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Avoiding the Legitimization of Iranian Enrichment

Better to Discourage Options Involving the Conversion of Iran's LEU Stock into Bushehr Reactor Fuel

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ISIS has learned of a proposal that has been discussed among some Western nations to reach agreement with Iran to send out Iranian low enriched uranium (LEU) to Russia for conversion and fabrication into fuel for the Bushehr nuclear power reactor. According to government officials knowledgeable about these discussions, this proposal is viewed as a way to reopen a conversation with Iran, if it is willing to discuss its nuclear program in a meaningful manner. A primary justification for this proposal is to reduce the LEU stock in Iran, because this stock can rapidly be enriched further to weapon-grade and used in nuclear weapons. The concern is that the production of weapon-grade uranium in a declared or clandestine plant could occur before the international community could muster an effective diplomatic and political response that could dissuade Iran from building nuclear weapons.

This option is an improvement on Iran's long-standing plan to simply convert the LEU hexafluoride into Bushehr fuel domestically or at least into an LEU oxide form. However, like Iran's plan or proposals to produce LEU oxide, this newer variation is unlikely to help achieve the goal of stopping Iran from obtaining nuclear weapons.

The production of Bushehr fuel, whether inside or outside Iran, would provide Iran the international legitimization that it has long sought for its uranium enrichment program. With such legitimization, Iran would face few objections to perfecting and enlarging its nuclear weapons breakout capability inherent to its gas centrifuge program. In addition, with the Russian fabrication option, it would be extremely difficult to ensure that a cap maintained on Iran's LEU stockpile would prevent an accumulation of many bombs' worth of LEU. The proposal also undermines the central goal of several United Nations Security Council resolutions aimed at obtaining a suspension of Iran's centrifuge program prior to negotiating a path to achieve confidence that Iran is not seeking nuclear weapons.

No option may sway Iran from seeking nuclear weapons—Iran's ongoing lack of cooperation with the International Atomic Energy Agency (IAEA) serves as a constant reminder that it has not provided confidence that it will use its nuclear program for only peaceful purposes. Compounding suspicion that Iran intends to possess nuclear weapons is extensive evidence assembled by the IAEA and Western nations of secret Iranian work on developing the capability to build nuclear weapons. Nonetheless, the likelihood of success is higher with strategies that prevent or delay Iran's development of a nuclear weapons breakout capability. Any proposal that legitimizes Iran's use of its own LEU in the Bushehr reactor undermines achieving that goal and should be avoided. The P5+1 and its partners should favor the current arrangement in which Russia provides fuel to the Bushehr reactor that does not involve Iranian produced LEU.

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Concerns about Iran's Growing Stock of LEU

An important concern is Iran's growing stockpile of 3.5 percent LEU hexafluoride. This stock now exceeds 2,500 kilograms, enough for two nuclear weapons, if further enriched to weapon-grade. A key question is whether the international community should take extra steps to keep Iran's LEU stock below a certain size—for example, below one or at most two thousand kilograms, no more than enough for one or at most two nuclear weapons.

This concern led to the Tehran Research Reactor (TRR) fuel swap proposals, in which Iran would trade 1,200 kilograms of its 3.5 percent LEU for 120 kilograms of 20 percent LEU fuel from abroad, enough to fuel the TRR for years to come. The TRR fuel swap deal is a useful confidence building measure that would temporarily reduce Iran's LEU stock while creating momentum and trust in negotiations aimed at the suspension or freezing of the Iranian enrichment program. However because the TRR is a small reactor, requiring very little fuel, the total impact of a fuel swap on Iran's growing LEU stock is only temporary if Iran continues to operate its centrifuges. Likewise, the relatively low fuel requirements for the TRR enabled a deal that could avoid legitimizing the prospect of continuous, large-scale enrichment. If negotiations failed to establish a suspension, however, little would have been lost or gained as a result of the TRR fuel swap.

The limited amount of LEU involved in the TRR fuel swap leads naturally to the consideration of a proposal to turn Iranian LEU into Bushehr fuel in Russia.[1] The Bushehr reactor produces over 500 times more energy than the TRR, so all of Iran's LEU could be sent to Russia for fabrication into Bushehr fuel.

On the surface, this new proposal has clear advantages over the existing Iranian plan, under which Iran would move its stock of 3.5 percent LEU hexafluoride from its enrichment plants and on its own create reactor fuel for the Bushehr reactor. For two decades, Iran has labored to finish its Esfahan nuclear conversion and fuel fabrication facilities with the ultimate goal of making nuclear power reactor fuel.

Reasons to Discourage Iranian LEU Production and Use

The proposals to make Bushehr fuel have significant disadvantages compared to the TRR fuel swap arrangements. On balance, the disadvantages far outweigh the benefits.

These proposals would allow Iran to assert that its enrichment program had become legitimized internationally. Any subsequent calls for suspension would be dismissed as denying the facts on the ground, and Iran could point specifically to the Bushehr power reactor as the reason for continuing enrichment—an argument that Iran has, so far, been hesitant to employ. The primary P5+1 goal of negotiating a freeze and then a suspension of enrichment would be compromised. Furthermore, Iran would be able to claim that it is justified in greatly expanding its centrifuge plants, in the process enabling it to create a growing nuclear weapons breakout capability on its territory. The fact is that the Bushehr reactor requires a considerable amount of LEU each year, and Iran wants to have on order of 50,000 P1 centrifuges to meet that annual need for LEU. Less than one-tenth that amount of P1 centrifuges could make enough weapon-grade uranium for at least one nuclear weapon per year, where each nuclear weapon would contain roughly 15-25 kilograms of weapon-grade uranium.

With a larger, more sophisticated gas centrifuge program, Iran would be more capable of creating a clandestine centrifuge plant able to use relatively small amounts of LEU to breakout and produce weapon-

[1] This proposal should not be confused with an earlier idea that involved Iran sending its stock of natural uranium hexafluoride produced at the Esfahan Uranium Conversion Facility to Russia for further enrichment and fabrication into fuel for the Bushehr reactor, circumventing the need for domestic Iranian enrichment.

grade uranium. Despite the good intentions of a proposal to remove LEU for fabrication of Bushehr fuel in Russia, in practice by legitimizing Iranian uranium enrichment, this approach could inadvertently speed up the timeline for when Iran has a robust nuclear weapons capability on its soil.

Likewise, efforts to restrict Iran's acquisition of necessary dual-use goods for its gas centrifuge plants would suffer. Iran is far from self-sufficient in producing vital equipment for its centrifuge plants, and strategies to deny these exports by foreign suppliers, backed by U.N. Security Council resolutions banning such exports, have delayed Iran's centrifuge program. Many countries, anxious to do business with Iran, could argue that they should not deny exports of dual-use equipment to Iran's nuclear program after it has received the blessing of the P5+1 to make essentially unlimited quantities of LEU.

Additional problems with domestic production of Bushehr fuel

During negotiations with the European Union in the mid-2000s, Iran proposed manufacturing Bushehr fuel domestically as the centerpiece of an agreement to alleviate suspicions about its nuclear activities. However, EU negotiators rejected this proposal as inadequate to address the underlying problems posed by Iran's nuclear activities and its frequent violations of IAEA safeguards agreements. The EU negotiators' reasons to reject this proposal to produce Bushehr fuel from Iranian LEU remain valid today.

One claimed benefit is that domestic production of Bushehr fuel would lead to the conversion of the LEU hexafluoride into LEU oxide at the Esfahan facility, further extending the time that Iran would need to breakout and produce weapon-grade uranium for nuclear weapons. Uranium oxide cannot be used in a centrifuge plant, so Iran would need to reconvert the LEU oxide back into uranium hexafluoride before using it in a breakout. However, this reconversion does not significantly delay an Iranian breakout. The LEU oxide can be reconverted relatively quickly back into uranium hexafluoride, on order of a few months, hardly enough time to justify the disadvantages of this option.

Another potential benefit is that the fuel would be placed in the Bushehr reactor and irradiated. After irradiation, the fuel would be much harder to chemically process and extract residual LEU. The irradiated fuel would contain newly produced plutonium, which poses an additional proliferation risk, although no worse than that already posed by Bushehr fuel produced using Russian LEU.

However, Iran is unlikely to be able to make Bushehr fuel anytime soon. Iran does not now possess the capability to fabricate fuel for the Bushehr reactor and is likely years away from having a capability to make significant amounts of LEU fuel for this reactor. It may be further delayed in making Bushehr fuel if any Iranian-produced fuel must meet modern safety criteria aimed at reducing the chances of a severe reactor accident that could spread dangerous amounts of radioactivity throughout the region.

In addition, this proposal would end the current situation in which LEU product cylinders remain at the Natanz Fuel Enrichment Plant (FEP) under IAEA seals. If Iran now moved a cylinder, the IAEA can detect that movement within 2-4 weeks and sound an alarm to the international community that something was amiss. Under the proposal for Iran to produce the fuel for Bushehr, cylinders would routinely be moved to the Esfahan uranium conversion facility. The opportunities for diversion to a clandestine enrichment plant would increase, and the time to detect a diversion could also increase.

So, other than turning the LEU hexafluoride into an oxide form, which is of minimal value, domestic production of Bushehr fuel would offer few benefits. It would leave Iran with a growing stock of LEU hexafluoride and unirradiated LEU oxide, ready for rapid use in a breakout. It is not surprising that this option has attracted very little support outside Iran.

Russian option has its own problems

On the surface, the idea of sending the LEU to Russia has significant advantages over Iran's plan to produce Bushehr fuel domestically. It would remove significant stocks of LEU from Iran. If done promptly, the removal of these stocks would temporarily allay concerns about Iran's growing stockpile of 3.5 percent LEU. Unlike the TRR fuel swap deal, this proposal would in effect have no limit on the amount of LEU that could be converted into fuel.

However, as mentioned above, this option would still legitimize a growing Iranian enrichment program, which would be far larger than that needed to supply a nuclear weapons program. In addition, the remaining stock of LEU would not be as small as expected. This option is also very dependent on the prospect of continuously shipping LEU out of Iran—and at a quickening pace.

In fact, to limit Iran's stock of LEU below that needed for a few nuclear weapons, this option would likely also require the separate negotiation of a cap the amount of LEU hexafluoride that Iran could stockpile at any one time, for example, a cap of one or two tonnes of LEU hexafluoride. Negotiating such a cap could be difficult, time consuming, and hard to verify.

Even if Iran agreed to a cap, such a limit is unlikely to be achievable for technical reasons. Moreover, Iran could emerge within a relatively short period of time with a stock of LEU far in excess of one or two tonnes, easily several nuclear weapons-worth.

Given the enormous fuel requirement for operating the Bushehr reactor, Iran would undoubtedly argue that it needed to continue expanding its centrifuge capacity in order to produce the amount of LEU required to fuel Bushehr each year. It currently enriches in about 4,000 P1 centrifuges and has in total over 9,000 P1 centrifuges installed at the Natanz Fuel Enrichment Plant. Iran intends to install 50,000 P1 centrifuges or an equivalent number of improved centrifuges at Natanz and is also currently building additional centrifuge plants.

As Iran expands its centrifuge plants, it would be very difficult in practice to ensure that it sends out all new LEU to Russia and does not build up a sizeable LEU stockpile well in excess of one or two thousand kilograms of LEU. Centrifuge plants are not built with maintaining such a cap in mind. Iran would need to send out its newly produced LEU at an increasing rate as its enrichment capacity increases, while significant stockpiles of 3.5 percent LEU would build up in increasingly shorter time periods.

One way to better understand this problem is to consider the Natanz Fuel Enrichment Plant, where the basic operational unit is a module with about 3,000 centrifuges that produce LEU. Iran currently has about three modules installed. Each module has a product cylinder that receives roughly 3.5 percent LEU. In addition, one or more dump tanks receive less enriched LEU (e.g. one percent enriched), which for one reason or another is removed from the module prior to full enrichment of about 3.5 percent. As Iran adds centrifuges, the number of LEU product cylinders would likewise increase. A typical product cylinder contains a maximum of 2,277 kilograms of LEU hexafluoride.[2] Iran would want to fill the product tanks before disconnecting them from a module. With three modules operational at the FEP plant, Iran could accumulate over 6,800 kilograms of 3.5 percent LEU hexafluoride and several thousand kilograms of lesser enriched uranium in the dump tanks, enough to make weapon-grade uranium for five to seven nuclear weapons.[3] This amount of LEU would represent a tremendous breakout capability.

[2] This value is the limit for a 30B cylinder, the typical LEU shipment container. Smaller containers could be used, but their use would not significantly affect the result discussed above, since Iran could manufacture reasons to delay sending out the tanks.

[3] The estimate of 5-7 weapons-worth of LEU relies on ISIS calculations, where on average about 1,000-1200 kilograms of 3.5 percent LEU hexafluoride is needed for one nuclear weapon. This calculation includes efficient use of the enriched

To maintain the cap with several modules, Iran would need to agree to regularly switch out the LEU product tanks long before they are full. Most plant operators would balk at the inconvenience of such an approach. In the case of Iran, the international community would justifiably need to worry that Iran would deliberately lower the frequency of regular tank switching and shipments—similar to how it degraded its IAEA inspections in the past by transitioning away from declaring the location of its centrifuge component manufacturing sites or delaying the provision of information about the construction of new nuclear industrial sites.

What to Do?

Iran may in any case go ahead and seek to build tens of thousands of centrifuges over the next several years, in the process creating a robust nuclear weapons breakout capability. Some may argue that it is better to try to limit Iranian LEU stocks even if a nuclear weapons capability would develop. Yet, the Bushehr reactor fuel production proposals not only would not prevent this possible future, it may in fact encourage its realization sooner by legitimizing Iran's centrifuge program and its plans to expand it.

These proposals are dependent upon significantly improved inspection arrangements. While such measures could be included in these proposed agreements, Iran could reduce these inspection arrangements later. Given Iran's downgraded cooperation with the IAEA and its resistance to even its traditional safeguards obligations, the international community could not count on IAEA inspections to detect a breakout in a timely manner if the Bushehr fuel proposals are implemented.

The P5+1 and its partners should prefer the current arrangement in which Russia provides the fuel for the Bushehr reactor without encouraging Iran's domestic enrichment capabilities. They should continue to seek a freeze and suspension of enrichment until a verified agreement can be implemented in which the international community has confidence in the purpose of Iran's enrichment program and other nuclear activities. If Iran refuses, then the P5+1 should focus on further isolating and politically pressuring Iran, bolstering sanctions, and focusing on efforts to limit Iran's ability to expand its centrifuge program.

Absent a successful agreement that has created confidence in Iran's peaceful intentions, the Bushehr fuel production proposals would only help legitimize an enrichment program over which the international community has serious questions. The proposals would be unlikely to cap Iran's LEU stock; they would contribute to the expansion of the enrichment program, possibly downgrade the IAEA's ability to safeguard the program and sound a timely warning of a diversion of LEU, and significantly expand Iran's nuclear weapons breakout capability.

uranium (a final tails assay of 0.7 percent), which may not occur during the production of the first significant quantity of weapon-grade uranium. Each weapon is assumed to need 15-25 kilograms of weapon-grade uranium in the form of metal.