The July 14, 2015 comprehensive nuclear deal between Iran and the P5+1 (known as the Joint Comprehensive Plan of Action or JCPOA) consists of the agreement itself and five technical annexes: Annex I – Nuclear-related measures; Annex 2 – Sanctions-related commitments; Annex III- Civil Nuclear Cooperation; Annex IV – Joint Commission; and Annex V – Implementation Plan. The version issued by the EU is used here because pages and paragraphs are numbered in proper order.

This article describes the main elements of the JCPOA. In coming days, the Belfer Center plans to publish a more detailed description and assessment of the agreement.

**Fissile Material Production**

The central nuclear limits of the agreement concern Iran’s ability to produce the two types of fissile materials commonly used to produce nuclear weapons: separated plutonium and highly enriched uranium.

**Plutonium production**

Iran’s primary option to produce plutonium is the 40 MW Arak heavy water research reactor, construction of which is currently frozen under the November 2013 interim agreement. Under the comprehensive agreement, Iran is required to convert Arak to a lower power 20 MW heavy water research reactor and use low-enriched fuel instead of natural uranium in order to reduce the amount of plutonium produced in the spent fuel and prevent production of “weapons-grade” plutonium (defined as plutonium with a high concentration of the Pu-239 isotope) during normal operation. The original core for the Arak reactor would be rendered unusable, and the P5+1 would support an international partnership to help Iran fabricate fuel for the redesigned reactor. The technical details of the plans for redesigning the Arak reactor in Annex I will allow experts to calculate maximum possible annual plutonium production and assess the technical feasibility of converting the reactor back to its original design.

In addition to modifying Arak, the comprehensive agreement calls for all spent fuel from Arak to be shipped out of Iran for the lifetime of the reactor. Iran also commits not to build any additional heavy water research reactors for 15 years and to ship out any surplus heavy water that
is not used in Arak for the same period. Finally, Iran commits to not conduct research and development on reprocessing and to not build a reprocessing facility (necessary to separate plutonium from spent fuel) for 15 years. After that, Iran states that it does not “intend” to build a reprocessing plant.

**Enrichment program**

Iran’s current enrichment program consists of nearly 18,500 first-generation IR-1 centrifuges (about 15,500 installed at Natanz and about 3,000 installed at Fordow) and about 1,000 more advanced IR-2 centrifuges, for a total of about 19,500 centrifuges. Of these, approximately 9,200 IR-1 centrifuges at Natanz and about 700 IR-1 centrifuges at Fordow are actually enriching. Iran’s current stockpile of enriched uranium includes about 7.6 tons of low enriched uranium (up to 3.67 percent Uranium-235) in the form of UF$_6$, about 2.4 tons of low-enriched uranium in form of oxide (or being converted to oxide) and about 100 kilograms of nearly 20% enriched uranium (some of which is in the process of conversion to oxide and some of which has been used to fabricate fuel for the Tehran Research Reactor).

The JCPOA includes a complex and detailed set of physical limits on numbers and types of centrifuges, centrifuge research and development, centrifuge manufacturing, locations and levels of enrichment and stocks of enriched uranium. The physical limits are staggered over 10-15 years.

Under the agreement, Iran is required to remove about two-thirds of its installed centrifuge machines, leaving it with about 5,000 IR-1 centrifuges at Natanz and about 1,000 IR-1 centrifuges at Fordow. The centrifuge machines and related enrichment infrastructure removed from Natanz and Fordow are to be stored at Natanz under IAEA monitoring. For ten years, enrichment capacity at Natanz is capped at about 5,000 IR-1 machines in their current cascade configuration, which will continue to produce low-enriched uranium. At Fordow, one-third of the remaining 1,000 IR-1 centrifuges will be converted to produce stable isotopes (i.e. not uranium) and the remaining two-thirds will be kept on standby status. No uranium enrichment or fissile material is permitted at Fordow for 15 years.

The agreement also defines the range of centrifuge research and development permitted at Natanz over ten years, specifying the type and number of advanced machines that can be tested and the type of tests that can be conducted. For example, Iran must dismantle the 164-machine test cascades of IR-2m and IR-4 centrifuges during the initial implementation of the JCPOA, but is permitted to scale up to 30-machine test cascades of IR-6 and IR-8 centrifuges at year 8.5 of the agreement. None of the test activities during this ten-year period are allowed to accumulate enriched uranium. Iran also commits to not pursue any research and development on enrichment technologies other than gas centrifuge technology for 10 years.

The JCPOA also limits Iran’s stockpile of enriched uranium. For 15 years, Iran will maintain a total stockpile of no more than 300 kilograms of low enriched uranium in the form of uranium
hexafluoride or other chemical forms. Excess enriched uranium – nearly 12 tons of LEU in various chemical forms at present – will be down-blended to natural uranium or sold on the international market in exchange for natural uranium. The 300-kilogram limit does not include enriched uranium that has been fabricated into fuel elements for Iran’s reactors, including the nearly 20% enriched uranium produced by Iran for fabrication of fuel for the Tehran Research Reactor. Iran will not build or operate a facility to convert fuel back to UF₆ for 15 years.

Between year 11 and year 15 of the JCPOA Iran is allowed to begin replacing the 5,000 IR-1 centrifuges with more advanced machines, according to an “enrichment and enrichment R&D plan” that Iran will submit to the IAEA during the initial implementation of the JCPOA. The enrichment plan is not public and is not included in the JCPOA, but it is known to US officials and will be provided to Congress. Reportedly, the plan calls for Iran to replace its entire inventory of operating IR-1 centrifuges with a comparable number of IR-2m or IR-4 centrifuges by year 13 of the agreement such that overall enrichment capacity will remain comparable. During this period, enrichment levels will continue to be limited to low enriched uranium (up to 3.67 percent) and enrichment will be limited to the Natanz facility.

After 15 years, all physical restraints on enrichment are removed, including numbers and types of centrifuge machines, enrichment levels, locations for enrichment facilities, and stocks of enriched uranium.

The details provided by the JCPOA are sufficient to assess the U.S. administration’s claim that breakout time is extended from the current estimate of 2-3 months to one year during the initial ten years of the agreement. Breakout time is defined as the time required to produce a single “significant quantity” of weapons grade uranium (defined by the IAEA as 25 kilograms of 90% enriched uranium) using all declared centrifuges and stocks of enriched uranium. Estimating breakout time between years 11 and 15 of the agreement is not possible until the details of the enrichment plan become public.

**Possible Military Dimensions and Weaponization-related Activities**

Coordinated with the announcement of the JCPOA, Iran and the IAEA signed a “Roadmap” agreement on July 14, 2015. The Roadmap lays out a timetable to resolve, by the end of 2015, all outstanding issues in the IAEA’s investigation of Iran’s past and possible present nuclear weaponization activities (so called Possible Military Dimensions or PMD). The Roadmap does not specify the actual steps that Iran has agreed to take (which are contained in separate, confidential documents). The process would culminate in a final report by the IAEA Director General to the IAEA Board of Governors by December 15, 2015.

The JCPOA is silent on specific measures Iran must take to satisfy the IAEA’s PMD investigation, but specifies that all steps in the Roadmap (except for the final IAEA report) must be taken before the JCPOA is implemented (i.e. before major sanctions relief).
The JCPOA also contains restrictions on certain Iranian activities related to weaponization. For 15 years, Iran commits to not produce or acquire uranium or plutonium metals or conduct research on uranium or plutonium metallurgy or work with such metals, and the Joint Commission (described below) must approve research on uranium-metal based fuel for the Tehran Research Reactor between years 10 and 15 of the agreement. Unless approved by the Joint Commission for non-nuclear purposes and subject to monitoring, the JCPOA also bans permanently a range of activities that could contribute to nuclear weapons development, such as computer modeling of nuclear devices, research on explosive detonation systems suitable for nuclear weapons and research on neutron initiation systems for nuclear weapons. The JCPOA does not specify how these prohibitions will be verified or permitted activities monitored, but other sections of the JCPOA suggests that the IAEA will be responsible.

**Monitoring and Verification**

As in any arms control agreement, the JCPOA includes provisions for monitoring and verifying the nuclear restrictions outlined in the agreement. The basic monitoring provisions are provided by IAEA inspections under Iran’s full scope safeguards agreement and the Additional Protocol, which Iran will apply on a provisional basis until ratified by the Majlis (Parliament). Overall, the monitoring system has two overall objectives. First, it is intended to verify that specified limits are being observed at declared nuclear facilities, such as Natanz, Fordow, Arak, and Esfahan. Second, the measures are designed to aid in the detection of clandestine or undeclared nuclear activities. The JCPOA includes a number of time-bound specific verification measures to supplement the general provisions of Iran’s safeguards agreement and the Additional Protocol.

Specific measures include:

For 25 years, the IAEA will monitor natural uranium ore produced in Iran or acquired from any other source and verify that all such ore is transferred to declared conversion facilities. The precise measures to monitor ore production and transfer are not specified in the JCPOA.

For 15 years “or longer,” the IAEA will be allowed to use “modern technologies” to monitor activities at declared nuclear facilities, such as on-line enrichment measure and electronic seals that provide continuous measurements directly to the IAEA.

For 15 years, the IAEA will implement continuous monitoring to verify that stored centrifuges and infrastructure at Natanz remain in storage and are used only to replace failed or damaged centrifuges.

For 15 years, the IAEA will be permitted daily access as requested to all relevant buildings at the Natanz enrichment facility.

For 20 years, the IAEA will implement continuous monitoring of all locations and specialized equipment, such as flow-forming machines and filament winding machines, used for production
of centrifuge rotors and bellows. This provision does not include monitoring of such specialized equipment that is being used for non-nuclear purposes, such as ballistic missile production.

For 10 years, the JCPOA establishes a mechanism for authorizing IAEA challenge inspections to any facility in Iran if the IAEA has concerns regarding undeclared nuclear materials or activities or activities inconsistent with the JCPOA. The challenge inspection provision includes any facility in Iran, including military facilities, with the caveat that the inspections are designed to verify compliance with nuclear obligations and not “aimed at interfering with Iranian military or other national security activities.” The mechanism provides for a specific timetable and dispute resolution mechanism. Upon the IAEA’s request for access to a suspect facility, Iran and the IAEA have 14 days to make arrangements for access to the facility or to establish alternative means to resolve the IAEA’s concerns. If this procedure fails, the issue is referred to the Joint Commission, which has 7 days to decide on appropriate action either by consensus or by a vote of 5 or more of its 8 members. Iran then has 3 days to implement the Joint Commission’s decision. Failure to comply would trigger re-imposition of international sanctions under the dispute resolution mechanism (see below).

Although some details are lacking, the monitoring and verification provisions in the JCPOA are sufficient to assess the degree of confidence that the IAEA can verify limits and detect cheating at declared nuclear facilities. Provisions to detect undeclared nuclear activities are inherently more difficult to assess, but there is sufficient information to identify strengthens and weaknesses of the verification measures that are designed to increase the likelihood of detecting clandestine nuclear activities.

**Procurement channel**

The JCPOA establishes a Procurement Working Group under the auspices of the Joint Commission with responsibility for reviewing and approving proposed sales of certain nuclear-specific and nuclear-related dual use items, equipment, materials, and technology (specified on Nuclear Supplier Group control lists) from any state to Iran. The Working Group decides by consensus (meaning any state could block a sale) and remains in operation for 10 years. The agreement sets out procedures and a time table for reviewing requests and provisions for verifying end-use of approved transfers. The procurement channel is intended to track Iranian acquisition of nuclear-related items for use in undeclared activities, but the procurement channel has several limitations that could weaken its effectiveness and lead to disputes. For example, Iranian purchases of nuclear-related dual use items for its ballistic missile and conventional military programs do not have to be approved by the Procurement Working Group.

**Sanctions relief**

Once the IAEA verifies that Iran has completed key nuclear-related steps, which are specified in the JCPOA, the United Nations, United States, and European Union will cease their nuclear-related sanctions against Iran. The majority of sanctions will be ceased in this first phase (in
various legal ways, given the different national and multilateral processes), while several measures – including embargoes on conventional weapons and ballistic missiles – would be lifted in subsequent years. While not specified in the JCPOA, the parties have agreed to lift the restrictions on conventional arms after five years and restrictions on ballistic missiles after eight years.

**UN Security Council sanctions.** Since 2006, the UN Security Council has passed six major resolutions pertaining to Iran’s nuclear program. Under the comprehensive agreement, all six resolutions would be nullified and replaced with a new resolution that endorses the comprehensive agreement and establishes the Joint Commission responsible for executing the agreement. The Security Council is expected to pass the new resolution in coming days, but the resolution will not take effect for 90 days in order for Congress and the Majlis to review the agreement. This new resolution will expire in ten years, after which “the UN Security Council would no longer be seized of the Iran nuclear issue.”

**United States sanctions.** Upon completion of Iran’s key nuclear steps, the US has agreed to “cease the application” of the most damaging economic sanctions against Iran’s financial and energy sectors. The US agreed to cease “efforts to reduce Iran’s crude oil sales,” and Iran will be permitted access to the roughly $100 billion of oil revenue frozen abroad in a special form of escrow. The US will also rescind most banking sanctions, allowing Iranian banks to reconnect to the global financial system. In addition, the US will lift restrictions on third parties conducting trade with Iran’s automotive, shipping and insurance industries, and on trade in gold and precious metals. The US will cancel four Executive Orders (13574, 13590, 13622 and 13645) and part of a fifth (13628) and remove 444 companies or individuals, 76 planes, and 227 ships from its sanctions blacklist. Non-nuclear sanctions, such as those relating to human rights abuses and support for terrorism, will remain in place.

After eight years, or once the IAEA concludes that all nuclear material in Iran remains in peaceful activities (whichever is earlier), the US will “seek such legislative action as may be appropriate to terminate” most sanctions related directly to nuclear proliferation. At that time, the US will also remove 43 companies or individuals from its sanctions rolls, including Dr. Mohsen Fakhrizadeh, who led Iran’s nuclear weapons program before 2003.

**European Union sanctions.** Upon completion of Iran’s key nuclear steps, the European Union has agreed to end its financial and energy sanctions against Iran, including the lifting of the oil embargo imposed in 2012. The EU will also lift sanctions on shipping and shipbuilding and on gold and precious metals. It also agreed to lift asset freezes on Iranian institutions, including on the Central Bank of Iran. The EU’s arms embargo and restrictions on transfer of ballistic missile technology remain in place for eight years after implementation of the deal or until the IAEA concludes that all nuclear material in Iran remains in peaceful activities (whichever is earlier).

**Joint Commission and Dispute Resolution**
The JCPOA establishes an eight-member Joint Commission, composed of the P5+1 countries (US, UK, France, Germany, Russia and China), Iran and the European Union. The commission will comprise of at least two Working Groups: a Procurement Working Group, which monitors and approves Iranian purchases of certain nuclear-related items, and a Working Group on Implementation of Sanctions Lifting, which reviews the status of sanctions relief. The commission also has the authority to review and approve various nuclear measures, such as the final plans for the redesign of the Arak heavy water research reactor and Iranian requests to obtain certain hot cells or test new types of centrifuges. Commission decisions are made by consensus among the eight members, with the exception of decisions on challenge inspections, which require a simple majority. It will meet quarterly in New York, Geneva, or Vienna.

The most important responsibility of the Joint Commission is dispute resolution, which can be triggered by any member of the Joint Commission who believes that commitments under the JCPOA are not being met. The dispute resolution mechanism includes a 35-day process to resolve any such concerns, including referral to the Foreign Ministers of Iran and the P5+1 and establishment of an Advisory Board to provide a non-binding opinion to the Joint Commission. If these measures fail to resolve the dispute, any member of the Joint Commission can refer the issue to the UN Security Council. The Security Council, in accordance with its procedures, would then be required to vote on a resolution to continue sanctions relief. Under this procedure, any permanent member could veto the continuation of sanctions relief, as opposed to a procedure requiring consensus of the permanent members to re-impose sanctions. If the UN Security Council fails to pass a resolution within 30 days, all sanctions under the previous UN Security Council resolutions would be reapplied. The provision for automatic re-imposition of UN sanctions expires after 10 years, although US officials say there is a side political agreement among the P5+1 to re-impose UN sanctions in years 11-15 if Iran violates the agreement.

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<th>Timeline for implementing nuclear deal</th>
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<td>July 14, 2015</td>
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Research assistance by Henry Rome.