



## When is the 300 Kilogram Cap on Low Enriched Uranium not a Cap?

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***We are releasing a series of reports containing our analysis of specific key issues in the Joint Comprehensive Plan of Action. We are neutral on whether the deal should be implemented. We are using our role as a technical nonproliferation organization to highlight strengths as well as potential problems and remediation steps.***

*While it was expected that the Joint Comprehensive Plan of Action (JCPOA) cap of 300 kilograms (kg) of less than 3.67 percent low enriched uranium (LEU) would have exceptions, the number of potential exceptions has grown since the Lausanne agreement and some of them could undermine the very value of the cap. Steps should be taken to preserve the full value of the cap to limit Iran's breakout timelines.*

According to the JCPOA, "Iran will maintain a total enriched uranium stockpile of no more than 300 kg of up to 3.67% enriched uranium hexafluoride (or the equivalent in different chemical forms) for 15 years." The agreement also appears to spell out that Iran must reduce its current stock of over about 10,000 kilograms of LEU enriched to less than 3.67 percent to this 300 kg limit. According to the JCPOA, "All enriched uranium hexafluoride in excess of 300 kg of up to 3.67% enriched UF<sub>6</sub> (or the equivalent in different chemical forms) will be down blended to natural uranium level or be sold on the international market and delivered to the international buyer in return for natural uranium delivered to Iran." This reduction in the LEU stock must take place by Implementation Day.

However, there are exceptions to this 300 kg cap, some of which are reasonable and some that could be problematic. Some of the exceptions were expected and are justified, such as LEU in fuel made overseas and used in the Bushehr power reactor or other power reactors to be supplied from overseas. This exception would also apply to the LEU in the first core load of the modernized Arak reactor, which will be supplied from abroad. No one would count these stocks of LEU against the 300 kg cap, which was intended to be applied to Iran's domestic production of LEU.

The problematic exceptions relate to enriched uranium produced in Iran. There is a risk that this exception could render this important cap ineffective. However, a reasonable interpretation of allowed exceptions would preserve the cap. This exception is conditional. The JCPOA states:

*"Enriched uranium in fabricated fuel assemblies and its intermediate products manufactured in Iran and certified to meet international standards, including those for the modernized Arak research reactor, will not count against the 300 kg UF<sub>6</sub> [uranium hexafluoride] stockpile limit provided the Technical Working Group of the Joint Commission approves that such fuel assemblies and their intermediate products cannot be readily reconverted into UF<sub>6</sub>." The Joint Commission will establish this Technical Working Group, which is charged to "within one year,*

*work to develop objective technical criteria for assessing whether fabricated fuel and its intermediate products can be readily converted to UF<sub>6</sub>.”*

In its evaluation, the Working Group will consider impurities (e.g. burnable poisons or otherwise) contained in fuels or through the fuel being in a chemical form such that direct conversion back to UF<sub>6</sub> would be technically difficult without dissolution and purification.

In practice, for typical LEU fuel and associated intermediate products, assessing that the intermediate LEU products and fabricated fuel are in fact readily convertible is technically straightforward. Typically, this assessment focuses on how long it takes to convert the intermediate product or fuel back to hexafluoride form. For typical reactor fuel fabrication processes involving LEU, no exceptions appear warranted. However, not all stakeholders, particularly Iran, may agree and that is the risk posed by these provisions, which aim to enable fuel to be fabricated in Iran while “adhering” to the cap.

One planned application of the cap is the fuel for the Arak reactor, where the fuel is expected to contain burnable poisons. This proposed fuel and its intermediate products would be evaluated by the Technical Working Group to see if this LEU is eligible for an exception from the 300 kg cap. In the currently discussed case, burnable poisons would be mixed with the enriched uranium, potentially significantly lengthening the time and difficulty of reconvert back the fuel and intermediate products to enriched uranium hexafluoride form. The fuel and intermediate products will be subject to approval by the Technical Working Group with a goal to ensure that each form is not readily convertible. Further, if the fuel is approved, the IAEA would monitor each step in the fuel fabrication process to ensure compliance with the approved fuel fabrication procedures. An important factor in this case is that the modernized Arak reactor will require relatively little LEU. When finished, which is not expected to occur for many years, its core will contain about 350 kg of LEU. With diligence, Iran can keep the total amount of LEU in the fuel fabrication cycle at any one time relatively small, on order of several hundred kilograms.

There are several potential stocks of LEU that could fall under this exemption, which should be blocked. The first is the roughly 4,000 kg of LEU (uranium hexafluoride equivalent) currently in the Enriched UO<sub>2</sub> Powder Plant (EUPP) and subject to so much recent debate. This plant is part of Iran’s facilities to make fuel assemblies from LEU, and Iran may ask that at least some of its LEU contents be subject to consideration for exemption, despite its pledge in the JCPOA to eliminate all this LEU. Much, if not almost all, of this LEU is in the intermediate forms of uranyl fluoride and ammonium diuranate. One could argue that the uranyl fluoride would require conversion to another chemical form before conversion to uranium hexafluoride and thus, it is not “directly convertible.” Iran may seek to make such LEU a candidate for an exception to the 300 kg cap. For example, it could state that the chemical forms make removal or down blending unusually difficult. That Iran could change its views about its commitments should not be a surprise. After all, the 300 kg cap in the Lausanne interim deal envisioned only an exception for Bushehr LEU fuel. However, the U.S. and at least some of its P5+1 allies appear fully prepared to block any Iranian attempt to exempt any of the LEU in the EUPP from the 300 kg cap. In any case, a public commitment to that affect should be sought from P5+1 governments.

Another exception could occur after year 10 of the deal, when Iran once again deploys more centrifuges, likely with the claim the LEU would be used for power reactor fuel assemblies. By year 13, according to Iranian plans, these centrifuges are expected to be producing relatively large amounts of LEU annually. Iran may argue that the LEU will be used in fuel assemblies and thus should be subject to the exception. This exception could amount to thousands of kilograms of LEU, if Iran states it is making LEU fuel assemblies for nuclear power reactors. Approval of this exception would effectively render the cap meaningless, since the

intermediate forms and the uranium dioxide powder in particular could be converted back to hexafluoride form in a straightforward manner.

To avoid the risk of significantly reducing the breakout timelines and instead preserve the value of the 300 kg LEU cap during the full fifteen years of this limitation, the United States should state officially that an exception to the cap will not be granted except in extraordinary circumstances, and in no cases for domestically produced LEU slated for fuel in nuclear power reactors. In the case of research reactors, any exception will depend on the technical merits of the fuel and the size of the reactor. The fundamental position is that fresh LEU can be readily converted into  $UF_6$  and, therefore, that the core goal of this 300 kg cap is not compatible with fuel fabrication in Iran, except in exceptional circumstances such as the Arak reactor.