

CASE 2: NATANZ



Figure 28: Aerial View of the Natanz Facility (Source: AP/GeoEye Satellite Image)

As the site of Iran’s underground Uranium Enrichment Facility, the Natanz facility (Figure 28) sits at the heart of Iran’s nuclear program. With a capacity eventually to house more than 50,000 centrifuges, it is feared that the Natanz facilities will soon produce enough highly enriched uranium (HEU) for Iran to make dozens of nuclear weapons. Natanz houses a Fuel Enrichment Plant (FEP) for the production of low enriched uranium (LEU) up to 5%, as well as a Pilot Fuel Enrichment Plant (PFEP), which has produced 110 kg of 20% enriched U-235 since February 2010.¹¹³ The Iranian government claims it intends to use the 20% U-235 UF6 to manufacture fuel for the Tehran research reactor; however, others believe that some of this material could be used to produce fuel for reactors that may be further processed for the production of weapons grade plutonium. Thus, much of the fear about Iran’s nuclear program is focused on the operation and efficiency of the centrifuges buried in this plant. The concern is that the material is a strategic stockpile for weapons.

The Natanz facility is located nearly 200 miles south of Tehran (Figure 29). It is one of the most sensitive and most hardened of Iran’s nuclear facilities. The 670,000 square-foot facility is built 8 meters (25.6 feet) deep into the ground, and is encased by a concrete wall that is 2.5 meters (8 feet) thick. That is, in turn, protected by another concrete wall. In 2004, a roof made of several meters of reinforced concrete was added.

Destroying Natanz is not easy. The destruction of this underground facility requires the use of a powerful strike force consisting of GBU-28 bunker busting bombs.¹¹⁴ The on-site casualties will be significant, effectively turning the buried nuclear site into a mass grave for all

113 “Implementation of NPT Safeguards agreement and relevant provisions of the Security Council resolutions in the Islamic Republic of Iran,” IEAE Board of Governors report, 25 May 2012.

114 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>>.

the people working there. Although the toxic plumes will be as large and lethal as those released in Isfahan, if not more so, the threat from toxic plumes will not be as severe. The facility is not in close proximity to a major urban center, the surrounding area is sparsely populated and the prevailing winds blow away from the cities of Natanz and Kashan (Table 5). However, several small towns such as Baad Rud (14 miles from site with a population 26,000), Abuzeidabad (11 miles with a population about 10,000), Shoja Abad (3 miles with a population of 500) and Komjan (10 miles with a population of 200) could be impacted.

| Month | Prevailing Wind Direction | Wind Speed (mi/h) |
|-----------|---------------------------|-------------------|
| January | North-East | 10.7 |
| February | North-East | 13 |
| March | North-East | 13 |
| April | North | 15.4 |
| May | North | 13.9 |
| June | North-East | 14.3 |
| July | North-East | 14.5 |
| August | North-East | 14.8 |
| September | North-East | 13.6 |
| October | North-East | 12.5 |
| November | South-West | 11.4 |
| December | North-East | 10.5 |

Table 5: Prevailing Wind in Natanz (Source: Fourth National Iranian Forum of Energy, 2002)



Figure 29: Natanz, Iran (Map Source: Parsi Times)



Figure 30: Distance: Natanz 28 km, (17.4 miles) Kashan 35 km (21.7 miles)

Human Casualties

An attack on the Natanz nuclear facility, whether it is with the GBU-28 earth-penetrating bunker buster, or repetitive strikes using less powerful weapons, would destroy the facility. Assuming the site employs 2,000 total workers, engineers, scientists, and soldiers working in two shifts, few, if any, of the personnel onsite during an attack would survive. We have estimated approximately 1,000 casualties at the site. Most would be killed as a result of the physical shock from the blast, toxic clouds releases in and around the site, and asphyxiation in a deep underground chamber whose roof, and the earth piled upon it, would collapse on them.

Natanz Toxic Plume Profile

The presence of unknown quantities of uranium hexafluoride at Natanz, up to the total 371 metric tons produced for enrichment at Natanz by the Isfahan Conversion Facility, raises the level of threat to civilians around the facility. As with Isfahan, the force of the blast would disperse these toxic agents into the atmosphere, and the plumes would be carried by prevailing winds. Fortunately, the prevailing wind direction at the Natanz facility are to the Northeast, North and Southwest (Table 5).¹¹⁵ They do not blow in the direction of the city of Natanz and Kashan. Still, about 35,000 people live within a 14-mile radius of the site. The lethal toxic plumes would endanger virtually everyone in their path, and while we do not expect casualties in the tens of thousands, it is reasonable to assume that hundreds of people in the smaller towns and villages would face serious health risks. It is highly likely that the rural inhabitants of this region would not be prepared to respond to the grave medical emergencies they would face.

115 Behyarm Mohammadbagher and Victoria Ezzatian, "Researching wind energy in different geographical locations of Iran for clean power," <http://www.civilica.com/Paper-NEC04-NEC04_027.html>.

While the UF₆ inventory at Natanz is not clear, the Natanz plume map demonstrates the travel pattern of the IDLH plume at a 1%, 5%, 10%, 20% and 50% of UF₆ release scenarios (Figure 31). Based on our calculations, if there is only a 1% release of UF₆ to the atmosphere, this plume will travel approximately 5 miles, covering a surface area 13 square miles. If only 5% of the uranium hexafluoride stockpile at Natanz becomes airborne, the toxic plumes could travel 6 miles with the Immediately Dangerous to Life or Health (IDLH) level of 25 ppm covering a surface area of 18 square miles. If we assume that this toxic plume would reach half the 35,000 people living in Abuzaidabad, Shoja Abad, and Komjan and assume the casualty rate of 5-20%, then we can expect additional civilian casualties in the range of 1,700-7,000 people.

As with Isfahan, the land area that could be contaminated at RESRAD levels from uranium compounds resulting from 10% release of 371 tons of UF₆ is around 3 square kilometers around the facility. This area would be permanently contaminated by uranium and uranium compounds, with attendant health risks. Furthermore, large quantities of the soluble uranium compounds released after the strikes will also permeate into the water table. We have not estimated casualties for such long-term chronic risks.

Military Capabilities

The Natanz facility is as vulnerable to a U.S. or Israeli strategic air campaign as Isfahan. Iran currently has seven active S-200 sites, with one of these firing batteries situated to defend the facilities in and around Isfahan, including the Natanz nuclear facility. The Natanz facility is protected by recently deployed tactical and strategic SAM systems. Natanz is defended by one HQ-2 site, three HAWK sites, one 2K12 battery, and four Tor-ME Telars. These systems were deployed between September 2006 and September 2009. The problem with Iran's strategic SAM deployment is the evident over-reliance on the S-200 system to provide air defense over most of the nation. Yet, according to military experts, Libyan S-200 systems proved completely ineffective against U.S. Navy and the U.S. Air Force strike aircraft in 1986, and the Iranian S-200 would fare no better in a much more challenging contemporary air combat environment.¹¹⁶

The Iranian air force would not be able to mount an adequate defense of the site. Thus, for all practical purposes, Natanz and its surrounding areas are defenseless. They would face one of the most severe bombings in modern history.

Civil Defense Capabilities

In Natanz, local officials and residents have either been kept in the dark, or encouraged to dismiss and discount the price of the Ayatollah's nuclear gamble — severe and sustained bombing with some of the most powerful bunker busters in the US and Israeli military arsenal. Citing the Iran-Iraq war in the 1980s, the mayor, Javad Ali Jamali, told foreign reporters that the municipality did not see the need for setting up a warning system or organizing evacuation drills: "We

116 Sean O'Connor, "Strategic Sam Deployment in Iran," 2009, <http://www.ausairpower.net/APA-Iran-SAMDeployment.html>.

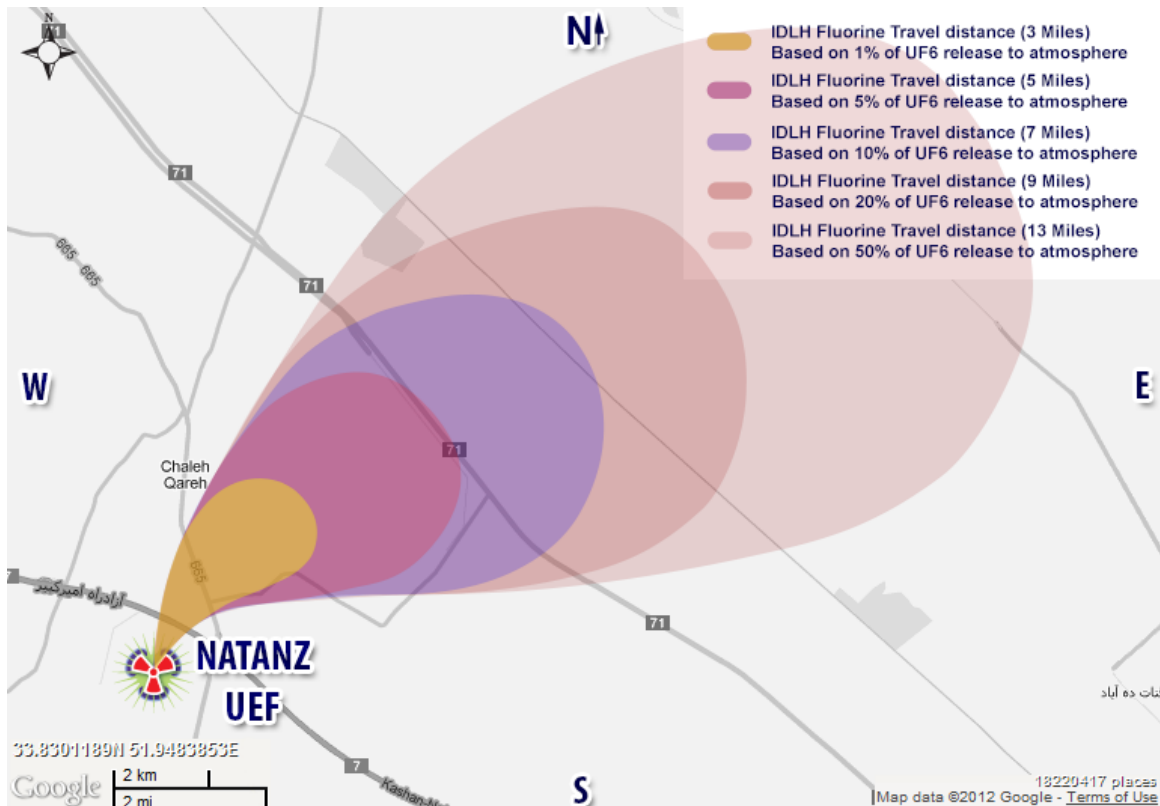


Figure 31: Possible Plume Travel Scenario (Source: Google)

don't need this, we've gone through worse."¹¹⁷ He had not heard of Chernobyl. The local Friday prayer leader, Mohammad Mortazavi, spoke of the economic benefits of the site to the inhabitants. As for a repeat of Chernobyl, he declared, "We're not afraid. Maybe something will happen. We trust in God."¹¹⁸ According to an interview a local shopkeeper gave to *Bloomberg*, until 2002 the residents were told that Natanz was a grain silo, and later that it was an air force base.¹¹⁹ To date, we have not been able to identify information regarding a substantial civil defense capability for the protection of the Natanz facility. Typically, it relies on Isfahan and possibly Kashan. However, since the facilities in Natanz and Isfahan may be attacked simultaneously, responsibility for Natanz might be shifted to Tehran or Qom. Tehran is expected to be more capable in the event of an attack and to have a more comprehensive civil defense capability, but it is more than 100 miles away.

The governor of Natanz is the head of the city's Crisis Management Council and would work closely with Isfahan Province Crisis Management Council (IPCNC). IPCNC is responsible for all emergency responses at provincial level. The Isfahan province governor heads IPCNC and there is a director general of Crisis Management in Isfahan Province. Total crisis management budget of Isfahan Province was more than \$20 million in 2010,¹²⁰ but such levels of funding will be

inadequate for any response or recovery operation involving mass exposure to radiation. Because a nuclear accident in Natanz would expose thousands of people to highly toxic chemicals as well as low-level but long-term radiation, such provincial emergency budgets grossly underestimate the nature of these nuclear emergencies, as well as the associated medical and clean-up costs. Military strikes on the Natanz facility will result in hundreds if not thousands of injuries at and around the site. It would require significant emergency response actions which local authorities are not equipped to handle.

The emergency response, radiation detection, and remediation capabilities in the Natanz area are minimal. As for subsequent clean-up costs related to damaged nuclear sites and the remediation of nuclear waste, a \$20 million budget reveals profound ignorance about the nature and scale of radioactive contamination. Cleaning up the Three Mile Island accident took 12 years and cost \$973 million.¹²¹ Although the cleanup of radioactive materials would primarily be limited to Uranium, the scale and distribution pattern of such an environmental contamination cannot be immediately assessed but would certainly exceed tens of millions of dollars—well above and beyond the existing emergency response budget.

Medical Capabilities

According to our sources, there are two hospitals in Natanz. Managed by Isfahan Medical University, Khatam ol Anbiyah was established in

117 Marc Wolfensberger, "Iranian Nuclear Site Makes Nearby City Boom While Tourists Flee," *Bloomberg*, 16 August 2006.

118 Ibid.

119 Ibid.

120 Islamic Republic News Agency Report news report, available at <www.irna.ir/View/FullStory/?NewsId=721626> (Persian).

121 "Three Mile Island Accident," World Nuclear Association, March 2001, <<http://www.world-nuclear.org/info/inf36.html>>.

1986 and has 50 general beds.¹²² The second, smaller facility, Badrood Hospital, has 21 beds. As with most rural regions, Natanz lacks the emergency medical facilities to treat the scientists and workers suffering from severe blast, thermal and chemical injuries.

Environmental and Economic Consequences

The destruction of the Natanz facility would result in the loss of a multibillion-dollar facility and expensive cleanup and reclamation of radioactive-contaminated soils and water. The contamination of water, land, and air, and thus vegetation and livestock by uranium compounds would pose an adverse health risk, particularly to pregnant women and children in the Natanz rural region. The impact on the gene pool of humans, as well as other animals and species could be of major concern.

In Natanz, three seasonal rivers start from Karkas Mountain. Hanjan River is the closest river to Natanz enrichment facility, about 3 km (1.8 miles) to the south. It moves east toward Badrood and is 20 km (12.4 miles) long. Other rivers which originate from the Karkas Mountain are Avareh and Tamehe. Both are about 4 km (2.5 miles) to the south of Hanjan River and about 7-8 km (4.3-4.9 miles) from Natanz Nuclear Facility. They extend about 50 km (31.05 miles) to the east and end at Dagh Shorkh, a lake in the desert near the town of Ardestan. If any of these rivers gets contaminated with radioactive materials—which is highly likely—contamination can spread downstream, affecting drinking water as well as irrigation networks.

Natanz and its surrounding areas are not major urban or industrial hubs. They are well-known for gardening, agriculture, carpet making, pottery, tourism, metal factories, mining, and some industrial units. Sixty-five industrial units are located in Natanz.¹²³ Kashan and surrounding small towns and villages are well-known for carpet making and weaving, agriculture, mining, pottery, tourism, metal production, ornamental stones, and chinaware factories.¹²⁴ The potential impact on the economy of Natanz and Kashan, neither of which are in the path of the immediate toxic plumes, comes from the potential environmental contamination of the region. The demographic impact can also be significant as it may result in the possible displacement of thousands from the villages and rural towns near the site.

122 <<http://mihanfa.com/culture-art/introduction-of-hospital/>>, <<http://www.tebyan.net/newindex.aspx?pid=21821>>.

123 "Active Industrial Units of the city of Natanz," <<http://www.natanz.gov.ir/Default.aspx?tabid=1149>> (Persian).

124 "Kashan," <<http://persia.org/imagemap/kashan.html>>.