

IV. THE IMPACT OF STRIKES:

THEORETICAL, HISTORICAL, AND ECONOMIC MODELS AND STUDIES

“A military attack against nuclear facilities of any state necessarily poses grave radiological risks to tens of thousands of innocent civilians and soldiers, especially citizens who lack the necessary preparation or information to protect themselves.”

A number of credible sources and methods help define the outer parameters for measuring the extent of the human, economic, and environmental damage from military strikes against Iran’s nuclear sites. Since prompt government intervention using effective recovery and response plans, evacuations, and medical treatment can shift casualty rates by a factor of ten, if not a thousand, we have also considered the Islamic Republic’s historical experience with natural disasters and radiological accidents.

1. The Theoretical Model: Hazard Prediction and Assessment Capability Software

In March 2007, following publication of Seymour Hersh’s Iran Plans, Physicians for Social Responsibility (PSR) published a fact sheet called the “Medical Consequences of a Nuclear Attack on Iran.”⁶⁹ Using the Department of Defense’s Hazard Prediction and Assessment Capability Software, PSR used meteorological models to map the thermal and radiation effects from strikes by tactical nuclear weapons against the nuclear facilities in Isfahan and Natanz (Figure 9).

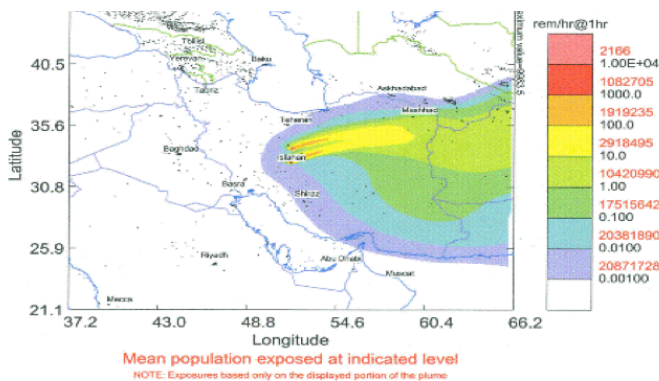


Figure 9: Fallout from nuclear attack on Natanz and Isfahan.⁷⁰

Assuming a tactical nuclear attack with three B61-11 earth-penetrating nuclear weapons for each target, PSR estimated that within 48 hours of an attack on the nuclear facilities in Isfahan and Natanz, 2.6 million people would die from radiation-related causes. More than 1 million people would suffer immediate injuries. And another 10.5 million people would be exposed to significant radiation from fallout. The medical consequences would range from radiation sickness, cancer, stillbirths, malignancies, and hypothyroidism to genetic abnormalities such as those witnessed in the aftermath of Chernobyl.⁷¹

Some experts argue that PSR’s assumptions about the use of tactical nuclear weapons were not realistic and are problematic, so consequently, the casualty estimates were too high. Still, as an alternative, the Department of Defense’s Hazard Prediction and Assessment Capability Software can and should be used to estimate casualties based on more conservative conventional strike scenarios.

2. The Historic Model: The Chernobyl Nuclear Accident

Although there are considerable differences between a military attack on Iran’s nuclear facilities and an industrial accident such as the Chernobyl accident (Figure 10), we are the beneficiaries of a number of studies that have tried to quantify the damage from nuclear disasters. One of the most comprehensive of these studies is the “Chernobyl Forum’s 2006 Report on the Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience.”⁷² That report examined radionuclide release and deposition in the urban, agricultural, forest and aquatic environments in Belarus, Ukraine, and the Russian Federation following the Chernobyl disaster in April 1986.⁷³

71 Ibid.

72 “Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience,” International Atomic Energy Agency and the Chernobyl Forum Report, 2006, <http://www-pub.iaea.org/mtcd/publications/pdf/pub1239_web.pdf>.

73 “Chernobyl’s Legacy: Health, Environmental and Socioeconomic Impacts and Recommendations to the Governments of Belarus, the Russian Federation, and Ukraine,” International Atomic Energy Agency and the Chernobyl Forum, 2005, <<http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf>>.

69 “Global Research Fact Sheet,” Physicians for Social Responsibility, 21 June 2008, <<http://www.globalresearch.ca/index.php?context=va&aid=9409>>.

70 Ibid.



Figure 10: Chernobyl Disaster (Photo: www.cofcsd.org)

Some of the consequences of Chernobyl are worth considering:

- The immediate deaths of plant workers and emergency responders
- Severe radiation exposure to responders and clean-up personnel
- Unprecedented release of radioactive material to the environment
- Evacuation of more than 100,000 people from the region
- Later relocation of about 200,000 people after 1986
- 5 million people live in areas contaminated by radioactivity
- Destruction of contaminated livestock and food crops
- Loss of 10,000 square kilometers (3,861 square miles) of agricultural land
- Contamination of fresh water supplies and tables in Iran and the Persian Gulf region

Any attack on Iran’s nuclear installation would have as its objective the total destruction of the facilities—reactors, centrifuges, buildings, equipment, warehouses, supplies, and, almost certainly, employees. Strikes on the nuclear plant at Bushehr and Arak (once the reactor is operational) would result in the death of plant workers and emergency first responders, including members of the Revolutionary Guard and soldiers not equipped to handle radiation; severe radiation exposure for clean-up personnel; unprecedented release of radioactive material; the evacuation and relocation of thousands of local residents; the exposure of millions to contamination; the destruction of livestock and food crops; and the loss of agricultural land and water resources.

Particularly telling is the fate of populations in cities near the nuclear sites. The residents of Pripyat, a city housing the workers at the Chernobyl plant, were evacuated shortly after the accident. More than 20 years later, Pripyat remains a ghost town. Iranian cities could suffer a similar fate (Figure 11).



Figure 11: Pripyat (Photo: Tricon Films & Television Inc.)

Many argue that in the end it was incompetence, corruption, and mismanagement—the Communist Party’s failure to inform, prevent, and protect the people of Russia, Belarus, and Ukraine against exposure to their own nuclear program — that sealed the Soviet Union’s fate. Yet, ironically, the Islamic Republic appears not only to depend on Russian reactors and engineers to salvage the Shah’s nuclear program, but also to discount and neglect safety issues. Despite some design differences, including a containment dome, Iran’s Bushehr nuclear plant with its VVER-1000 Russian reactor is comparable in size and power production to the Chernobyl RBMK-1000 reactor. Worse, the same negligent culture regarding safety that led to Chernobyl exists in Bushehr, as repeated delays and testing due to old and incompatible parts, including the cooling system, demonstrate. Even without strikes, just as with the Soviet Union, a political approach to management that promotes ideologues over professionals can only ensure that the Iranian people will face political, economic, and ecological catastrophe.



Figure 12: Isfahan in 2006 (Photo: Younes Kolahdouz)

Whether Isfahan, Bushehr and other cities become casualties of the nuclear gamble is a question that the Iranian people and parliament should address before, not after, an attack.

3. The Macro-Economic Model: Belarus, Ukraine, and Japan

According to the IAEA’s Chernobyl Forum, the government of Belarus has estimated that the direct and indirect cost of Chernobyl over three decades amounted to \$235 billion dollars.⁷⁴ This figure includes:

- Direct damage caused by the accident
- Expenditures related to:

⁷⁴ Ibid.

- Actions to seal off the reactor and mitigate consequences of exclusion zone
- Resettlement and reconstruction of housing and infrastructure
- Social protection and welfare to the affected population
- Radio-ecological improvement of settlements and disposal of radioactive waste
- Indirect losses relating to the opportunity cost of removing agricultural land and forests from use and closure of agricultural and industrial facilities
- Other opportunity costs such as the additional costs of energy resulting from the loss of power from the Chernobyl nuclear plant and the cancellation of the Belarus nuclear power program
- Total spending by Belarus on Chernobyl between 1991 and 2003 is estimated at U.S. \$13 billion; this amounted to 22.3% of the national budget in 1991, declining gradually to 6.1% in 2002
- In Ukraine, 5 to 7% of government spending each year is devoted to Chernobyl-related expenditures

Thus, Iran's leaders risk a military confrontation that not only promises the destruction of Iran's nuclear facilities, but also shackles generations to illness, misery, poverty, and dependence. The estimates of Iran's national budget vary. If one assumes that the 5% ratios for Belarus and Ukraine would also apply to Iran, at the CIA World Fact Book estimate of \$105.7 billion⁷⁵ national budget in 2010, military strikes against Bushehr would cost Iran more than \$5 billion a year. And the CIA estimates are at the low end of some estimates of Iran's budget. A *Reuters* story quoted *The Islamic Republic News Agency* in April as saying the Iranian parliament passed a budget of \$500 billion⁷⁶ for 2011-12—nearly five times the CIA estimate.

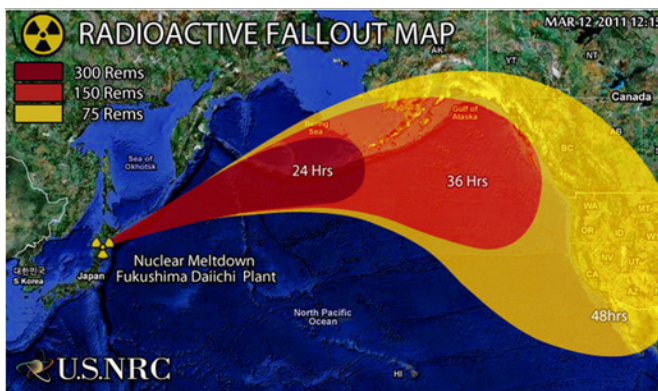


Figure 13: Source: *The United States Nuclear Regulatory Commission*

Japan's experience with Fukushima is also instructive (Figure 13). Although it is still too early to put a final cost on the Fukushima nuclear tragedy, the evacuation of tens of thousands of Japanese citizens, the contamination of agricultural and industrial supply chains, the disruption of the marine ecology and the banning of fishing along the northeastern coast of Japan have led economists to estimate the

cleanup and compensation costs at over \$200 billion.⁷⁷ Although Iran's economy does not compare with Japan's, considering the fact that military strikes against Iran would not be limited to Bushehr, it is reasonable to estimate that the human, economic, and environmental cost of military strikes against Iran would be more severe than Fukushima. In case of military strikes leading to a prolonged war, those costs would climb. The Iran-Iraq war claimed more than 1 million casualties (262,000 Iranian war dead, 105,000 Iraqi war dead, and more than 700,000 injured), with direct monetary costs for each country estimated as high as \$100 billion, and indirect costs in terms of lost income at more than \$1 trillion dollars (\$561 billion and \$627 billion for Iraq and Iran respectively).⁷⁸

4. The Micro-Economic Model: September 11th Victim Compensation Fund

To gain an understanding of the scale of disasters of such magnitude, the costs of the September 11th terrorist attacks on New York City serve as a powerful reference. A 2004 study by the Rand Institute for Civil Justice titled "Compensation for Losses from the 9/11 Attacks" put the benefits provided to those killed in the attacks on the World Trade Center (WTC), Pentagon, and the Pennsylvania crash site, and to businesses and individuals in New York City affected by the attack on WTC at \$38.1 billion.⁷⁹ \$10.6 billion went to the families of those who were killed or to those who were seriously injured. Emergency responders received \$1.9 billion. And \$23.3 billion of the benefits went to businesses for property damage and business interruption. The benefits' sources included insurance (51%), government (42%), and charity (7%).⁸⁰

According to Rand, private insurance payments were expected to be the "largest for any single-event loss in U.S. history and far in excess of losses for any terrorist-related event."⁸¹ Estimates of insured losses were as high as \$32.5 billion, or over 50% more than Hurricane Andrew, the second-largest single event loss in U.S. history. Insured losses were 30 times larger than the next-largest insured loss for a terrorist attack.

Congress also set up a \$7 billion September 11th Victim Compensation Fund to provide compensation to families and dependents of those killed and injured after the September 11, 2001, attacks. According to Rand, quantifiable benefits for the 2,551 killed and 215 seriously injured totaled \$8.7 billion, or \$3.1 million per recipient.

77 Note: According to Kazumasa Iwata, president of the Japan Center for Economic Research, the Fukushima nuclear accident could cost Japan between 5.7 and 20 trillion yen, and would require a 12 trillion "nuclear power burial fund" to cover cleanup and compensation costs. The JCER also predicted that a 10% electric power shortage in the Kanto region in the summer could lead to a 2% decline in economic activity over the year. "Impact to Last Decade or More if Existing Nuclear Plants Shut Down," Japan Center for Economic Research, 25 April 2011, <[http://www.jcer.or.jp/eng/research/pdf/pe\(iwata20110425\)e.pdf](http://www.jcer.or.jp/eng/research/pdf/pe(iwata20110425)e.pdf)>.

78 Maj. Dexter Teo Kian Hwee, "The Iran-Iraq War: An Examination of War Termination Theories," *Journal of the Singapore Armed Forces*, Vol. 29 (January-March 2003), <www.mindef.gov.sg/safti/pointer/back/journals/2003/Vol29_1/2.htm>.

79 Lloyd Dixon and Rachel Stern, "Compensation for Losses from the 9/11 Terrorist Attacks," RAND Institute for Civil Justice, 2004 (pg. 20), <http://www.rand.org/pubs/monographs/MG264.html>.

80 Ibid.

81 Ibid.

75 CIA World Factbook, last updated 11 January 2011, <<https://www.cia.gov/library/publications/the-world-factbook/geos/ir.html>>.

76 "Iran parliament passes 2011-12 budget," *Reuters*, 26 April 2011, <<http://www.reuters.com/article/2011/04/26/iran-budget-approved-idUSPOM65348720110426>>.

The Department of Justice's September 11th Victim Compensation Fund payment statistics put the median deceased victim award after offsets at \$1,677,633.⁸² Awards have ranged from \$250,000 to \$7.1 million depending on age and income levels. In all, 7,408 claims were processed.⁸³

It is highly unlikely that the Iranian government, insurance industry, and philanthropic organizations would be able to compensate the families of the scientists, emergency workers, and soldiers killed as a result of the bombing of Iran's nuclear facilities in a way that would match the U.S. response to the September 11th terrorist attacks. Although the number of civilians likely to be killed or injured as a result of the bombing of nuclear facilities near Isfahan, Natanz, Arak, and Bushehr can exceed the number of victims of the September 11th attacks several-fold, and the radius of economic damage to property and business is likely to be extensive, it is highly unlikely that the Iranian government, industry, and philanthropies could provide adequate and timely support to ensure the recovery of families and local businesses from massive and sudden loss.

If the Iranian government had the budget and plans to compensate victims of attacks on Iran's nuclear facilities, the costs would be significant. With U.S. gross domestic product (GDP) per capita of \$45,934 compared to Iranian GDP per capita of \$10,939 (the U.S. GDP is 4.2 times greater), adjusting the U.S. \$3.1 million quantifiable benefits per recipient would translate to about \$749,000 per recipient. Adjusting for the median deceased victim award of \$1,677,633, the Iranian government's compensation fund would have to pay a medium deceased victim award of \$419,500. Awards would range from about \$60,000 to \$1,700,000. Assuming deaths and injuries at the same level as 9/11, the Iranian government would have to allocate approximately \$1.7 billion to a nuclear strike victim compensation fund.⁸⁴

If we assume deaths and serious injuries among scientists and workers at four nuclear plants at approximately 5,000 people, the benefits would be approximately \$2.1 billion. If one factors in the tens of thousands of soldiers, rescue and recovery workers, local residents, and clean-up crews who would suffer serious injuries from exposure to fissile material and toxins released from the bombing, the costs of compensating the victims for economic loss could be in the range of \$5-50 billion. Assuming provisions are not made to cover the costs and protect the victims, the political, economic, and social consequences of having a large population in key provinces absorb such a high level of damage with no hope of recovery and no support from government, industry and charities would be enormous.

Just as the U.S. government and insurance industry facilitated the recovery of lower Manhattan with more than \$23.3 billion in insurance awards, low-interest loans, government grants and tax breaks, the Iranian government would need an urban recovery plan for Isfahan, Natanz, Arak, and Bushehr. Such a plan would have to enable local residents to reclaim or replace the land, property, housing, and businesses that would be exposed to contamination as well as

other forms of loss of income caused by the bombing. Such costs could certainly match the recovery costs of lower Manhattan as they would require cleaning up much more pernicious chemical and radioactive agents. The alternative to such intervention—negligence—would create sharp economic decline and urban blight marked by a spike in insecurity, unemployment, depression, homelessness, and unrest.⁸⁵ That is clearly not the utopia Iran's nuclear program was intended to deliver; yet as long as these costs remain hidden from the Iranian people, nothing stops the Ayatollah from gambling at their expense.

5. Casualty and Morbidity Rates: From Traffic to Natural Disasters

One can get some indication of the impact poor governance would have on casualty and morbidity rates in the event of nuclear strikes by examining the government's responses to natural disasters such as earthquakes and forest fires, as well as airline and traffic accidents. The Iranian government's approach to crisis management is one that shifts liability for massive failures of governance and management onto the Iranian people. Every year, thousands of Iranians are killed or injured as a result of wounds or burns from accidents and disasters that could have been prevented if government made the protection of Iranian life a priority. In fact, one study of the annual mortality rate of Iranians from road accidents concluded that Iran's rate of 44/100,000 is the worst of any country studied. It stated that with more than 30,000 people dying from road traffic crashes, the annual mortality rate is "substantially higher than the Bam earthquake, one of the worst natural disasters of recent decades."⁸⁶



Figure 14: Blankets cover quake victims in Bam (Photo: Reuters)

⁸² "September 11th Victim Compensation Fund, Award Payment Statistics," Department of Justice, <http://www.justice.gov/archive/victimcompensation/payments_deceased.html>.

⁸³ Ibid.

⁸⁴ "World Economic Outlook Database," International Monetary Fund, October 2010, <<http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx>>.

⁸⁵ Michael Cooper, "Spill Fund May Prove as Challenging as 9/11 Payments," The New York Times, 21 August 2010.

⁸⁶ "Iran's death rate from traffic accidents highest in the world," Institute for Health Metrics and Evaluation, 19 May 2009, <<http://www.healthmetricsandevaluation.org/research/publication-summary/adverse-health-outcomes-road-traffic-injuries-iran-after-rapid-motoriza>>.

As for Bam and similar earthquakes, such natural disasters have struck Iran on a regular basis—and with devastating force. Despite this experience, almost 30,000 Iranians lost their lives in the Bam earthquake.⁸⁷ A prominent Iranian seismologist at the scene of the Bam earthquake bemoaned the ignorance and neglect that had multiplied the casualties and trauma (Figure 14). Turkey, Iran's neighbor, lost fewer people following the 7.6-magnitude Izmit earthquake of 1999—an earthquake 10 times the magnitude of the Bam earthquake and unleashed in a much more densely populated region.⁸⁸ The Turkish example suggests that better planning, prevention, and response could have reduced the death toll in Iran by at least a factor of 10. Compared to the United States, an earthquake of similar magnitude to Bam struck Los Angeles at roughly the same time of night. It reportedly only claimed 20–60 lives.⁸⁹ If one were to simply compare the difference in the casualty figures after the Bam and Los Angeles earthquakes, it becomes evident that in the event of a disaster, whether natural or manmade, planning, preparation, and prevention can reduce the death toll by a factor of 100, if not 1,000. Conversely, a poor emergency response—lack of planning, preparation, prevention, and intervention due to significant underfunding—can mean that the death toll from a strike against an Iranian nuclear site might be 100 to 1,000 times greater than necessary. It is a gamble where the initial loss from strikes gets compounded by subsequent losses from a woefully underfunded response.

Yet, sadly, a Supreme Leader, Council of Guardians and Parliament that claim power as deputies of God and representatives of an absent Messiah hold themselves to slippery standards. They excuse the government's failures of funding, planning, and preparation as acts of God and the Prophets, rather than reflections of man. The death, misery, and poverty afflicting thousands of Iranians—whether from car accidents, plane accidents, or nuclear accidents—get concealed under the shroud of an ideology that glorifies martyrdom and gets priced into an economy that rewards victimhood rather than initiative, accountability, and responsibility for the life of the Iranian people and others. In this regard, the Ayatollah's failure to demand and fund the development of a serious nuclear emergency and recovery plan is every bit as damaging as the fraud and corruption leading to the collapse of faith in Iran's government.

6. Recovery and Response: Radiological Accidents

Despite the obvious threats of accidents, earthquakes, terrorism, sabotage, and strikes to Iran's nuclear program, the Iranian government has not publicly demonstrated that it has a manual for organizing a coordinated national response to a nuclear catastrophe. Yet, after a radioactive accident involving a nuclear plant, site remediation activities require a highly complex response plan, beginning with a unified command structure at the national and local level that can provide security, communications, logistics, medical, and public

affairs support by deploying, coordinating, and managing specialized assets. The "National Response Plan" developed by the U.S. Department of Defense for its nuclear, chemical, and biological defense programs, provides an overall framework that makes the complexity of these operations abundantly clear.⁹⁰ Without a framework for organizing a response, defining the role of government agencies, developing a plan for each nuclear installation, securing the assets and equipment for each phase of a response, training the teams at the sites as well as nationally, and developing a site remediation plan that takes into account the specific characteristics of each plant and area, accidents and strikes would lead to chaos and paralysis rather than an immediate and effective response. Basic questions such as who is in charge, where to set up an operational command center, how to secure and intervene at the sites, where to evacuate and how to treat the casualties, how to detect and dispose of contaminated materials, how to deliver food, water and other uncontaminated materials, how to inform the public, and who to contact to secure international assistance would remain open. Crucial time would be lost and the Iranian people would be left to fend off threats they would not be able to see, identify or avoid. When it comes to responding to nuclear disasters, the Iranian government is woefully ill-prepared. It has not had experience with nuclear accidents, radiation or contamination on a large industrial scale, let alone simultaneous military strikes on four nuclear facilities.

The high casualty ratios following the Bam earthquake provide a glimpse into what would follow in the event of a nuclear catastrophe. Problems of inadequate funding, poor planning, communications, and logistics would be compounded by corruption, looting, and insecurity. The local population has not been notified or trained to react to an early warning system and would not know how to follow evacuation plans. Additionally, there would be minimal civil defense, minimal capacity to detect, minimal equipment to monitor, and few medicines to mitigate the consequences of exposure to physical blasts, toxic dust, chemical plumes, and radiation. As in Bam, thousands of lives that could be saved would be lost.

As in Chernobyl, there is no reason to believe that the scale of such an accident would be properly assessed and reported and no evidence to suggest that the movement of toxic plumes and radiation would be detected and monitored, or that local residents would be rapidly warned and evacuated. And like the Soviet soldiers and firefighters sent into the accident site armed with nothing but shovels or the rescue workers exposed to toxic dust after 9/11, there is no reason to believe that Iranian soldiers and firemen would be better prepared or equipped. While Iran's leaders would be making fiery speeches against foreign aggressors, Iran's rescue teams would be dispatched into highly contaminated sites to provide the public with a false sense of security. They would not have the training, equipment, or planning to handle hazardous toxins and radioactive materials released as a result of policies beyond their control.

87 "Iran Lowers Bam Earthquake Toll," BBC News, 29 March 2004, <http://news.bbc.co.uk/2/hi/middle_east/3579173.stm>.

88 "Preliminary Earthquake Report," US Geological Survey, 17 August 1999, <http://neic.usgs.gov/neis/eq_depot/1999/eq_990817/>.

89 "Massive Earthquake Hits LA," BBC News, 17 January 1994, <http://news.bbc.co.uk/onthisday/hi/dates/stories/january/17/newsid_4079000/4079741.stm>.

90 "Nuclear Weapon Accident Response Procedures (NARP)," Department of Defense (DoD 3150.8-M), 22 February 2005, <<http://www.dtic.mil/whs/directives/corres/pdf/315008m.pdf>>.

7. Medical Infrastructure: The Radiological Accident in Gilan

There are no clear models for assessing the medical infrastructure and resources required to treat the casualties from military strikes on Iran’s nuclear plants, particularly in the case of Bushehr. What is certain is that the victims would number in the thousands, and the cause and range of injuries—physical, chemical, thermal, radiological, and psychological—would stretch even the most advanced medical system to its limits. But unlike traditional accidents, radiological accidents require highly specialized medical training and equipment. Despite a remarkably accomplished medical profession, Iran lacks the resources and expertise to treat radiation injuries.

Strikes on Iran’s nuclear facilities would expose everyone in their vicinity to two types of radiation, each with different consequences. At Bushehr and Arak, victims would be exposed to both short-term acute and long-term chronic radiation. Attacks on Natanz and Isfahan would result in exposure to long-term radiation from depleted uranium.



Figure 15: Slight retraction of the body to the right side due to the fibrotic chest graft in November 1997 (Photo: IAEA)

According to the International Atomic Energy Agency “Study on the Radiological Accident in Gilan,” July 24, 1996, Iran experienced one of its first serious radiological accidents at the combined fossil fuel power plant there when a lock on a radiography container failed and an Iridium source fell in a trench without being detected by the radiography team. A worker later picked up the Iridium source (IR 192) and placed it in his right breast pocket for 90 minutes (Figure 15). He started to experience nausea, lethargy, dizziness, and a burning sensation in his chest. As a result, an inspection team from the Atomic Energy Organization of Iran recommended blood checks for all 600 personnel. All of the samples, which were processed in Tehran, were reported normal except that of the worker, who was transported to Tehran two days later for blood tests and tests to determine cell damage. His chest lesion got worse over the next 16 days, leading to red and moist, peeling skin, typical of radiation exposure.

Almost a month after the accident, following treatments in Iran, the patient was sent to the Radiopathology unit at the Institut Curie of Paris, where he was treated in an isolation room using reverse barrier nursing techniques for two months for a blood condition and skin lesions induced by radiation (Figures 16 and 17).⁹¹



Figure 16: Necrosis of the epidermis on Day 15 (Photo: IAEA)



Figure 17: Moist desquamation on the left palm on Day 35 (Photo: IAEA)

The Gilan radiological accident makes it pretty clear that the AEOI’s Medical Service had to turn to the Institut Curie in Paris to treat a single worker exposed to a radiation source for 90 minutes. In the event of large-scale exposure involving hundreds of workers at a site, let alone an explosion that would spread radioactive debris, toxins and clouds across entire cities and provinces, it is almost certain that Iran would not be able to provide instant bone marrow stimulating cytokine treatment, thermography, grafting and a variety of other treatments necessary for restoring platelet counts, burned skin, and the like.⁹² While Iranian doctors have the training and equipment necessary for responding to earthquakes, strikes on nuclear facilities require a highly complex medical infrastructure able to treat thousands of people exposed to wounds, burns, toxins, and radiation. The number of hospital beds in Isfahan, Arak, Natanz, and Bushehr is not enough to cover a fraction of the casualties resulting from military strikes,

91 “The Radiological Accident in Gilan,” International Atomic Energy Agency, 2002, <<http://www-pub.iaea.org/books/IAEABooks/6284/The-Radiological-Accident-in-Gilan>>.

92 Ibid.

let alone begin to treat them.⁹³ If the Gilan case proves anything, it is that the Islamic Republic's ability to cope with radiation-related sickness is so limited that scientists and workers who are exposed to radiation at the sites must be sent abroad for medical treatment. Since the Gilan accident, there is no evidence to suggest that Iran has developed the necessary medical programs to handle large-scale radiological accidents.

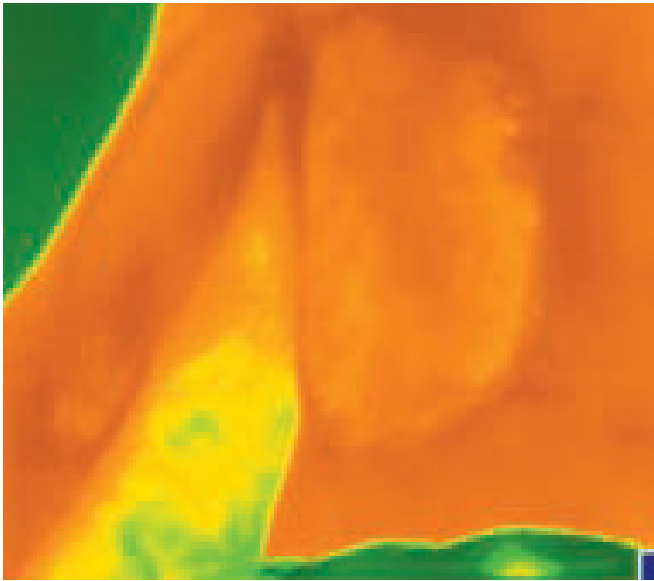


Figure 18: Thermography of the chest and right elbow on Day 28 (Photo: IAEA)

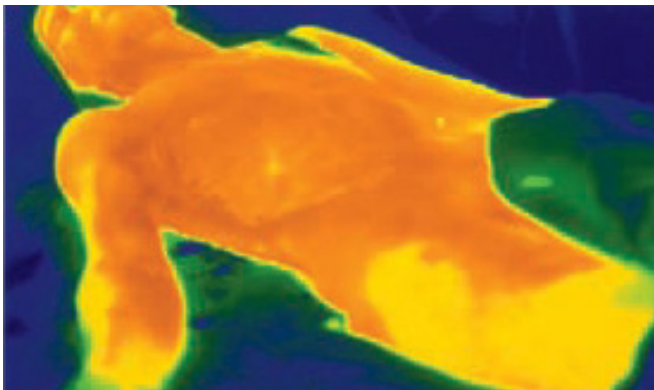


Figure 19: Thermography of the chest and right elbow on Day 28 (Photo: IAEA)

93 Note: It is important to remember that Iran is already dealing with a large number of people who were victims of chemical attacks in the war against Iraq. According to the Christian Science Monitor, Iranian officials “estimate that in the eight-year war with Iraq, 100,000 were exposed to nerve agents like sarin and soman and blistering agents like mustard gas.” Scott Peterson, “Lessons from Iran on facing chemical war,” Christian Science Monitor, 19 November 2002. Another source said Iran spends about \$67 million a year treating its chemical victims and notes indirect costs including psychosocial damage to victims and their offspring who, though born since the war, may suffer from severe deformities and disabilities. No studies have confirmed that mustard gas can alter DNA as some believe. It has not been quantified, but is widely believed as well that people living in the affected areas have a higher incidence of diseases such as cancer. “Iranian Chemical Attacks Victims,” Speech by Kamin Mohammadi (Payvand News), <<http://www.payvand.com/news/06/dec/1239.html>>.

8. Limits of Models

Critics may argue that these models exaggerate the costs of the bombing of Iran's nuclear sites. While none of these models can predict precisely what would unfold in Iran, they provide a realistic framework for understanding a catastrophe on the scale being contemplated. The models offer a point of reference and methodology that accounts for the potential scale of the human, economic, and environmental damage that might result. And while there would be substantial variation between models, the historic, scientific, medical, and economic experience of Russia, Belarus, Ukraine, Japan, the United States, and Iran with catastrophes and disasters allows us to put brackets around scenarios likely to take place in Iran. In the case of Bushehr, the similarities with Chernobyl are such that the risks of a nuclear catastrophe caused by technical malfunction and human error are every bit as grave as the risks from military strikes (Figure 20).



Figure 20: Aerial view of a neighborhood in the city Bushehr

Finally, there is common sense. A massive military assault designed to guarantee the destruction of four major nuclear facilities in any country is an event of enormous magnitude. A military strike with powerful conventional weapons is intended to destroy Iran's nuclear program by destroying its hardware: the buildings, equipment, and testing material. It will only delay and degrade Iran's nuclear capability. Still, no one disputes that fact that one unintended consequence would be the release of tons of radioactive materials and toxic gases. As Ehud Barak has pointed out, after a certain point in time, “any military solution would result in unacceptable collateral damage.”⁹⁴ The parameters for measuring the actual impact of such a release can only be determined in real time after the fact.

We contend that a military attack against nuclear facilities of any state poses grave risks to tens of thousands of innocent civilians and soldiers, most of whom have the least degree of preparation or information about radiological risks. An attack against nuclear facilities guarantees the release of vast amounts of toxic materials. Pre-emptive military strikes against nuclear power production facilities — whether they are located in Iran, Israel, the United States, or any other nuclear state — amount to the premeditated murder of thousands of civilians, constitute a grave breach of the Geneva Conventions, and can be prosecuted as war crimes.

The level of harm caused by military strikes makes it imperative to devise a long-term strategy that makes it harder for the

94 Jo Becker, James Glanz and David E. Sanger, “Around the World, Distress over Iran,” *The New York Times*, 28 November 2010.

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Ayatollah and others to gamble with the Iranian peoples' lives. It is nearly impossible to verify and inspect Iran's nuclear program, let alone change Iran's nuclear policies, as long as the Iranian state remains cloaked and the Iranian people confined under his rule. Given Iran's claims about the peaceful nature of its nuclear programs, the belligerent rhetoric and secretive policies only make it more difficult to verify if Iran has allocated the necessary funding, training, and transparency to ensure that safety standards at existing facilities meet international standards.