

The Joint Comprehensive Plan of Action: An Effective, Verifiable Nuclear Deal

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The comprehensive nuclear agreement that Iran and the P5+1 (China, France, Germany, Russia, the United Kingdom, and the United States) finalized in July 2015 and implemented beginning in January 2016 is an effective, verifiable deal that blocks Iran's pathways to nuclear weapons development, stringently monitors its nuclear activities, and provides incentives for Tehran to maintain a peaceful nuclear program. While certain limits do phase out over time, several key provisions, including more intrusive monitoring and restrictions on activities relevant to weaponization are permanent.

The JCPOA should not be judged on how it addresses any single element of Iran's nuclear program. Instead, policymakers should assess its overall impact on reducing Iran's nuclear capacity, improving international monitoring and verification, and influencing Iran's decision making about the costs of pursuing nuclear weapons versus the benefits of maintaining a peaceful nuclear program. Without the JCPOA, Iran's nuclear activities would be unrestrained and subject to minimal monitoring as required by the Nuclear Nonproliferation Treaty (NPT).

For more than two years (January 2016–May 2018) the parties to the JCPOA fully implemented the accord, which demonstrated its efficacy and nonproliferation benefits. Since the United States' May 2018 decision to unilaterally withdraw from the agreement and reimpose sanctions that it had waived under the terms of the deal, Iran decided to take

retaliatory steps beginning in May 2019 to scale back its compliance with key nuclear obligations. Despite these violations, the JCPOA's nonproliferation and security benefits can be restored if the United States and Iran can agree to a process that simultaneously brings both back into full compliance with their respective JCPOA obligations.

Blocking the Highly Enriched Uranium Route

The agreement includes stringent limitations on Iran's uranium-enrichment program. When fully implemented, the restrictions extend the time it would take for Iran to produce enough weapons grade uranium for a bomb—if the political decision were made to do so—to more 12 months. The U.S. intelligence community reiterated this assessment, concluding in the [January 2019 Worldwide Threat Assessment](#) that "Iran's continued implementation of the JCPOA has

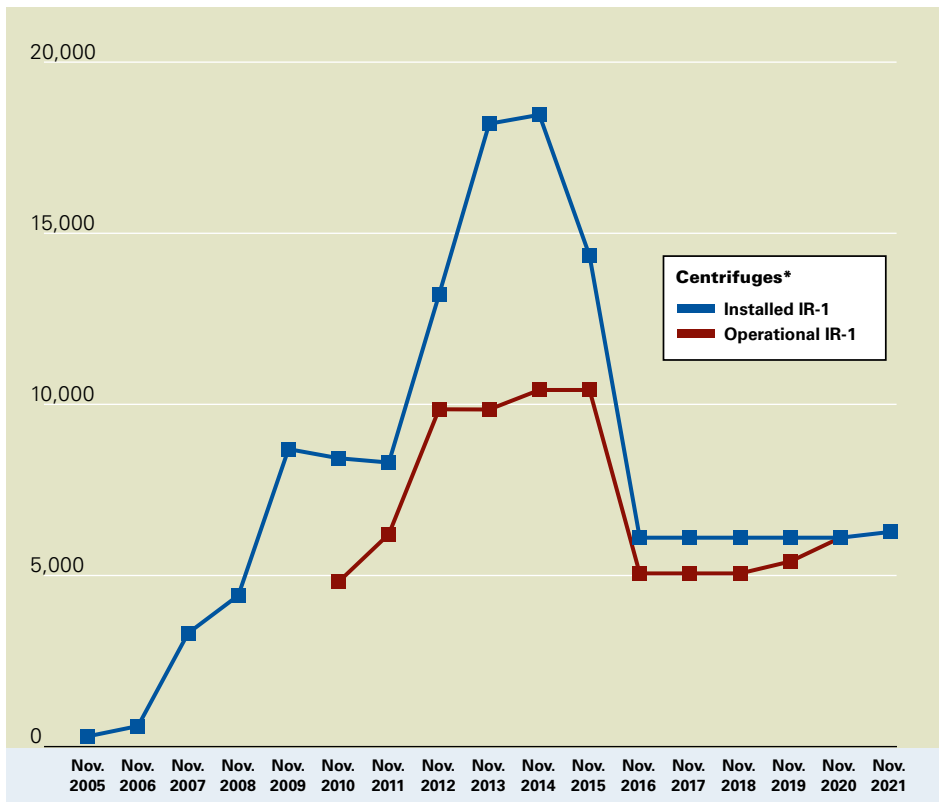
extended the amount of time Iran would need to produce enough fissile material for a nuclear weapon from a few months to about one year."

Prior to JCPOA negotiations, that timeframe was 2–3 months. As of December 2020, it was about 3–4 months.

The JCPOA achieves a 12-month breakout for more than a decade through a combination of restrictions, including:

- limiting Iran to the installation of 6,104 first-generation IR-1 centrifuge machines, of which 5,060 can be used for uranium enrichment at Natanz for 10 years;
- prohibiting the accumulation of enriched uranium using advanced centrifuges and limiting the number and type of advanced centrifuges allowed for testing for 10 years;
- barring enrichment of uranium above 3.67 percent uranium-235 and capping the stockpile at 300 kg of

Capping Iran's Deployment of Centrifuges



*Iran is permitted to enrich uranium using 5,060 IR-1 centrifuges for 10 years. This chart does not reflect the advanced-model IR-2m, IR-4, and IR-6 centrifuges Iran has tested, operated, and used for the production of enriched uranium in breach of the accord since 2019. Source: IAEA, JCPOA

- shipping out the spent fuel from the Arak reactor for the duration of its operation;
- refraining from reprocessing spent fuel and building any reprocessing facilities for at least 15 years; and
- refraining from building any new heavy-water reactors for at least 15 years.

Intrusive Monitoring

The nuclear deal put in place the most intrusive monitoring and verification regime ever negotiated to deter Iranian noncompliance and quickly detect any violations. The agreement set up a multi-layered system to monitor every aspect of Iran's nuclear supply chain and fuel cycle. This includes:

- advanced approval for procuring certain dual-use technologies for 10 years;
- daily access to certain sites by International Atomic Energy Agency (IAEA) inspectors, including Natanz and Fordow for 15 years;

UF6 gas enriched to this level for 15 years; and

- converting the underground Fordow facility to a medical research facility with 1,044 first-generation centrifuges and prohibiting uranium enrichment at that site for 15 years.

Blocking the Plutonium Path

The nuclear deal eliminates Iran's plutonium pathway to nuclear weapons for at least 15 years. The JCPOA requires:

- modifying the unfinished heavy water reactor at Arak so that the reactor will produce a fraction of the plutonium necessary for a bomb on an annual basis (the original design would have produced enough plutonium for about 2 bombs per year);

Estimated Plutonium Production for Original IR-40 and Modified Arak Reactor Design

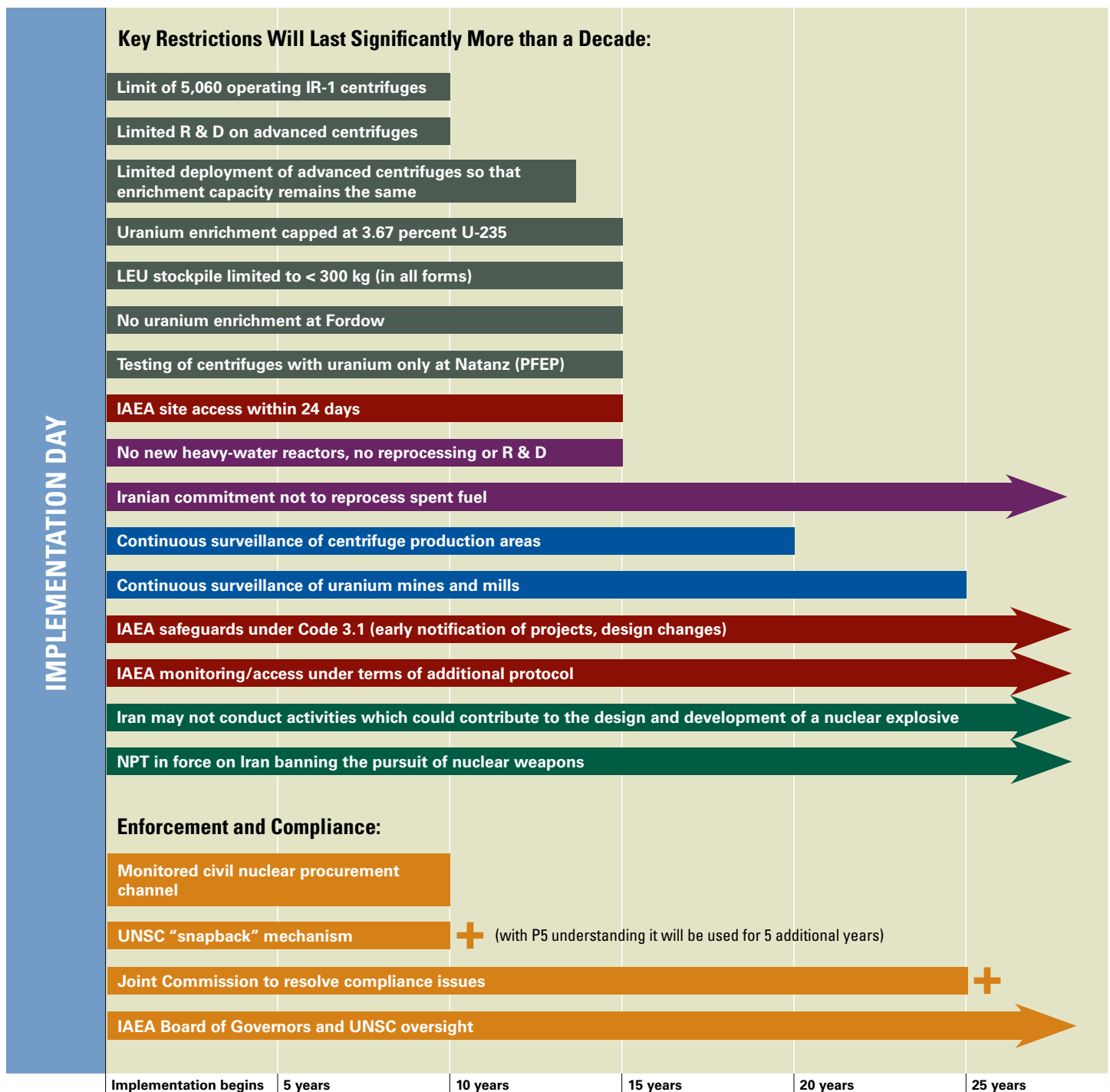
The table below lists the calculated annual reactor-grade plutonium production in the fuel of the original Arak design and in the modified design described in the JCPOA assuming full-power operation 250 days per year.

Reactor/fuel combination	Annual unseparated plutonium production (kilograms per year)	
	40 MWt	20 MWt
ORIGINAL DESIGN Heavy-water research reactor, natural uranium fuel	≈6.5	
MODIFIED DESIGN Heavy-water research reactor, 3.67 percent-enriched fuel		≈1.0

Source: Ali Ahmad, Frank von Hippel, Alexander Glaser, and Zia Mian, Princeton University; Arms Control Association

Key Nuclear-Related Commitments and Limitations of the JCPOA Over Time

The Joint Comprehensive Plan of Action (JCPOA), the IAEA-Iran “roadmap,” and UN Security Council Resolution 2231, involves several interrelated requirements designed to limit Iran’s sensitive nuclear fuel cycle activities over a period that extends for more than two decades. In exchange, the P5+1 agreed to waive all nuclear-related sanctions on Iran. The following chart summarizes the major nuclear-related components.



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- continuous IAEA monitoring at key nuclear sites for up to 25 years; and
 - permanent restrictions on certain weaponization-related activities.

One of the most critical monitoring provisions in the JCPOA is the requirement that Iran implement the additional protocol to its IAEA safeguards agreement in perpetuity. The additional protocol gives inspectors a number of additional verification tools and expands the facilities included in Iran's declared nuclear program. The additional protocol also allows for short-notice inspections and allows access to any site in Iran—including military facilities—if the agency has concerns about illicit nuclear materials or activities. If Iran refuses to cooperate or provides access deemed inadequate for IAEA purposes, the nuclear deal outlines a procedure for the Joint Commission to adjudicate access disputes within 24 days. It is highly unlikely that Iran could sanitize

a site to remove traces of nuclear material in that time and any effort by Iran to do so would be detected.

Iran's Compliance with the JCPOA

From January 2016 through May 2019, U.S. officials confirmed on a regular basis that Iran was adhering to its JCPOA commitments. This period also demonstrated that the monitoring worked as intended and the JCPOA's oversight body, known as the Joint Commission, was able to resolve ambiguities in the JCPOA or disagreements over how to interpret the text. For instance, when Iran exceeded the heavy-water limit set by the JCPOA in 2016 and argued that the cap was a guideline, the JCPOA's monitoring provisions quickly detected the breach and the deal's oversight body clarified that the limit was binding, demonstrating the effectiveness of the verification mechanisms and the procedures to

address disputes over interpretation.

One month prior to former U.S. President Donald Trump's reimposition of sanctions on Iran in violation of the JCPOA and withdrawal from the accord in May 2018, U.S. Secretary of State Mike Pompeo testified in a Senate Foreign Relations Committee hearing that he had seen no evidence of Iranian noncompliance with the JCPOA. Regular reports by the IAEA also indicated Iran's compliance through May 2019, at which point Tehran announced it would breach certain JCPOA limits if its demands on sanctions relief were not met. While Iran is violating its obligations, the State Department's April 2021 report on compliance with arms control and nonproliferation obligations concluded that "the United States continued to assess that Iran is not currently engaged in key activities associated with the design and development of a nuclear weapon."