

Iran's recent statements about production of fuel for the Tehran Research Reactor: A quick review

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Iran announced Sunday, February 7, that President Ahmadinejad had instructed the Atomic Energy Organization of Iran to "start production of 20 percent enriched uranium if talks on swap deal (sic) fail." (IRNA report [here](#); the swap deal refers to a plan under which Iran would relinquish some 1200 kg of its accumulated low enriched uranium (LEU) from Natanz in exchange for fuel for the Tehran Research Reactor, a 5 MW-thermal reactor that is expected to run out of fuel within the year).

Later in the day, Ali Akbar Salehi, the head of the Atomic Energy Organization of Iran, was quoted saying on Iran's Arabic-language state television channel, al Alam: "We will hand over an official letter to the IAEA (International Atomic Energy Agency) tomorrow [Monday], informing the agency that we will start making 20 percent enriched fuel from Tuesday." Whether Iran has already prepared the Natanz Fuel Enrichment Plant to actually enrich uranium to this level is unknown.

Salehi also told al Alam that "Iran will set up 10 uranium enrichment centres next year." The Iranian year begins on March 21.

ISIS described [here](#) in a technical note the fueling requirements of the TRR. In short, if operated at its capacity of 5 MW-th per year, it would require between 9.2 and 18.4 kg LEU (uranium mass) annually. If operated at lower output, as have been its history, it would require between 5.5 to 11 kg of LEU (uranium mass) per year.

A timeline describing the history of the TRR can be found [here](#).

Can Iran produce 20 percent-enriched uranium?

Yes. Though Iran may encounter some challenges, it is technically equipped to produce 19.75 percent enriched uranium at the Natanz Fuel Enrichment Plant (note, any uranium enriched to under 20 percent U-235 is classified by the IAEA as LEU; uranium enriched to 20 percent or greater is classified as high enriched uranium (HEU)).

Iran has not stated how it intends to produce this enriched uranium at Natanz. A likely scenario would involve dedicating an existing module for the production of the 19.75 percent LEU with some modification at feed and withdrawal points to handle smaller canisters of material. It is worth noting that approximately half of Iran's 8,000 installed centrifuges are not currently operating and could be dedicated to this effort.

In operating its cascades to produce the 19.75 percent LEU, Iran would have to take special care to prevent the concentration of impurities including air, water vapor, and volatile gases which can build as the enrichment level goes higher. Iran has already had some experience addressing these issues with its existing enrichment effort.

It is difficult to determine if Iran could start producing 19.75 percent enriched uranium on Tuesday. The IAEA has not confirmed any of Iran's statements as of early Monday morning. If it were to start on Tuesday, Iran would have had to already accomplish several preliminary steps at Natanz, perhaps without notifying the IAEA. However, Iran is likely to use 3.5 percent enriched uranium as feed into the cascades to make 19.75 percent enriched uranium, and Iran would have to notify the IAEA about moving this LEU feed and starting the actual enrichment process.

How much of its existing LEU will it use for TRR fuel?

As of November 2009, Iran had accumulated over 1800 kg of LEU enriched to approximately 3.5 percent (when the next IAEA report is released later this month, it is likely that Iran will have surpassed 2,000 kg of LEU). But Iran needs to use only a small fraction, about 200 kilograms of 3.5 percent enriched uranium, to make 20 kilograms of 19.75 percent enriched uranium, more than enough to fuel the TRR each year.

If Iran were to allocate 1,200 kg of LEU, as proposed in the swap arrangement, Iran could produce approximately 120 kilograms of 19.75 LEU (uranium mass), assuming a tails assay of 0.71 percent (natural uranium). This quantity of fuel would correspond to roughly 6-13 years worth of fuel at an operating power of 5 MW-th and a capacity factor between 40 and 80 percent, assuming some minimal losses in fuel fabrication. If the TRR remains at 3 MW-th, this would be sufficient fuel for 11 to 21 years of operation.

If Iran were to use its entire stockpile of accumulated LEU in the effort, it would be going most of the remaining way toward the production of weapon-grade HEU. Producing 3.5 percent enriched uranium is about 70 percent of the way to weapon-grade uranium in terms of enrichment efforts. If this is the case, Iran would require only a small enrichment capability of between 500-1,000 P1 centrifuges, assuming significant inefficiencies in its centrifuges, to produce sufficient weapon-grade material in a breakout scenario in six months. Such a facility would be extremely hard for the IAEA or intelligence services to detect.

An Iranian decision to dedicate its entire LEU stockpile to the production of 19.75 percent LEU is likely to raise significant alarm in the international community about Iran's intentions.

Can Iran fabricate the necessary fuel rods for the reactor?

Yes, but not without some challenges to overcome. Currently, the fuel for this type of reactor is made by France and Argentina, and in small quantities by a few other countries, including

Chile. Argentina was the last supplier to Iran. Iran has never fabricated this type of fuel and would require some time to master the process.

Iran will likely use knowledge gained from abroad to make the fuel. But Iran will need to do so without jeopardizing the reactor's safety. Normally, a safety authority would want new fuel tested for an extended period of time, before allowing it to be used routinely in a reactor. Otherwise, the chance of an accident could increase. Iran may choose to skip this step, since it may not have enough fuel left to allow for prolonged testing of the new fuel. However, issues of the fuel's quality assurance and ultimately reactor safety would give most nations pause about heading down this path.

Can Iran build ten enrichment plants?

No, Iran cannot build ten enrichment plants anytime soon. It can certainly break ground for ten, but outfitting them with centrifuge equipment is far-fetched, and we doubt this is the motivation for the announcement. Iran may seek to project defiance, strength, and technical prowess, despite deficits in all but the first. A subtler point is that Iran may be signaling that it is building other centrifuge plants that it has no intention of declaring early, unless one is discovered by foreign intelligence. Iran is capable of installing several thousand P1 or more advanced centrifuges at one or two other sites, each having enough centrifuges to produce weapon-grade uranium from natural uranium. A new site could be built secretly and be hard to identify against the growing noise from all of Iran's centrifuge activities. Iran appears to be doing due diligence against what it likely fears is an impending military strike, following which it could push rapidly for nuclear weapons. Alternatively, Iran may decide to build nuclear weapons and want facilities able to survive subsequent, almost assured military strikes. There is a cost to this strategy of building multiple enrichment plants simultaneously, in addition to Natanz and Fordow, in particular stretching thin Iran's still meager centrifuge expertise.