INSTITUTE FOR SCIENCE AND INTERNATIONAL SECURITY

IMAGERY BRIEF

Khushab Reactors Operational While New Construction Progresses

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Pakistan's Khushab reactors remain in operation and continue to increase Pakistan's inventory of plutonium for nuclear weapons. Commercial satellite imagery shows that at least three of the four reactors are in operation. The imagery also shows that construction is progressing at a new location in the southwest corner of the Khushab nuclear site. However, the ultimate purpose remains unknown.

Pakistan's Khushab nuclear site has four reactors dedicated to the production of plutonium for nuclear weapons. In the 1990's, the site consisted only of one heavy water reactor with an estimated power of 50 megawatt-thermal (MWth) and an associated heavy water production plant. However, Pakistan subsequently expanded its plutonium production capability by constructing a second heavy water reactor between the year 2000 and 2002, a third one in 2006, and a fourth one in 2011. The expansion of this site appears to be part of an effort to increase the production of weapons-grade plutonium, allowing Pakistan to build a larger number of miniaturized, plutonium-based nuclear weapons that would complement its existing highly enriched uranium nuclear weapons. At the end of 2014, Pakistan had already produced an estimated 205 kilograms of plutonium, with a range of 185-230 kilograms.[1] Pakistan also makes highly enriched uranium for nuclear weapons and is estimated to have a total of about 145 (median) nuclear weapons, with a range of 125-170 nuclear weapons. Of the median value of 145 weapons, about 35 nuclear weapons are estimated to be made from plutonium. The number of plutonium-based weapons is estimated to be increasing at a rate of several weapons per year.

As of February 2016, the date of the most recent satellite image purchased and analyzed by ISIS, Khushab reactors 1, 2, and 3 appear to be operational. As figures 1 and 2 show, steam can be seen venting from the cooling towers of reactors 1 and 2. A smaller amount of steam is also venting from the cooling towers of reactor 3.

In the February 2016 image, reactor 4 does not appear operational (see figure 3). ISIS first spotted steam venting from the cooling towers of reactor 4 in January 2015. Work on reactor 4 proceeded at a much slower pace than expected. It is possible that the slower pace could be due to the differences in layout compared to reactors 2 and 3, or to factors not evident in satellite imagery. It is also important to note that although the reactor's construction was complete by the end of 2014; construction of adjacent buildings continued throughout the year 2015. As figure 4 shows, two new buildings were built and a new area cleared between January 2015 and February 2016. Therefore, it is possible that the

[1] David Albright, "Pakistan's Inventory of Weapon-Grade Uranium and Weapon-Grade Plutonium Dedicated to Nuclear Weapons," ISIS Report, October 19, 2015. http://isis-online.org/uploads/isis-reports/documents/Pakistan_WGU_and_WGPu_inventory_Oct_16_2015_final_1.pdf

operational signatures spotted in January 2015 were associated with the reactor's start-up operations rather than the commencement of its full power operation.

Additionally, the February 2016 image shows that construction is progressing at a new location in the southwest corner of the Khushab nuclear site. As figure 5 shows, the new building at the site is externally complete although construction of a smaller L-shaped building is continuing nearby. As highlighted in a previous brief, the similarities between this building and another one located close to reactor 3 suggests that it could serve as a storage building for construction purposes. Another hypothesis, which rises because of the presence of a series of roof vents, is that the building could house some sort of chemical processes that require the release of gases. If so, it is important to note that the gases released would not be radioactive because such gases usually vent at higher altitudes through a stack, which is not visible at this site. However, the ultimate purpose remains unknown.

What also remains unknown is the purpose of the buildings that are being constructed nearby. As figure 5 shows, one square building appears externally complete while the other three remain under construction. The square building has a shape and structure consistent with an office building with an internal courtyard. However, the nature of the buildings under construction nearby is difficult to estimate at this time. These buildings clearly contain cells, which could suggest they will be used as an intermediate storage for nuclear waste. As of now, however, the thickness of the walls does not seem sufficient to house high level waste but possibly only low level waste. It is also interesting that circular ground excavation is taking place nearby. If this is for the construction of a stack, it would indicate processes requiring the release of radioactive gases. However, it remains to be seen if this excavation is actually for a stack.

ISIS first highlighted this new construction activity in in early 2015. However, so far, none of the features visible in the imagery allows a final determination on the purpose of this construction.

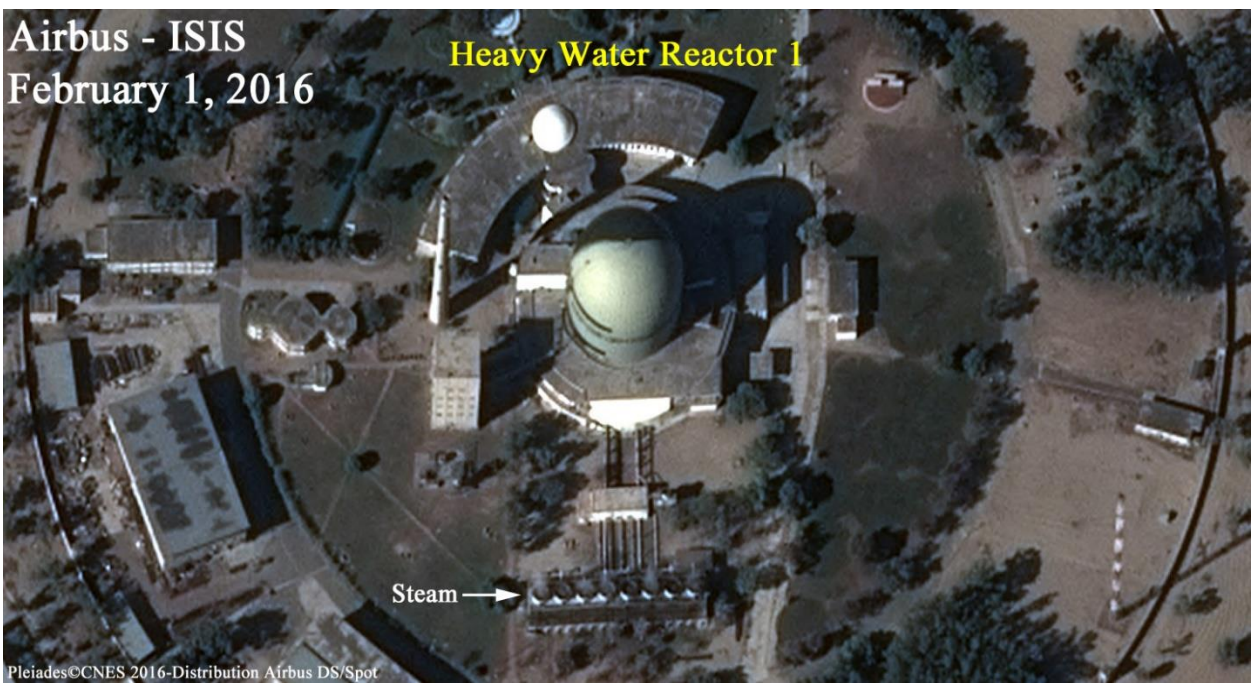

Figure 1. Airbus imagery showing Pakistan's Khushab Reactor 1 on February 1, 2016.

Figure 2. Airbus imagery showing Pakistan's Khushab Reactors 2 and 3 on February 1, 2016.

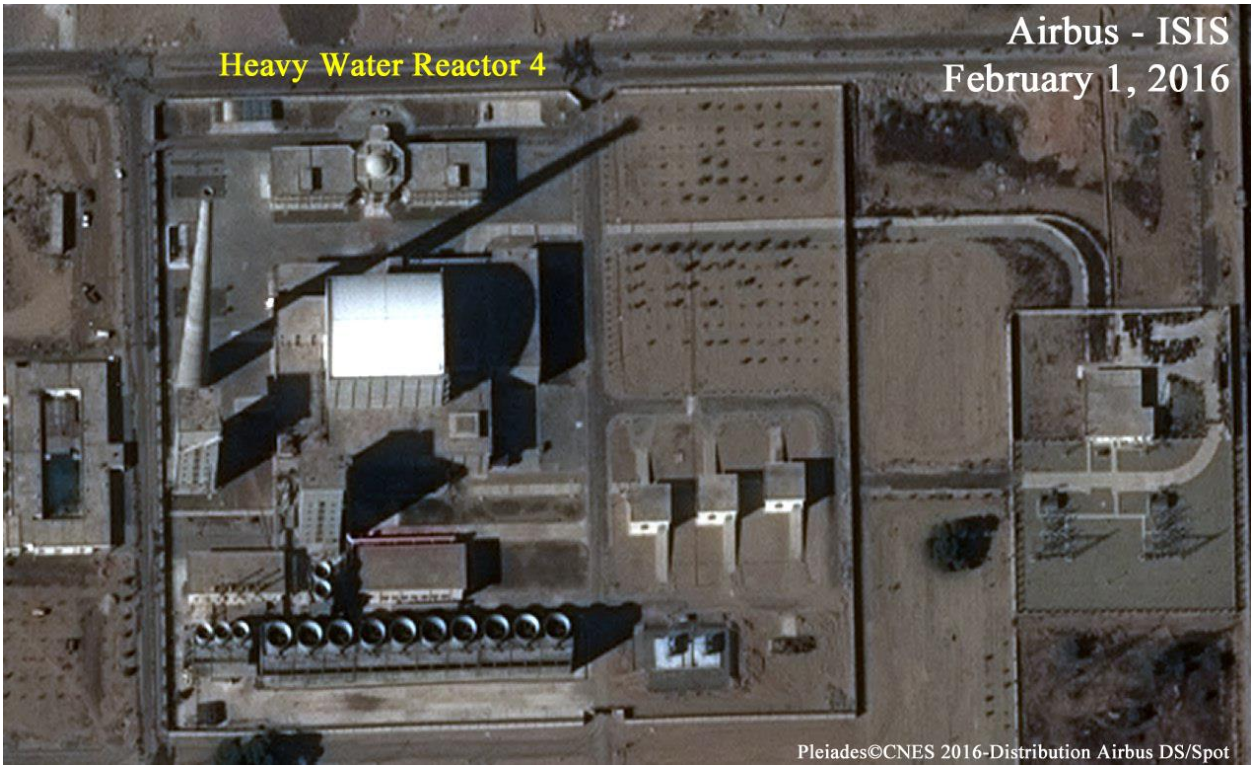

Figure 3. Airbus imagery showing Pakistan's Khushab Reactor 4 on February 1, 2016.

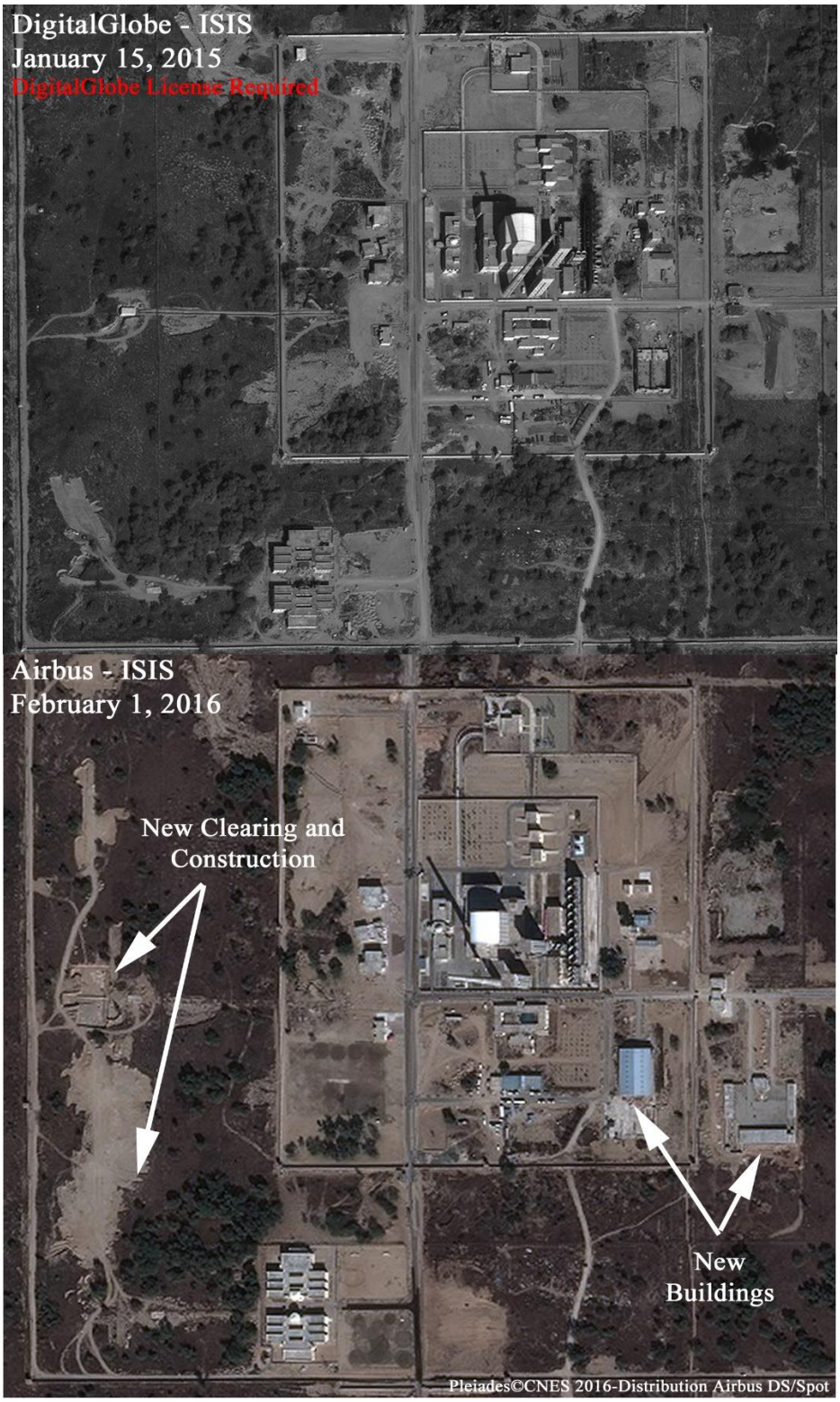

Figure 4. DigitalGlobe/Airbus imagery showing Pakistan's Khushab Reactor 4 on January 15, 2015 and February 1, 2016.

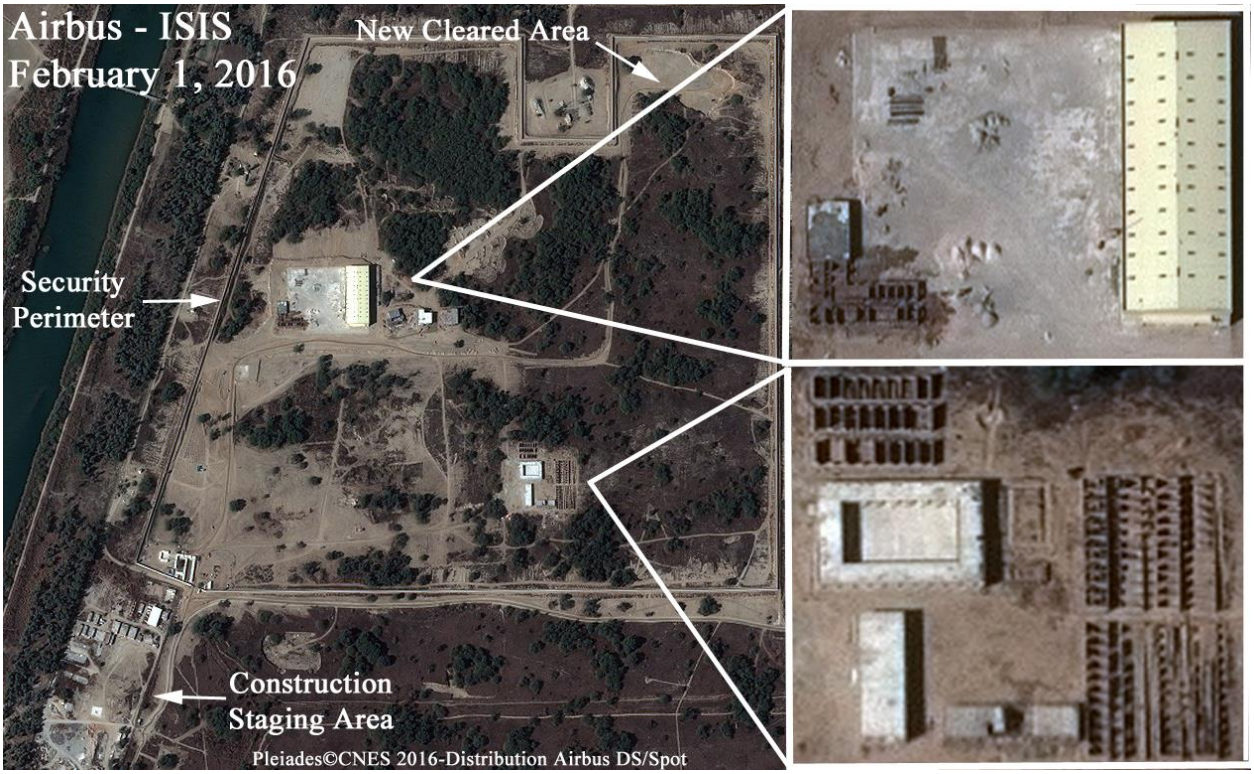

Figure 5. Airbus imagery showing the site of new construction in the southwest corner of Pakistan's Khushab nuclear site on February 1, 2016.