

## CASE 3: ARAK



Figure 32: Arak Nuclear Facility (Source: Reuters)

The nuclear facilities at Arak house two nuclear programs: an operational heavy water production plant and a 40 MW heavy water nuclear reactor facility, which is still in development and is not expected to come online until the third quarter of 2013, according to the IAEA.<sup>125</sup> The 40 MW Heavy Water Reactor at Arak has been compared to Israel's Dimona Nuclear Plant, and, according to the Institute for Science and International Security, will be capable of producing 9 kilograms of plutonium annually, or enough for two nuclear weapons each year when operational.<sup>126</sup> The United States and Israel allege that contrary to Iran's claim that the Heavy Water Research Reactor is operated for peaceful purposes, Iran really intends to develop an alternate methodology for the manufacturing of nuclear weapons using Plutonium-239 instead of an enriched Uranium-235 based device.

In many ways, production of PU-239 is much less complex than highly-enriched U-235. Naturally produced U-238 is radiated with neutrons and PU-239 can be obtained through the following steps:

- A. U-238 + Neutron → U-239
- B. U-239 decay to Ne-239
- C. Ne-239 after alpha emission decay → PU-239

Although production of PU-239 is simpler than highly-enriched PU-235, the more sophisticated implosion detonation devices needed for a Plutonium-239-based weapon will be significantly more challenging than simpler gunshot assembly used for a highly-enriched U-235-based weapon.

Unlike Isfahan and Natanz, with Arak, the primary threat is from the release of fission products and other radioactive products. If strikes take place after the reactor is operational, the destruction

of the reactor pressure vessel or spent fuel could lead to the release of dangerous quantities of Iodine-131, Strontium-90, Cesium-137, and Plutonium-239.

### Human Casualties

An attack before the reactor becomes operational would kill most of the 500 employees at the site but it would not pose significant risks to the population centers around the site. However, once the reactor becomes operational, an attack would expose Khondab, a town of 72,000 residents less than 3.5 km (2 miles) from the facility, to large quantities of radioactive material (Figure 34). In such a scenario, potential casualties at Khondab could be in the thousands. In addition to Khondab, there are approximately 27 villages with more than 60,000 inhabitants living in a 10 km (6.2 miles) radius of the plant. These villages would almost certainly be within the range of the radioactive fallout. Therefore, the number of human casualties may vary between 500 to 3,600, assuming additional exposure and a casualty rate of 5% of the population of neighboring villages close to the facility. The city of Arak, with a population of 600,000 inhabitants, is about 50 km (31 miles) southeast of the facility (Figure 34). Prevailing winds in the area trend in a westerly direction away from Arak (Table 6).<sup>127</sup>

Season	Prevailing Wind Direction
Spring	South-West, West
Summer	South-West, West
Fall	West, South-West
Winter	West, South-West

Table 6: Prevailing Winds of Arak (Source: Arak Government.)

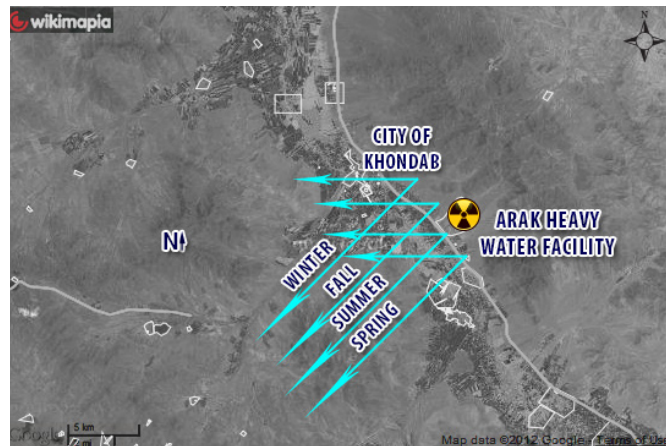


Figure 33: Possible Toxic Release Scenario (Map source: Wikimapia, TerraMetrics)

### Civil Defense Capabilities

Arak's civil defense capabilities are poor. The Markazi Province Crisis Management Council (MPCNC) is responsible for all emergency

125 "Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran," IAEA Board of Governors report, 11 November 2011.

126 "Nuclear Iran," Institute for Science and International Security, <<http://www.isisnucleariran.org/sites/facilities/arak-ir-40/>>.

127 "Information Technology Center Post Company of Iran," <<http://www.arak.post.ir/HomePage.aspx?TabID=10150&Site=arak.post&Lang=fa-IR>>.

responses at the provincial level. In 2011, the budget of emergency response and disaster mitigation was set about \$6 million, a nominal sum for a disaster-prone province.<sup>128</sup>

According to reliable sources, there is a heightened awareness of defense and security concerns arising from a potential strike against the Arak facility. The town of Khandab was approved for coordinating civil defense by the Political and Defense Commission of Government in 2009.<sup>129</sup> At the town level, the mayor of Khandab is the head of the Crisis Management Task Force. Security issues are addressed by the Security Committee, which consists of members from the intelligence agencies, police, the Revolutionary Guard and the heads of some civil organizations. The town suffers from a lack of funds and has a limited capacity in terms of responding to emergencies. Despite frequent Sky Guard drills, the facility cannot be shielded against a U.S. or Israeli military strike.<sup>130</sup> The total number of hospital beds in Arak is reported to be 1,033.<sup>131</sup>



Figure 34: Arak Heavy Water Plant Distance to City of Arak : 50 km (31 miles) (Map source: Wikimapia, TerraMetrics)

### Environmental Consequences

If the Arak facility is bombed before it becomes operational, the environmental effects would be limited. However, once operational, the environmental threat becomes severe. Radioactive contamination resulting from the spread of fissile products (iodine-131, strontium-90, cesium-137, cesium-134, and, in certain cases, plutonium-239) will pose a threat to the soil and water surrounding the plant. Arak nuclear facility is very close to one of the main sources of Ghareh Chaye River, one of the major rivers in central Iran. After crossing the industrialized city of Saveh, the river flows into the Salt Lake of Qom, 100 km (62 miles) south of Tehran. It is important to note that the Arak facility is located on the northern edge of the Markazi

aquifer, which supplies drinking water as well as underground water for agricultural production throughout the region. Some 90.75% of the underground water of Markazi province is used for agricultural production, while 4.75% is used for drinking and the remaining 4.5% is used for industrial production.

### Economic Consequences

Arak is a well-known industrial hub in Iran with 25 factories in the field of machinery, metals, food, tires, and others, employing a considerable number of workers. It is part of the Markazi Province, comprised of 2,650 industrial units and 320 mining units.<sup>132</sup>

At present, exports include a range of products such as machines, metal, electronics, food and health products, cements, and glass. In 2010, this province managed to export \$562 million USD to foreign markets. The short-term consequences of military strikes include closed factories, impaired local businesses, unemployment, and experts who abandon the facilities. In the long term, military strikes would damage the export of industrial products from the region.

128 MPCNC information available at <[http://www.ostan-mr.ir/index.php?option=com\\_content&task=view&id=473&Itemid=510](http://www.ostan-mr.ir/index.php?option=com_content&task=view&id=473&Itemid=510)> (Persian).

129 Khandab information available at <[http://fa.wikipedia.org/wiki/%D8%A8%D8%AE%D8%B4\\_%D8%AE%D9%86%D8%AF%D8%A7%D8%A8](http://fa.wikipedia.org/wiki/%D8%A8%D8%AE%D8%B4_%D8%AE%D9%86%D8%AF%D8%A7%D8%A8)>(Persian).

130 "Heavy Water Plant of KHANDAB is awaiting investment," <<http://www.ravy.ir/content4638033.html>> (Persian).

131 <<http://www.tebyan.net/newindex.aspx?pid=38129>>.

132 "Industries and Mines Organization of the Central Province," <<http://markazi.mim.gov.ir/index.php?name=news&file=article&sid=40925&archive=1>>.