

Inspecting Syria's Al-Kibar Site: A Technical Note

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Following the destruction of the Syrian nuclear reactor at Al-Kibar on September 6, 2007, Syria launched an intensive campaign to destroy all evidence of the existence of the suspected nuclear reactor at this site.¹

Syria repeatedly insisted that the site was a military one, and denied the existence of a nuclear project at Al-Kibar. Recently, some Syrian officials have indicated that the IAEA would be welcome to inspect the site, although no date for an inspection has been set. The following summarizes the main findings of the U.S. Government report and describes how an IAEA inspection of the site might unfold, including what inspectors will be looking for and how they would carry out their work under less than friendly circumstances.

The Al-Kibar reactor is believed to have had the following specifications:²

- A natural uranium, graphite moderated, carbon-dioxide cooled reactor, with a full power capacity of 20 Megawatts.
- The nuclear fuel contains some 0.5% of aluminum, and is clad in a magnesium canister, containing 0.5% zirconium.
- The several hundred tons of graphite are "nuclear grade", i.e., of high and specific purity.
- The reactor core is located inside a steel canister placed inside a thick cement encasement.
- The two heat exchangers, used to dispose of the reactor's energy produced by its operation, are located in two heavy cement-walled chambers outside the reactor core.³
- The heat is removed from the carbon dioxide in the heat exchangers by the Euphrates river water which is then sent back to the river (ref.1).

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¹ Information concerning the site and its destruction is based on the video released by the U.S. government available here:

http://www.cbsnews.com/stories/2008/04/24/national/main4040170.shtml?source=RSSAttr=HOME_4040170

² For more information on the North Korean small power reactor at Yongbyon see "Solving the North Korean Puzzle" by David Albright and Kevin O'Neill, ISIS Press, Washington, D.C., 2000.

³ The energy produced by the reactor in North-Korea was used to produce electric power. The US report notes that there was no imagery evidence that the Syrians intended to produce power at the Al-Kibar site.

What will IAEA inspectors be looking for? It is highly unlikely that inspectors will find any above-ground major components of the reactor and affiliated equipment. There could be however, tell-tale signs that would be uniquely attributed to a nuclear reactor in general, and to this site specifically.

The first one is the heat removal system. Given that there would have been a significant amount of heat to be removed, the characteristics of the water pumps and the piping system should be enough to assess the existence of a major heat source inside the large building at the center of the site.

A second possibility is the discovery of specific reactor components in the environs of the main building. This is by no means certain, and a failure to discover corollary evidence does not mean anything but that Syria meticulously cleaned the surroundings of the buildings. Inspectors will still attempt to sample for particles of uranium, particles of the cladding and particles of graphite. Although the U.S. report assesses that there was no uranium loaded into the reactor, this cannot be assumed. Specific uranium metal alloy particles would be a significant finding. Asking to inspect the debris that was removed from the site could be futile, as either the request would not be heeded or the debris shown would be unrelated to the site, but the IAEA should pursue the matter nevertheless.

From the ground-level photographs presented in ref.1 it can be seen that there was a basement, consisting at least of one floor lower than the local ground level. The layout of the underground structure of the main building would probably be the best evidence of the existence of the nuclear reactor at this site.

The Inspection Process: Assuming that the IAEA inspectors are able to execute their inspection of the site freely, without constraint, the following describes the process that is likely to unfold.

First, the inspectors are likely to begin the inspection working from the outside in, using all available maps and satellite imagery. Although Syria claims that the ground-level photography was fabricated, these pictures should be available to the inspectors, as references.

Two tasks would be carried out in parallel: sampling the environment and inspecting the water supply and heat-removal system. Several hundred

ground surface samples would be collected from several radii centered on the main building. The samples are placed in tamper-proof packaging, with chain of custody established and maintained throughout the process. According to standard IAEA sample analysis procedures, each sample is divided and shipped to both an IAEA laboratory and to one from a cooperating member state for control purposes. This process can take up to several months.

Because the heat removal system is dependent on the return piping to the river, inspectors are likely to concentrate on this piping. From ref.1 it can be seen that the outlet into the river is situated downstream of the inlet pumps, which is standard engineering practice.

The diameter of this pipe is the best indication of the design power of the reactor. The diameter can be assessed by two methods: use of remote sensing or by simply uncovering the pipe. Remote-sensing equipment would include ground penetrating radar and magnetometers. These actions should not take place at the outlet, but at several places along the route from the main building to the river. If Syria disputes the results of the measurements, or if the inspectors are not satisfied with them, the pipe could be excavated at least at one untampered site along the pipe's route. This is not a major undertaking, but the ground moving equipment must be made available by local authorities.

If Syria continues to deny having had a nuclear reactor project at the site, further inspection work is possible at the main building. This would include remote sensing from within the building to map the underground structure, and possibly digging from the outside to uncover the extent of this underground structure. The underground structure should have retained at least the foundations of the reactor core block, the heat exchangers and the spent fuel storage pool (ref.1).

It is always possible that Syria might resist or seek to obstruct the inspections. The IAEA will be within its rights to take a firm stance and inform Syria that obstruction will be interpreted by the international community as an admission of guilt, an unfavorable report to the IAEA's governing board and possibly further action by either the Board or the UN Security Council.

At the same time, it will be vital for the IAEA's own credibility to undertake a careful, rigorous inspection of the site, notwithstanding the dismantlement, in light of its own early assessment that the site was unlikely to be a nuclear reactor.