



August 25, 2009

### Update on the Arak Reactor in Iran

On August 11, 2009, [ISIS released a report](#) on Iran's IR-40 heavy water reactor at Arak, which is currently under construction. The report raised several questions regarding the reactor's planned fuel and the status of its construction. Since the release of that report, ISIS has received additional information on these issues, shedding more light on the origin of the Arak reactor fuel rod bundle depicted in President Ahmadinejad's visit to the Fuel Manufacturing Plant at Esfahan.

ISIS has learned that the fuel rod bundle seen in photographs of President Ahmadinejad's visit (see figures 1 and 2) is in fact intended for use in the Arak heavy water reactor. Its close visual similarity to a Russian fuel bundle is because it is indeed a modified Russian RBMK (Reaktor Bolshoy Molschnosti Kanalyiy) fuel design. As discussed in more detail in the August 11 report, RBMK reactors are the commercial descendents of Soviet-era large plutonium reactors of the 1940s and 1950s, and were designed by the Russian research and design institute NIKIET. Based on interviews with knowledgeable officials, NIKIET and a Russian company in Obninsk provided technology for the Arak reactor. This assistance included modifying the design of a RBMK fuel rod bundle for use in the Arak heavy water reactor. As a result of U.S. pressure, this assistance for Arak stopped in the late 1990s.

The RBMK fuel pin is clad in an alloy of zirconium with 1% niobium, which is an alloy widely used in Russia. Based on Iranian statements, the Arak fuel pin is also designed to have a zirconium cladding. Iran has built a zirconium plant at Esfahan that is expected to supply cladding for the Arak fuel pins, although the plant's operational status is unknown. Whether the Iranian fuel pins shown by President Ahmadinejad are clad in zirconium could not be determined from the photo.

There are still questions about whether Iran will build hot cell facilities at the Arak site or possibly elsewhere that could be used to separate plutonium, despite Iranian denials of planning to do so. The reported hot cell facility at the Arak site will handle irradiated fuel and targets from the reactor, but it is not believed to be sufficient to chemically separate plutonium from the fuel. Instead, it will be dedicated to producing radioisotopes for civilian uses. Suspicions remain, however, that Iran intended to build a plutonium separation plant at the Arak site, based on its attempted procurements prior to 2003 of specialized remote manipulators and 1.3 meter thick leaded glass. Whether Iran will build a plutonium separation plant later is a major question.

ISIS also learned that Iran still requires international procurements to outfit the Arak reactor and its associated facilities. Many of these procurements would violate U.N. Security Council resolutions and many states' national export control laws.

### Note on RBMK Fuel Rod Bundle

The RBMK has an unusual fuel design. The basic building block is a *fuel pin*, a long thin pin of zirconium cladding holding the uranium dioxide fuel pellets. Eighteen pins are arranged to make a *fuel rod bundle* as seen in figure 3. Each fuel rod bundle is 3.5 meters long. The RBMK core is 7 meters high so 2 fuel bundles are joined together vertically to make a *fuel cell*, 7 meters long. The fuel cells are suspended from the top of the reactor core by a suspension system that is used to insert them and lift them out. The entire assembly of fuel rod bundles and suspension is a *fuel assembly*.

In figure 1, President Ahmadinejad is examining the lower end of a fuel rod bundle that appears visually identical in every way to an RBMK fuel bundle of 18 pins, spacers, end caps, etc. Judging by the height of the people, this is a 3.5 m long fuel rod bundle and not a fuel cell. The suspension is about 4 meters long.



**Figure 1. Iran's President Ahmadinejad examining a fuel rod bundle at the Fuel Manufacturing Plant at Esfahan.**



**Figure 2. The entire length of the fuel assembly on display.**

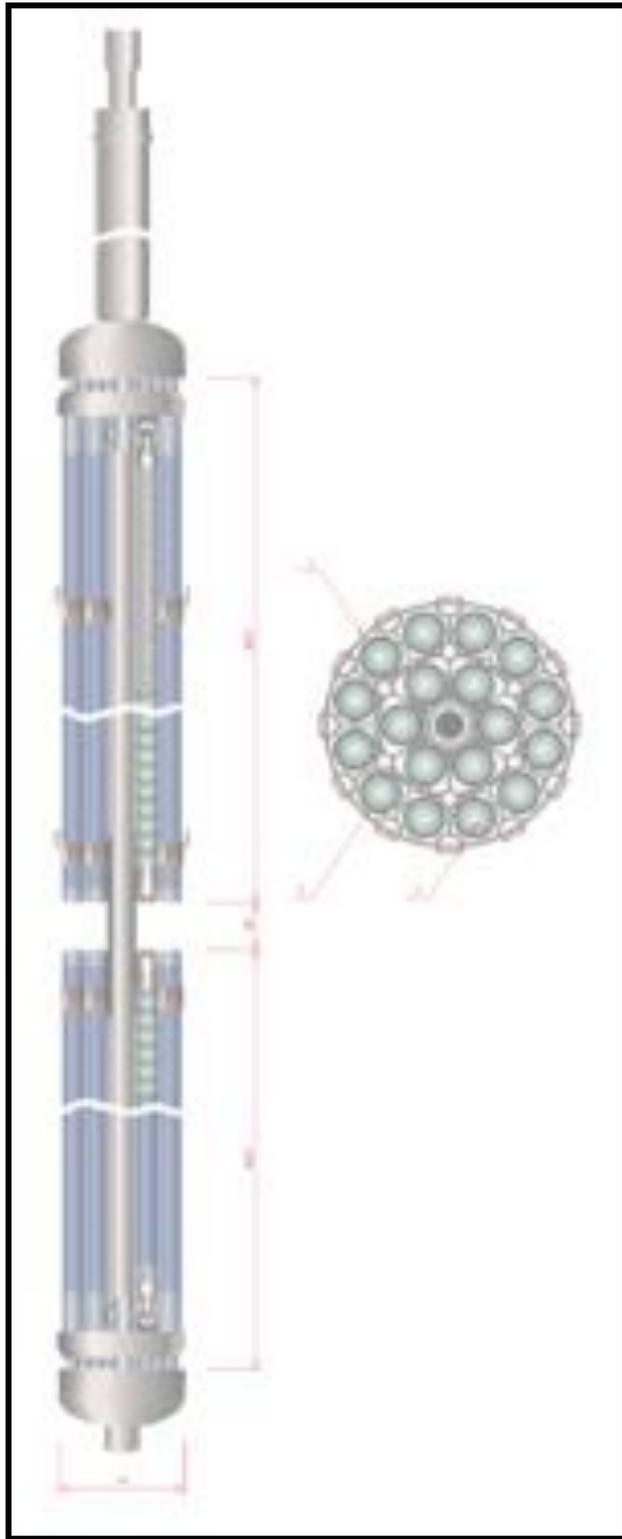


Figure 3. Illustration of an RBMK fuel rod bundle from the ELEMASH website.