CASE 4: BUSHEHR

Figure 35: Bushehr power plant (Source: AP)

Figure 36: Bushehr Nuclear Power Plant (Map source: Iranmap.com)

Although the chances of a military strike against Bushehr are low, the potential human, environmental and economic tragedy unleashed by such an assault make Bushehr the most dangerous of Iran's nuclear facilities. While in the case of Isfahan, the primary risk comes from the exposure of hundreds of thousands of civilians to toxic chemical plumes, in the case of Bushehr, the nuclear gamble threatens to expose millions to radioactive fallout. Strikes against Bushehr would have profound international ramifications, as, in addition to Iranian casualties at and around the site, virtually all the countries in the Persian Gulf region, particularly the smaller Persian Gulf states, would face a major threat to their national security, economic viability and longevity as states. Given the presence of Russian personnel at the site, an attack on the plant would also mean risking a confrontation with Russia.

The reason most experts consider a strike on Bushehr as highly unlikely is that the plant's primary function is to generate electricity. Iran claims it has an agreement with Russia to collect and reprocess spent fuel from the facility, which some experts have said makes Bushehr less of a proliferation threat.[133]

What makes it a potential target is the possibility that Iran would renege and fuel from the plant could be diverted for the separation of plutonium from irradiated fuel. This process is slow and requires several years or much more frequent refueling cycles which can be easily detected by the Russians and the IAEA. The timeline for Iran producing a plutonium weapon has been placed at no earlier than 2015 and perhaps beyond. This May, the plant was reported to be operating at 75% capacity and was expected to reach full capacity soon thereafter.[134]

History of the Site

Bushehr is not an ordinary nuclear power plant. It is a nuclear experiment. Originally, Iran and Germany planned a joint venture to build two pressurized water reactors subcontracted to ThyssenKruppAG based on the design of the German Biblis Nuclear Power Plant. The construction of the first reactor at Bushehr that began in 1971 was scheduled for completion in 1980 and the second, in 1981. It was abandoned after the revolution of 1979 and damaged during the Iran-Iraq war in the 1980s. For much of those years, the plant was frozen in time, subjected to an embargo that left Iran with no access to German expertise and documentation concerning over 80,000 random pieces of equipment and spare parts, many of which were exposed to a hot and humid climate.

The challenge of salvaging Iran's white elephant on the Persian Gulf fell upon the Russians, at a cost to the Iranian citizens of 10 billion dollars. In 1995, Iran signed a contract with Russia's Ministry for Atomic Energy to revive the plant by installing the V-320 915 MW(e) VVER 1000 pressurized water reactor. The project was scheduled for completion in 2001, and then in September 2007. Finally, on August 21, 2010, at a ceremony with his Iranian counterparts, the chief of Russia's Rosatom state agency, former Soviet Prime Minister Sergei Kirienko, marked the official opening of the Bushehr nuclear plant with the transfer of enriched uranium from a fuel rod to the plant.

In February 2011, Russia was forced to shut down the plant to "thoroughly clean the reactor core and the primary cooling system to remove metal shards left by the cooling pump failure." The failure was blamed on German cooling pumps dating back to the 1970s. Russia's Ambassador to Iran stated that the delay was necessary since it is better "to prevent unwanted consequences rather than to regret it later," which Iranian state radio confirmed.

In a joint press conference held on February 26, 2009, Reza Aghazadeh, then head of the Atomic Energy Organization of Iran, blamed

133 Ariel Zurulnick, "Iran nuclear program: 5 key sites," Christian Science Monitor, <http://www.csmonitor.com/World/Middle-East/2011/1117/Iran-nuclear-program-5-key-sites/Bushehr-nuclear-power-plant>.

134 "Iran's Bushehr nuke power plant nears full capacity," Xinhua, 4 May 2012, <http://english.peopledaily.com.cn/90777/7807636.html>.

the delays on the design anomolies at Bushehr: "24% of the parts and equipment used at the Bushehr power plant are German, 36% Iranian, and 40% Russian."[135] Kirienko agreed. As he put it, "Until now, no one has succeeded in operationalizing such a plant, and, actually completing the Bushehr nuclear plant is not the same as constructing a new plant but rather it is completing a plant that has been constructed by a company from another company and consequently, we have had to make extremely important technical decisions about it."[136] When pressed to explain a decade of delays, Kirienko could not resist a dig at his Iranian counterparts: "Of course, it is 35 years past the deadline."

In a report released by the IAEA in November 2011, the agency reported that the reactor at Bushehr is operational; however, information regarding its electrical production was unavailable. Finally, in May 2012, Rosatom announced that it had conducted a test on May 1, and that the power plant had successfully generated electricity at 90% of its capacity.[137] The head of the Atomic Energy Organization of Iran (AEOI) Fereidoun Abbasi, anounced that the plant had produced 730 MW of electricity since February and the Mohammad Hossein Jahanbakhsh, Governor-General of the province declared that "the Russian contractor will definitely deliver the power plant to the Iranian side by the end of autumn [2012]."[138]

Human Casualty Estimates

Most immediate casualties would occur among the Bushehr plant workers and people close by. We estimate the total number of workers at the site at between 2,000-3,000 people, plus their families. The number of Russian advisors at the site was estimated at 1,500[139] with another 500 Iranian personnel.[140] Additional casualties will occur in the two villages of Bandargah and Helileh, which are next to the site and have a combined population of 4,500 inhabitants in 1,100 households.[141] In recent years, the government has tried to relocate the people of Bandargah and Helileh, but faced considerable resistance.[142] To complicate matters, the location of the plant next to the sea limits site access to one road.

Beyond the immediate casualties, several factors make Bushehr particularly dangerous. The site is 10 km (6.2 miles) south-east of Bushehr, a city with a population of more than 240,000 people (Figure 37). The prevailing winds in the area blow predominantly to the North-West in the direction of the city of Bushehr (Table 7). An attack on the facility would result in the release of large quantities of fission products including iodine-131, strontium-90, and cesium-137 which, due to their heavy concentration, could easily engulf the city. Recognizing that radioactive material outside the plant operating area is less likely to have acute health consequences, even if only 1-5% of the population is exposed to significant radiation levels, 2,400 to 12,000 people could suffer from chronic effects such as those witnessed in the aftermath of Chernobyl. Given the proximity of Bandarghah and Helileh, the casualty rates from the effect of bombing and exposure to radiation can exceed 50%. Further, as with Pripyat, the Russian city evacuated after Chernobyl, Bushehr would become uninhabitable for many decades into the future.

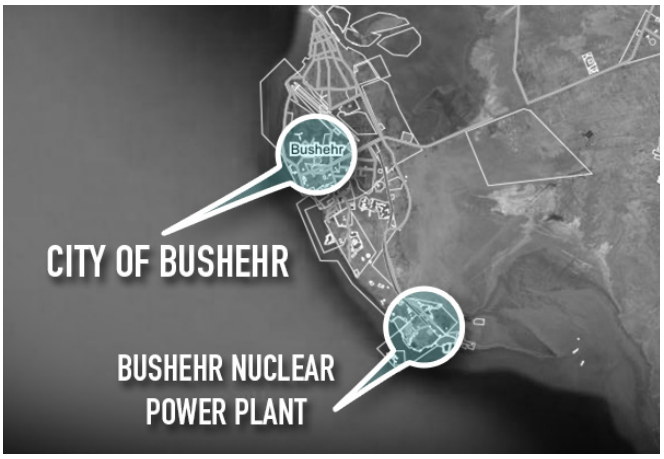

Figure 37: Bushehr Nuclear Power Plant distant. Distance to Bushehr City 10 miles (Map source: Wikimapia, TerraMetrics)

Station Name	Yearly Average Wind Direction	Max. Wind Speed (mi/h)
Bushehr Synoptic Station	N	34
Jam Synoptic Station	SW	31
Borazjan Synoptic Station	W	29
Khark Island Synoptic Station	N	38
Chahkootah Synoptic Station	NW	27
Asalooyeh Synoptic Station	NW-SW	34

Table 7: Wind speed and direction in the vicinity of the Bushehr Nuclear Power Plant (Source: I.R. of Iran Meteorological Organization)

135 "ASR-Iran News Analysis," <http://www.asriran.com/fa/pages/?cid=66101> (Persian).

136 Ibid.

137 "Russian Contractor: Bushehr N. Power Plant to Reach Full Capacity in May," Fars News Agency, 4 May 2012, <http://english.farsnews.com/newstext.php?nn=9102110533>.

138 Ibid.

139 "Moscow: The number of workers at Bushehr facilities will double," Islamic Republic News Agency, <http://www2.irna.com/ar/news/view/line-8/8611269045074856.htm> (Persian).

140 John C.K. Daly, "Iranian Bushehre Nuclear Plant Comes Online," Stock Market Review, <http://www.stockmarketsreview.com/extras/iranian_bushehr_nuclear_plant_comes_online_world_survives_20110916_162652/>.

141 Bushehr geographical and census information available at <http:www.nasir-boushehr.com/Journal-0l-issue140-3964.html>(Persian). This newspaper and its website were created by the Iranian government in late 2011.

142 Note: Ahmadinejad announced in his last visit to Bushehr Province that the people of these two places should be relocated as part of the Bushehr Nuclear Power Plant development plan. Subsequently, the Bushehr governor banned the movement of certain construction material to Bandargah and Helileh. This subject was approved in a visit of the Iran government headed by Ahmadinejad to Bushehr province in 2006 and mentioned on president.ir website (<http:www.president.ir/fa/?ArtID=8151>). The head of Iran Atomic Energy Organization announced in an interview that this is part of Bushehr power plant development plan and was also approved in National Security Council.

Although they did not focus on Bushehr as a likely target, in "A Study on a Possible Israeli Strike on Iran's Nuclear Development Facilities" published by the Center for Strategic and International Studies (CSIS) in March 2009, Anthony H. Cordesman and Abdullah Toukan predicted the highest level of environmental damage would come from an attack on the Bushehr Nuclear Plant.[143] They estimate the damage from an attack on an operational nuclear facility can cause casualties in the hundreds of thousands. Drawing on Bennett Ramberg's "Destruction of Nuclear Facilities in War," they point out that the release of highly radioactive actinide and uranium fuel fission products resulting from the fission process would lead to the release of iodine-131, strontium-90, cesium-137, and activation production material, plutonium-239, all of which are "most damaging to human health" since they attack critical organs such as the lungs, thyroid, bones, tissues, organs, and cells.[144] In fact, according to this study, more than 300 radioisotopes can be released into the environment, over 40 of which are produced in abundance and have a significant half-life. These radioactive particles can contaminate the body through clothing and skin, or through wounds. They can be inhaled as dust, or ingested through food and water. Once released, it is very hard to contain their damage as they can have a "physical half-life ranging from eight days to 24,400 years, and a biological half-life ranging from 138 to 500 days."[145]

As the CSIS study warns, "Any strike on the Bushehr Nuclear Reactor will cause the immediate death of thousands of people living in or adjacent to the site, and thousands of subsequent cancer deaths or even up to hundreds of thousands depending on the population density along the contamination plume."[146]

The major Iranian city closest to the site after Bushehr is Shiraz (pop. 1,500,000) to the northeast of the power plant. However, the prevailing winds could carry this radioactive material in the opposite direction across the Persian Gulf to contaminate Iraq, Kuwait, Bahrain and other countries along the southern coast (Figure 36). Virtually all population centers in the Persian Gulf, including Kuwait, Bahrain, Qatar, and the United Arab Emirates would be at risk. As noted earlier, a 2007 study published by the U.S. Army War College warned that attacks on Bushehr would likely result in catastrophic regional environmental consequences, including the contamination of the majority of the water desalination plants in Saudi Arabia, Kuwait and the United Arab Emirates, which account for more than half of the world's water desalination capacity.[147]

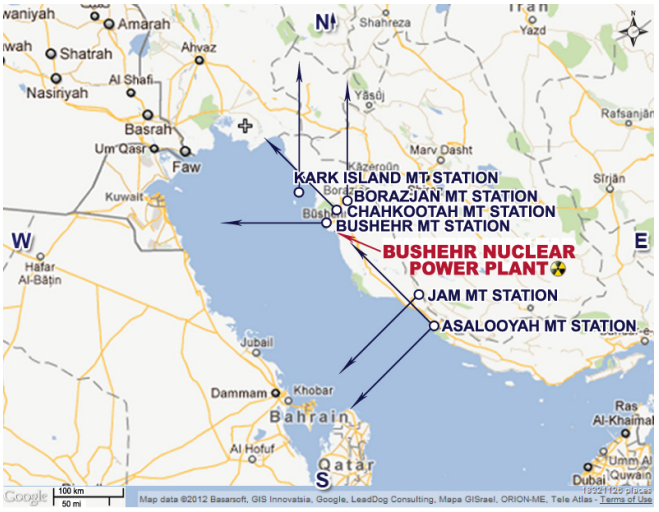

Figure 38: Direction of prevailing wind in the vicinity of the Bushehr Nuclear Power Plant (Map source: Wikimapia, TerraMetrics)

Civil Defense Capabilities

A military strike on the Bushehr nuclear facility would trigger a catastrophe on a scale that would overwhelm the civil defense capabilities of the most advanced industrial countries, let alone the Islamic Republic of Iran. Iran simply lacks the civil defense capabilities and emergency response plans to respond to a tragedy similar to Chernobyl or Fukushima. The Bushehr Province Crisis Management Council (BPCNC) is responsible for all emergency responses at the provincial level. In the event of major disasters, Fars Province would be called on for support.[148] Still, the total emergency response budget of Bushehr province is less than $10 million, excluding the drought response budget.[149] As for medical facilities, there are four hospitals in Bushehr with 520 total beds:[150] Fatemeh Zahra, Amir al Momenin Hospital, Hospital of Air Force, and Salman e Farsi, the general hospital of the Welfare Organization. None can cope with radiation-related injuries.

Environmental and Economic Consequences

The destruction of the nuclear facility can lead to the contamination of the Persian Gulf and the Gulf of Oman water basin, which covers one-fourth of the country but accounts for nearly half of its renewable water resources. Approximately 97,000 wells, 4,000 channels, and 13,500 springs discharge 26.39 km^3 (16.38 miles) per year of groundwater in this major sub-basin.[151] Though not a major industrial hub, this

143 Anthony Cordesman and Abdullah Toukan, "Study on a Possible Israeli Strike on Iran's Nuclear Development Facilities," Center for Strategic and International Studies Report, 14 March 2009, <http://csis.org/publication/study-possible-israeli-strike-irans-nuclear-development-facilities>.

144 Bennett Ramberg, "Destruction of Nuclear Facilities in War," Lexington Books: 3, as quoted in Toukan,et al., "Study on a Possible Israeli Strike on Iran's Nuclear Development Facilities," Center for Strategic and International Studies, 14 March 2009.

145 Ibid.

146 Anthony Cordesman and Abdullah Toukan, "Study on a Possible Israeli Strike on Iran's Nuclear Development Facilities," Center for Strategic and International Studies Report, 14 March 2009, <http://csis.org/publication/study-possible-israeli-strike-irans-nuclear-development-facilities>.

147 Col. Salem Al Jaberi, "Implications on the Gulf States of Any American Military Operation Against Iran," U.S.Army War College: 30 March 2007.

148 Note: Mohammad Hussein Jahanbakhsh, Bushehr province governor is head of BPCNC. He is an experienced manager, but never had experience before his appointment last January with Busheshr Province. He was governor of North Khorasan Province in the past. The same problem exists in other main administrative and response organizations. High turnover of managers, poor performance and lack of budget and resources have made its response system inefficient and incapable.

149 Planning Deputy of Bushehr County,<http://ostb.ir/?part=news&inc=news&id=2120>.

150 <http://www.tebyan.net/mobile.aspx/index.aspx?pid=21824>.

151 "Iran water report" Food and Agriculture Organization of the United Nations (report 34), 2009.

province is one of the main producers of dates and oranges in Iran, as well as limited beef and lamb production.[152] Fisheries also have an important role in the economy, with production of 50,000 tons (56,000 U.S. tons) of fish and shrimp in Bushehr province annually.[153] Given the province's heavy reliance on agriculture, husbandry, and fisheries, the contamination of water and soil can have a profound impact on the food supply, local economy, and health of the local population.

Bushehr is also one of Iran's main ports, its capacity about 5 million tons (5.6 million U.S. tons) with offloading/loading non-oil products of 200,000 tons (224,000 U.S. tons) per month and offloading/loading oil products about 130,000 tons (145,600 US tons) each month.[154] Ship, vessel, and marine industrial factories, weaving, pottery, gas, petrochemical, and oil are also other main industrial activities of the province. The destruction of the Bushehr facility and contamination of the port facility would be a serious setback to domestic industries and foreign exports.

The Bushehr facility also strengthens local markets. Destroying the plant would result in the loss of a multibillion-dollar facility and expensive cleanup and reclamation of radioactive-contaminated soils and water.

152 Agriculture Organization of Bushehr, <http://www.sjkob.ir/index.php?option=com_content&view=article&id=70:-22000-&catid=42:1389-02-04-04-20¬52&ltemid=110>(Persian).

153 Agriculture Organization of Bushehr, <http://khzshilat.ir/page.php?49>.

154 "Bushehr Port Special Economic Zone," <http://bushehrport.pmo.ir!introduction-portataglance-facilities-fa.html>(Persian).