. The document was distributed to IAEA Board Members, and Iran also made it available to journalists.

It is worth noting that as part of the suspension-monitoring scheme in 2003-2006, the Agency was provided access to a number of military sites to take environmental samples at workshops involved in the

36. International Atomic Energy Agency, "Road-map for the Clarification of Past and Present Outstanding Issues regarding Iran's Nuclear Program," GOV/INF/2015/14, July 14, 2015. (https://www.iaea.org/sites/default/files/gov-inf-2015-14.pdf)
37. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," GOV/2011/65, November 8, 2011. (https://www.iaea.org/sites/default/files/gov2011-65.pdf)
38. International Atomic Energy Agency, "Communication Dated 27 August 2007 from the Permanent Mission of the Islamic Republic of Iran to the Agency Concerning the Text of the 'Understandings of the Islamic Republic of Iran and the IAEA on the Modalities of Resolution of the Outstanding Issues,'" INFCIRC/711, August 27, 2007. (https://www.iaea.org/sites/default/files/publications/documents/infcircs/2007/infcirc711.pdf)
39. International Atomic Energy Agency, "Communication Dated 2 March 2012 Received from the Permanent Mission of the Islamic Republic of Iran to the Agency," GOV/INF/2012/4, March 2, 2012. (http://www.isisnuclearіran.org/assets/pdf/gov-inf-2012-4.pdf)

domestic production of gas centrifuge components.[40] If verification standards have now changed or diluted—and it's difficult to see now how they have not been—the ramifications for, and impact on, meaningful verification work need to be recognized in the context of the kind of assurances the IAEA is able to provide under its final broader conclusions. The IAEA's basic credibility is at stake here.

The IAEA will provide regular updates to the Board of Governors on the implementation of this Road-map, which will likely reveal some of the methodologies used and shed light on some of the questions raised above. In addition to the regularly scheduled Board meetings at the end of November, there will likely be an extraordinary meeting after the issuance of the report on December 15, 2015.

It is unlikely, however, that the profound concerns over the PMD issues will end there. To begin with, the text refers to only the issues raised in the IAEA's report of November 2011. Director General Amano has stated on several occasions[41] that there is information that some activities have continued in recent years that may not be identical to those in the 2011 report.

When, in 2008, the IAEA publicly introduced the notion of the Possible Military Dimension,[42] it was seeking answers to longstanding unresolved issues. Resolution of these issues is essential for the Agency to provide assurances regarding the absence of undeclared nuclear material and activities in Iran. That 2008 report asked Iran to, inter alia, resolve questions related to its alleged nuclear-weapons studies, provide more information on the circumstances of its acquisition of the uranium metal document,[43] clarify procurement and R&D activities of military-related institutes and companies that could be nuclear-related, and clarify the production of nuclear equipment and components by companies belonging to defense industries.

Sample analysis, verifying information, and seeking additional clarifications are time-consuming. The Road-map also does not specify the kind of inspection and verification activities the IAEA will conduct after receiving the first statements from Iran. This leaves room for flexibility and interpretation—for better or worse—for the IAEA's next steps.

The biggest challenges among the PMD concerns are some of the items related to nuclear-weapon design listed in Annex I of the JCPOA. Among these items are designing, developing, acquiring, or using computer models to simulate nuclear explosive devices and designing, developing, fabricating, acquiring, or using multi-point explosive detonation systems suitable for a nuclear explosive device. These are extremely difficult to verify given their non-nuclear nature and lack of easy signature.

Due to the complexity of issues related to PMDs and the time required for sample analysis and subsequent discussions with Iranian officials to corroborate information provided by Tehran, it is near certain

40. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2004/11, February 24, 2004, paragraph 8. (https://www.iaea.org/sites/default/files/gov2004-11.pdf)
41. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," GOV/2015/15, February 19, 2015. (https://www.iaea.org/sites/default/files/gov2015-15.pdf)
42. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007) and 1803 (2008) in the Islamic Republic of Iran," GOV/2008/15, May 26, 2008. (https://www.iaea.org/sites/default/files/gov2008-15.pdf)
43. This document, which describes in some detail the conversion of high-enriched UF6 to uranium metal buttons, which are further machined to nuclear weapon components, was found among documentation related to uranium enrichment. The document originates from Pakistan. Iran has stated that it did not request it, but it came with centrifuge related documents from the AQ Khan network.

that the IAEA will not be able to issue a conclusive comprehensive final report by December 2015, regardless of the level of Iran's cooperation. Issues such as the completeness of the nuclear material declaration, understanding past activities, and possible past or current existence of a parallel nuclear program, which are all required to confirm the strictly peaceful nature of Iran's nuclear program, will oblige a much longer period of time than envisioned in the JCPOA. And when and where more questions arise, Iran will need to provide concrete answers. Also we will need to see that inspectors are able, in a meaningful manner, to take samples, interview scientists and government officials, inspect sites, and review and copy documents required to conduct their investigations, all of which are time consuming tasks.

It is important to stress that addressing PMD issues is not a matter of forcing a confession from Iran on whether a nuclear-weapons program existed. If the

Table 2: The Milestones of the Road-map:

August 15, 2015: Iran will provide, by way of submitting written explanations and related documents to the IAEA, information relating to PMD issues set out in the Annex of the IAEA report of November 2011 (GOV/2011)/65.[44] Iran has provided its explanations in a timely fashion.

September 15, 2015: The IAEA will review Iran's written explanations and related documents and will submit to Iran questions on any possible ambiguities regarding information provided.[45] The IAEA submitted additional questions in a timely fashion.

October 15, 2015: By that date, after the IAEA submitted to Iran questions on any ambiguities regarding such information, technical-expert meetings, technical measures, and discussions were organized in Tehran to seek to remove ambiguities. Associated verification measures to conduct findings are specified in a separate arrangement, which has not been made public.

Iran and the IAEA also agreed on another separate arrangement regarding the issue of Parchin, which has also not been made public.

December 15, 2015: The IAEA will provide its final assessment on the resolution of all past and present outstanding issues, as set out in the November 2011 IAEA report (GOV/2011/65). A wrap-up of the technical meetings between Iran and the Agency will be organized before the issuance of the report. Then, according to the JCPOA, "The E3+3 … will submit a resolution to the [IAEA] Board of Governors for taking necessary action, with a view to closing the issue, without prejudice to the competence of the Board of Governors."[46]

44. Iran submitted its explanations to the IAEA on August 15, 2015. Laurence Norman, "Iran Submits Information on Past Nuclear Work to U.N. Agency," The Wall Street Jour*nal, August 15, 2015. (*http://www.wsj.com/articles/iran-submits-information-on-past-nuclear-work-to-u-n-agency-1439641478)
45. The IAEA submitted additional questions on the ambiguities to Iran on September 8, 2015. International Atomic Energy Agency, Press Release, "IAEA Statement on Iran," September 9, 2015. (https://www.iaea.org/newscenter/news/iaea-statement-iran)
46. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, paragraph 14. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/iran_joint-comprehensive-plan-of-action_en.pdf)

IAEA is to certify that Iran's nuclear program is purely peaceful, the IAEA needs a full understanding of the history of PMDs, how far Iran got along the path to weaponization, and what steps are necessary to ensure weaponization activities are not reconstituted. This is critical to the JCPOA's integrity. These answers, as well as assurances, will not come easy. Therefore, the JCPOA seems to imply that IAEA must resolve the PMD issues before the P5+1 will grant substantial sanctions relief lest the P5+ 1 lose its primary leverage before Tehran has even begun to answer the outstanding PMD questions. It will likely take many years before the IAEA can draw the so-called broader conclusion that all nuclear material and activities, not just declared ones in Iran, have been placed under IAEA safeguards.

Verifying Parchin

Questions and concerns have surrounded inspection procedures at Parchin. Is the IAEA getting the necessary physical access to the site to collect meaningful information? As foreseen in an unofficial draft of the Iran-IAEA agreement reported by the *Associated Press,*[47] the Iranians, under IAEA inspectors' direction but without their physical presence on site, took environmental samples at the suspect location.[48]

The IAEA Director General's remarks to its Board on September 21, 2015 did not reveal any specific details about the sampling arrangement or about how the IAEA directed the taking of environmental samples inside the key building of interest and possibly at other locations at the site. So we will have to be careful in our speculation about the procedures used. We know from the IAEA's statements that the sampling was videotaped by the Iranians under IAEA direction. Media reports were unclear, however, as to whether the videotaping was done in real time—that is, with a live feed to IAEA inspectors located elsewhere—or if Iran provided the digital files after the fact to the inspectors for analysis, review, and subsequent action. In the latter case, the inspectors may have first received videos taken inside the suspect building and then, after reviewing the videos, instructed the Iranians where to take the samples, a process also videotaped by the Iranians. Thereafter, the Iranians would have presented the new videos and samples to the IAEA. However, what actually happened remains unknown publicly.

Parchin and the PMD issues are relevant for understanding how far Iran has gone toward designing a nuclear weapon. Their impact on overall safeguards means that confidence in IAEA verification cannot be set lower than accepted in the past. During 2003-2005, IAEA inspectors visited military sites in Iran and took samples, on short notice, at buildings of its choice that had not been pre-selected. IAEA inspectors took samples without Iran imposing undue restrictions.

We must remember that the Parchin site is not a nuclear laboratory in a university or a civil plutonium-handling facility in Japan or France. **The IAEA needs to clarify serious allegations about Iran's work on high explosives related to nuclear-weapons development in a situation that has far-reaching non-proliferation implications.** Inspection arrangements require a cohesive attempt to find out if the nuclear-weapons allegations are true. Thus the methods have to be sound and based on the strongest IAEA inspection and sampling procedures.

In granting permission for Iranians to take their own sampling at Parchin, the IAEA explained that it had, on limited occasions, permitted a country's nationals to

47. "Text of Draft Agreement between IAEA, Iran on Inspection at Parchin Military Site," *Associated Press*, August 20, 2015. (http://www.foxnews.com/world/2015/08/20/text-draft-agreement-between-iaea-iran-on-inspections-at-parchin-military-site/)
48. International Atomic Energy Agency, "IAEA Director General's Remarks to the Press on Visit to Iran," Vienna, September 21, 2015. (https://www.iaea.org/newscenter/statements/iaea-director-generals-remarks-press-visit-iran)

handle a specific task during an inspection process. But it is equally important that the IAEA provides the context of its statement. The IAEA inspectors have permitted samples to be taken inside highly radioactive hot cells (shielded nuclear radiation containment chambers with thick walls) by the facility operator, using remote manipulators. But the accepted procedure has always been for the inspectors to be physically present the entire time next to the operator and to control where and how to sample, thus ensuring that the sampling is representative and that the inspectors can identify any possible alterations to the objects sampled. Similarly, the IAEA has allowed a country's technicians to take swipe samples inside plutonium glove-boxes under inspector supervision and guidance. Here again, this procedure was used because of the highly radioactive environment encountered by inspectors and the need to use specialized equipment or procedures to ensure safety and health requirements. Significantly, the inspectors were not kept out of the room where the operator was taking the samples, as in the case with Parchin. Moreover, there are no radioactive hazards inside the suspect building at the Parchin site.

The broader concern is that if verification standards were, or at least appear to have been, diluted for Parchin (or elsewhere) and limits were imposed on IAEA inspections, it will affect the IAEA's ability to draw definitive conclusions with the requisite level of confidence in the verification procedures used. Moving forward, the IAEA needs to demonstrate during the next several months as the JCPOA is implemented, that it can access all Iranian sites of concern, including military sites, and conduct effective verification into the allegations of Iran's past nuclear weapons work. It should release the Parchin agreement and associated procedures to member states. It essential for the credible conclusions that the IAEA will also gain access to the other known sites associated with past nuclear weapons work and interview key scientists and engineers and their leadership linked to those efforts. This includes IAEA access to relevant sites, locations, and entities, as well as interviewing individuals reflected in the U.N. Security Council resolutions[49] and in the Annex of the IAEA November 2011 report.[50]

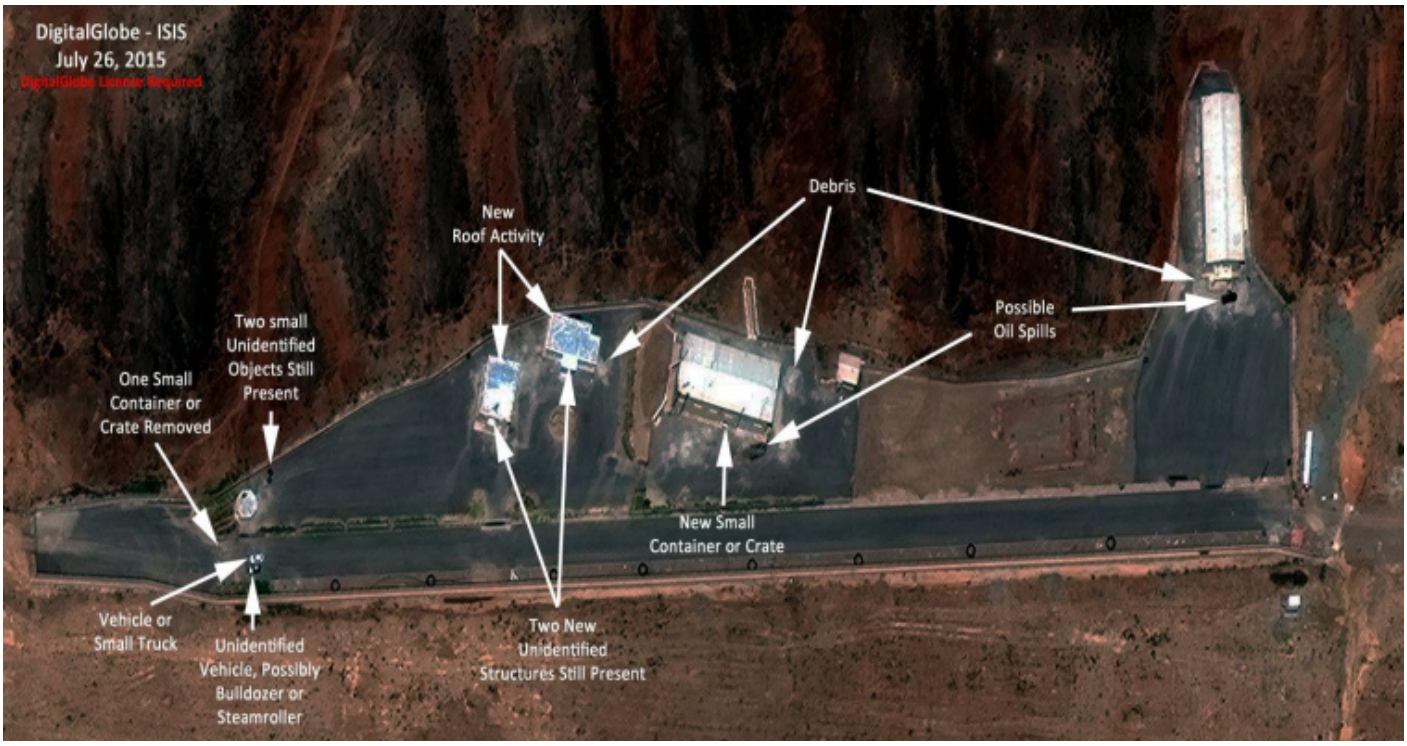
Addressing Sanitization Efforts

Commercial satellite images dated July 12, 19, and 26, 2015, showed renewed activity at a site at the Parchin military complex.[51] These activities could be related to refurbishment or further sanitization prior to any IAEA inspection. The IAEA had first requested access five years ago. Iran has since cleared and renovated the site on multiple occasions. The more important point—and difference here—is that the July activities took place *after* the IAEA and Iran reached an agreement to access Parchin under the July 14 Road-map. Regardless of the kind of activity involved, the concern is about changes to suspect sites for which access has already been requested and agreed upon.

The second point to bear in mind is that while Parchin is an open complex that can be monitored by satellite imagery, which makes tracking movement possible, it is not always the case that a suspect location or area will have easy overhead monitoring.

Any policy allowing or acquiescing to alterations by Iran following a request to access a suspect site would have significant effects on verification. This precedent

49. This refers to six United Nations Security Council resolutions adopted between 2006 and 2010: 1696 (2006); 1737 (2006); 1747 (2007); 1803 (2008); 1835 (2008); and 1929 (2010).
50. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," GOV/2011/65, November 8, 2011. (https://www.iaea.org/sites/default/files/gov2011-65.pdf)
51. David Albright & Serena Kelleher-Vergantini, "Renewed Activity at the Parchin Site in Iran," *Institute for Science and International Security*, August 5, 2015. (http://www.isis-online.org/uploads/isis-reports/documents/Renewed_Activity_at_Parchin_August_4_2015_FINAL.pdf)



July 26, 2015 DigitalGlobe imagery showing renewed activity at a site at the Parchin Military Complex that has been linked to high explosive work related to the development of nuclear weapons. (Photo Source: DigitalGlobe/ GettyImages; Photo Analysis: Institute for Science and International Security)

might facilitate hiding, evasion, removal, sanitization, and prevarication on all activities, equipment, and evidence relating to a nuclear-weapons program. For the purposes of verification, the new procedures at Parchin will surely establish a paradigm that will challenge the safeguards process for the JCPOA and for future IAEA efforts elsewhere in the world including, not least, verification activities foreseen in North Korea.

IAEA Capabilities

Verifying Iran's large and complex nuclear infrastructure with a history of concealment is going to be long and hard. Challenges are likely to emerge especially over the medium to long term as sanctions fall away or additional inconsistences come to light. The IAEA stands ready to receive an increase in funds, equipment, and personnel to fulfill its task. These are essential, but the most important asset is to have the right people to do the job. The durability of verifications work is also about maintaining vigilance as Iran expands its nuclear infrastructure, as allowed by the JCPOA, and continues to improve its skill sets on nuclear R&D, especially as regards the development of more advanced centrifuges.

As envisioned in the JCPOA, the IAEA will need to designate additional inspectors. The JCPOA, however, limits the ability of the IAEA to designate additional experts by requiring that experts be "from nations that have diplomatic relations with Iran."[52] Given the magnitude of the various tasks at hand, additional skills sets and expertise are required. These include expertise

52. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraph 67.3. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)

on centrifuge manufacturing and R&D, uranium and plutonium metallurgy, and weaponization. While IAEA rules do not allow experts or consultants to be designated as safeguards inspectors, IAEA is usually able to call in the required experts, without prejudice to nationality, particularly in dealing with proliferation-sensitive areas. IAEA experts and consultants are subject to the same confidentiality rules as its regular staff. The IAEA, for instance, can hire experts to work at its headquarters in Vienna, but it is equally important to be able to deploy these experts on the ground in Iran. This has precedent. The IAEA has, for example, used such experts, with Iran's agreement, on a case-by-case basis since 2003. With a negotiated deal in place to inspect Iran, the IAEA should expect greater, rather than less, cooperation from Iran on this matter.

The JCPOA foresees regular reporting by the IAEA Director General to the Board of Governors and to the U.N. Security Council. The JCPOA also emphasizes the need to maintain the confidentiality of information. Over the years, Iran has repeatedly complained that IAEA reports include too much detailed information.[53] However, it is essential that the IAEA report its findings in detail so that its member states can make their own independent judgments on the progress of the implementation of the JCPOA and Iran's compliance. For instance, recent IAEA reports have not disclosed any information on Iran's uranium inventories or production numbers. Likewise, meaningful information was short in the Agency's reports on its inspection visit to Iran's uranium mines and milling facilities. Given the scrutiny that will be generated by Iran's implementation of the JCPOA, IAEA should revert to its past practice of issuing detailed Board reports.

53. International Atomic Energy Agency, "Communication Dated 16 June 2015 Received from the Permanent Mission of the Islamic Republic of Iran to the Agency Regarding the Report of the Director General on the Implementation of Safeguards in Iran," INFCIRC/885, June 25, 2015. (https://www.iaea.org/sites/default/files/infcirc885.pdf)

Enrichment Capabilities

In some cases, the IAEA will face greater challenges as a result of the language of the JCPOA. Although Iran will place excess centrifuges together with dismantled supporting infrastructure at Natanz and Fordow under continuous monitoring by the IAEA, the provisions of the JCPOA only account for Iran's *declared centrifuge inventory.*

The IAEA will monitor the inventory of all centrifuge rotor tubes and bellows. Iran will also declare and place under IAEA monitoring all locations and equipment used for the production of centrifuge rotor tubes and bellows such as flow-forming machines and filament-winding machines. The JCPOA, however, doesn't specify that balancing machines and the mandrels for flow-forming and filament-winding machines should be placed under IAEA monitoring. These are key manufacturing equipment and should be under IAEA monitoring.

Given Iran's nuclear history, there will be some past equipment and skills from older manufacturing workshops that will be harder to account for. The current JCPOA arrangements do not appear to deal with past sites and workshops, which could still potentially be used for the production of centrifuge rotors and bellows.

When Iran suspended its enrichment program in 2003 pursuant to the agreement with the EU-3, Iran stopped all domestic manufacturing of centrifuge components and placed these under the Agency's monitoring.[54] All key materials, including maraging steel and high-strength aluminum, were also subject to monitoring.

54. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2004/11, February 24, 2004, paragraph 69. (https://www.iaea.org/sites/default/files/gov2004-11.pdf)

The monitoring arrangements related to the manufacturing of centrifuges and their components implemented during the suspension of Iran's enrichment program in 2003-2005 were stronger than the ones foreseen for the JCPOA.

The objective of the JCPOA nuclear agreement with Iran is to prevent the Islamic Republic from acquiring nuclear weapons. Given the permitted existing infrastructure and capacity that Iran retains under the JCPOA, what robust verification does, if properly and fully implemented, is allow for early detection and help deter and delay such actions. Estimation of a breakout time to produce enough nuclear material for one bomb depends on several factors, which all have their uncertainties. These include the number and capacity of centrifuges available in Iran, stocks of natural and enriched uranium, the speed of installation of additional, new centrifuges and process equipment, and the reintegration of dismantled equipment into a functioning cascade. With 5060 IR-1 centrifuges operating in Natanz, capping the stocks of 3.67 percent enriched uranium to 300 kg will effectively prevent Iran, for the next 10 years, from producing enough fissile material for one nuclear weapon in one year's time at its declared nuclear facilities.

At year 15, the time required to produce enough highly-enriched uranium for a single weapon decreases to a few weeks at declared facilities, after more advanced centrifuges, allowed by the JCPOA, have been installed. After that, restrictions on uranium enrichment will be removed; Iran will be permitted to build additional enrichment facilities; and there will be no limits on Iran's uranium stocks. This will bring breakout time down to a couple of weeks or, according to some estimates, even fewer.[55] While Tehran may not choose to break out, such a capacity will exist.

The JCPOA has a mechanism to re-impose sanctions if Iran violates the agreement. However, responses remain unclear to smaller violations that fray the agreement, such as exceeding slightly the limits for centrifuges allowed or delaying shipments of enriched uranium. To deter transgressions, the P5+1 should be prepared to counter small violations in an effective manner. During the course of the agreement, Iran will acquire more modern equipment and distribute key activities over the country, making any coercive action more difficult. Depending on the security situation, Iran's next enrichment plant could also be built to be less vulnerable. In the event of a significant violation, the snapback of sanctions is envisaged, but these effects would be measured in months or years, while breakout time, which will gradually shrink and essentially disappear after year 15, will operate more quickly.[56]

For the first 10 years, Iran's uranium isotope separation-related research and development or production activities will be exclusively based on gaseous centrifuge technology, which will be verified by the IAEA using the verification tools of the safeguards agreement and the Additional Protocol. In February 2010, Iran announced publicly that it had technology to enrich uranium with laser technology.[57] In January 2014, Iran stated that

55. David Albright, "Joint Comprehensive Plan of Action (JCPOA): Non-Proliferation, Inspections, and Nuclear Constraints," *Testimony before the Senate Foreign Relations Committee*, August 4, 2015. (http://www.foreign.senate.gov/imo/media/doc/080415_Albright_Testimony.pdf)
56. David Albright, Houston Wood, & Andrea Stricker, "Breakout Timelines Under the Joint Comprehensive Plan of Action" *Institute for Science and International Security*, August 18, 2015. (http://isis-online.org/uploads/isis-reports/documents/Iranian_Breakout_Timelines_and_Issues_18Aug2015_final.pdf)
57. "Iran Possesses Laser Uranium Enrichment Technology," *Iran Review*, February 8, 2010. (http://www.iranreview.org/content/Documents/Iran_Possesses_Laser_Uranium_Enrichment_Technology.htm)

the technology was based on experience acquired in R&D, which ended in 2003, and since then "there had not been any specially designed or prepared systems, equipment and components in laser-based enrichment plants in Iran."[58] The laser technology equipment was reportedly dismantled and stored at the Atomic Energy Organization of Iran's facilities at Lashkar Abad and Karaj, but there have not been any inspections of the dismantled equipment reflected in the IAEA reports since 2006.

If Iran proceeds with the installation of more advanced centrifuges, the breakout time after 15 years will drop to a couple weeks at most.[59] The U.S. administration and Congress would do well, sooner rather than later, to jointly address the post-year-15 situation to prevent Iran from obtaining a nuclear weapon.

In order to limit Iran's access to weapons grade uranium, the United States should make clear, as a matter of policy, that there is no need for Iran to enrich uranium above 5 percent—a level customarily used for fuel in light-water reactors. Furthermore, Iran is supposed to submit a long-term nuclear energy plan as part of the Additional Protocol. To strengthen the JCPOA, the United States can affirm, as often as required, that it will rigorously enforce its pledge to prevent Iran from obtaining sufficient fissile material for a nuclear weapon.

58. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2004/11, February 24, 2004, paragraph 69. (https://www.iaea.org/sites/default/files/gov2004-11.pdf)
59. Ali Akbar Salehi, the head of Iran's Atomic Energy Organization, has repeatedly stated that Iran plans to produce fuel to its nuclear power plants itself. He has envisioned that in 15 years' time Iran will manufacture annual reloads for three power plants in Bushehr, which requires more than 60 tons of low enriched uranium annually. This means that Iran would have enrichment capacity of close to 400,000 SWU.

Congress is also in a position to seek a policy statement from the administration requiring Iran to detail its long-term public energy plan. This will allow an assessment of whether the JCPOA's limitations are adequate given Iran's intentions. Such transparency is necessary since Iran retains a sizable nuclear infrastructure that will be free to grow as nuclear restrictions are lifted over the years.

Plutonium Production

The JCPOA's physical limits to constrain weapons-grade plutonium production are strong and irreversible for the first 15 years. The redesigned Arak heavy-water reactor will have a limited capacity to produce plutonium (about 1 kg annually). Additionally, Iran will ship out the spent fuel for the lifetime of the reactor.[60] The JCPOA indicates that Iran is planning to build light-water power and research reactors in the future. It also states only that Iran does not *intend* to build additional heavy-water reactors after 15 years.[61]

Iran's two additional reactors, the Tehran Research Reactor (TRR) and Bushehr Nuclear Power Plant, have plutonium in their spent fuel, which can also be used to produce additional plutonium by irradiating uranium targets. The JCPOA does not make any reference to the spent fuel of these reactors. According to its standard practices, the IAEA inspects Bushehr quarterly to confirm through camera surveillance that the reactor core is closed and the spent fuel remains in the pool. Once a year, the spent and core fuels are verified, and the absence of irradiation targets is confirmed. Should Iran try to divert spent fuel or remove irradiated targets, the activity will, with a high probability, be detected through the surveillance and the annual inventory verification.

60. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraph 11. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)
61. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraph 16. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)

TRR is a 5-megawatt research reactor built in the late 1960s. In recent years, the IAEA has inspected TRR on a quarterly basis. Like many other reactors at the time, the original fuel was high-enriched (93 percent), but in the early 1990s it was converted to use 19.75-percent enriched fuel.[62] Such a reactor could be used to produce plutonium up to 1 kg annually by irradiating targets.[63] Spent fuel of that reactor could be used as an enriched uranium source, if fission products were removed. Depending on the burn-up, the spent fuel could yield half of the amount of enriched uranium necessary for a nuclear weapon.[64] This would save Iran substantial enrichment efforts. It is not clear from the JCPOA text whether Iran has committed to ship out spent fuel from the TRR.

The JCPOA states that "Iran intends to ship out all spent fuel for all future and present power and research nuclear reactors, for further treatment or disposition as provided for in relevant contracts to be duly concluded with the recipient party."[65] The language "intend" nonetheless leaves the door open that some of the fuel may stay in Iran.

Iran is banned for 15 years from building a reprocessing facility to separate plutonium from spent fuel, insofar as the JCPOA registers Iran's intention not to do so.[66] It is therefore not explicitly proscribed. On the other hand, the ban includes commitments in other areas not to produce or acquire plutonium or uranium metals or their alloys, or to conduct R&D on plutonium or uranium (or their alloys) metallurgy, or engage in casting, forming, or machining plutonium or uranium metal.

This leaves the door open for future reprocessing, which does not have any economic justification. The United States and its partners should state as policy that they do not see any justification for Iran to engage in reprocessing and reprocessing R&D after 15 years. With its partners and reactor vendors, the U.S. could agree to provide Iran with long-term assurances for fuel supplies and the retrieval of spent fuel. These assurances should also be negotiated as part of any power or reactor-delivery agreement, and would, for example, form part of the understanding of current negotiations on future reactors that Iran is conducting with China and Russia.

Before 2003, Iran conducted uranium-metal production activities at the Jabr Ibn Al Hayan Laboratories (JHL) located at the Tehran Research Center, without reporting them to the IAEA.[67] JHL has equipment suitable for uranium metallurgy and the production and casting of uranium metal. In the last few years, IAEA reports have not reflected the status of any such R&D scale activities, and whether or not they have continued.

The Uranium Conversion Facility (UCF) has a process line to produce uranium metal from natural and depleted uranium. The JCPOA states that the production line to produce fuel for the Arak Heavy

62. "Teheran Research Reactor (TRR)," *Institute for International Security and Science Website*, accessed November 2, 2015. (http://www.isisnuclearіran.org/sites/facilities/tehran-research-reactor-trr/)
63. In October 2003, Iran acknowledged the irradiation of about 7 kg of UO2 targets at TRR and subsequent plutonium separation experiments in a hot cell at the Tehran Research Center. These activities, which took place between 1988 and 1992, and separated plutonium had not been reported to the IAEA, as required under the comprehensive safeguards agreement. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2003/75, November 10, 2003, page 4. (https://www.iaea.org/sites/default/files/gov2003-75.pdf)
64. Older Tehran Research Reactor fuel was enriched to 93 percent, and the fuel used from early 1990's was enriched to 20 percent U-235.
65. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraph 17. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)
66. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraphs 18-20. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)
67. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2003/75, November 10, 2003. (https://www.iaea.org/sites/default/files/gov2003-75.pdf)

Water Reactor will be dismantled, and the equipment will be used as part of the Fuel Manufacturing Plant to produce fuel for the light-water reactors.[68] However, the JCPOA does not make any reference to the future of the uranium metal line at UCF.

For the next 15 years, Iran will be limited in acquiring, building, and operating hot cells suitable to handle spent fuel and conduct reprocessing experiments.[69] These will be co-located with the modernized Arak research reactor, the Tehran Research Reactor, and radio-medicine production complexes. The hot cells will only be capable of the separation and processing of industrial or medical isotopes and non-destructive post-irradiation examination (PIE) of fuel pins, fuel assembly prototypes, and structural materials. These examinations will be conducted exclusively at the Arak research reactor complex. The JCPOA includes a provision that the P5+1 will make available their facilities to conduct destructive testing with Iranian specialists.[70] Thus, Iran will not be able to test the first step of reprocessing: fuel dissolution. All sensitive hot-cell equipment will be acquired through the established procurement channel.

The IAEA verification system will detect in a timely manner, and with high probability, the diversion of spent fuel at Bushehr, TRR, and, in the future, Arak. Any irradiation of undeclared uranium targets at Bushehr will also be covered. Clandestine irradiation of small amounts of uranium at research reactors, such as a small clandestine hot-cell laboratory, will, however, be difficult to detect. To that end, intelligence information is essential. Iran had tried on several occasions to acquire heavy-duty "master slaves" suitable for handling equipment behind thick walls and shielded windows, which are essential equipment for hot cells. If Iran has been successful in any of these procurement attempts, those items need to be accounted for. Iran should also provide a statement on its failed attempts in any baseline declaration.

Procurement Channel

Under the JCPOA, the Joint Commission will create a Procurement Working Group to ensure that all of Iran's procurement is legitimate.[71] More clarification on the requirements of this procurement channel is needed. For instance, although Iran is required to submit dual-use equipment exports of its own under Additional Protocol requirements, the text suggests that the responsibility lies with the countries exporting such items to Iran to submit a proposal to the Working Group. While potentially creating an additional barrier to control procurement, such arrangements will not work well with countries that do not have well-enforced export-control systems. With the onus placed on other nations, Iran's role could be absolved in cases of disputes.

IAEA assurances on the overall absence of undeclared centrifuges and other sensitive uranium enrichment equipment will also not come easy.[72] Many other elements will need to be factored in. For instance, key dual-use manufacturing equipment (such as flow-forming and filament-winding machines) and raw materials (like maraging steel, high-strength aluminum, and carbon fiber) are used elsewhere in Iran, particularly by the military industries. A dedicated procurement

68. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraphs 21-23. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)
69. The dimensions of permitted hot cells are limited to less than 6 cubic meters, which will allow the production of medical and industrial isotopes, but which are not useful for larger-scale reprocessing experiments.
70. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex I, paragraph 17. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_1_nuclear_related_commitments_en.pdf)
71. "Joint Comprehensive Plan of Action," Vienna, July 14, 2015, Annex IV, paragraph 6. (http://eeas.europa.eu/statements-eeas/docs/iran_agreement/annex_4_joint_commission_en.pdf)
72. The IAEA will also monitor declared centrifuges not yet installed and installations declared manufacturing them.

channel will follow any new acquisition of those commodities. **However, the original inventories and historical stock of such materials remain unknown, which reduces the probability of catching the undeclared production of centrifuges.**

Pursuing Sooner Ratification

Code 3.1 specifies when an IAEA member state must report a new facility to the Agency.[73] In 2003 Iran agreed to implement the modified Code 3.1, which requires the submission of design information to the IAEA as soon as a new facility is planned. Iran unilaterally revoked its implementation of the modified code in February 2006.[74] Iran is the only country with a substantial nuclear program that does not adhere to the modified code.

Iran commenced full implementation of the modified Code 3.1 on Adoption Day, per the JCPOA. It is important that Iran expeditiously ratify this undertaking. Iran has always insisted on provisional implementation of anything beyond its basic safeguards requirements and argues that it is not in breach of its legal obligations and therefore not in non-compliance.

The significance of implementing the code *before* a facility is built is that it would provide assurance that the necessary safeguards could be incorporated into the facility's design. The code's implementation in Iran takes on special salience given that in January 2014, Iran informed the IAEA that it had started preliminary site selection for five enrichment facilities (and up to 10 in its stated plans), but had not completed them.[75] To give meaning to the implementation process, all pending or present design plans have to ensure proper safeguards can be carried out. There remains no practical and economic need for Iran to build these enrichment facilities.

Conclusion

We should aim to take advantage of the collective positive verification provisions of the JCPOA and repair the vulnerabilities that would compromise the agreement's ability to keep Iran a year away from breaking out to a nuclear weapon. After 15 years, verification will need to be geared toward a scaled-up and more-advanced nuclear program, with a significantly decreased breakout time. The JCPOA contains beneficial aspects, but also significant troubling elements. The improvements and adjustments outlined above would go some of the way in mitigating the agreement's notable weaknesses in verification.

73. Code 3.1 is part of the Subsidiary Arrangements to the Iran's safeguards agreement with the IAEA. According to the original version of Code 3.1, agreed in 1970s, the state was obligated to report a new facility no later than 180 days before the introduction of nuclear material. The IAEA Board recognized this in 1992 as a weakness to the verification system, and the code was modified. Having this information early, the IAEA can develop a safeguards approach that can be incorporated in the design and construction of the facility.

74. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2006/15, February 27, 2006. (https://www.iaea.org/sites/default/files/gov2006-15.pdf)

75. International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," GOV/2014/10, February 20, 2014. (https://www.iaea.org/sites/default/files/gov2014-10.pdf)

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