GLASS HOUSES: Iran's Nuclear Vulnerabilities

"If one day, the Islamic world is also equipped with weapons like those that Israel possesses now, then the strategy of global arrogance will reach a standstill because the use of even one nuclear bomb inside Israel will destroy everything. However, it will only harm the Islamic world. It is not irrational to contemplate such an eventuality."

-FORMER IRANIAN PRESIDENT ALI AKBAR HASHEMI RAFSANJANI, DECEMBER 14, 2001

THE PUBLIC DEBATE in Iran about its nuclear program is highly circumscribed, focusing mainly on its nuclear "rights" and the proclaimed benefits of nuclear energy and technology. Almost nothing is said about the potential dangers that it poses to Iran. So perhaps it is not surprising that polls show between one-third and one-half of Iranians as favoring nuclear weapons development. But Iran's efforts to become a nuclear threshold state could set off a nuclear arms race in an already unstable neighborhood. Nuclear deterrence in a proliferated region characterized by short missile flight times and deep-seated mutual suspicions would be an inherently uncertain proposition. Irresponsible rhetoric, including frequent threats by Iran to destroy Israel, could increase the chances of a miscalculation during a crisis or war that leads to the use of nuclear weapons—with catastrophic consequences for Iran:

- A single 1-megaton (MT) weapon detonated over Tehran would kill or severely injure millions of residents of the capital and have a devastating impact on the entire country, due to Tehran's large number of governmental, industrial, and educational institutions.
- A "limited" strike on Iran's 18 largest cities would kill tens of millions, due to the compact patterns of settlement and poor building construction standards, while many survivors would die due to inadequate medical care.
- Were Iran to eventually build some 20 nuclear power plants, as reportedly planned, it would be much more vulnerable to terrorist or conventional military attacks that could result in massive releases of radiation.

EFFECTS OF A NUCLEAR STRIKE ON TEHRAN

A single 1-megaton device* detonated over Tehran would kill or severely injure millions of residents through blast, heat, and radiation. In a nuclear war, Tehran would presumably be targeted by multiple devices, ensuring close to a 100% fatality rate.

A nuclear strike on Tehran would have a devastating impact on the entire country. Some 16% of all Iranians live in the greater Tehran area, which includes more than 50% of Iran's industry, 30% of Iran's public sector workforce, and most of its higher education institutions (50 colleges and universities). In a flash, millions of people, the central government, and much of the country's economic capacity would be wiped out.

Tehran is a nearly ideal nuclear target, due to its compact pattern of settlement (a characteristic shared by nearly all of Iran's cities) and the fact that the mountains that bound the city on several sides act as natural reflectors—thereby intensifying the effect of a nuclear blast.

*A 1 MT device (equal to 1 million tons of TNT) is roughly equivalent in yield to missile-delivered weapons used by several of the original nuclear weapons states. In comparison, the Hiroshima bomb was a 16-kiloton device (equal to 16,000 tons of TNT), while the largest ever created was a 50 MT device tested by the Soviet Union in 1961 (equal to 50 million tons of TNT).

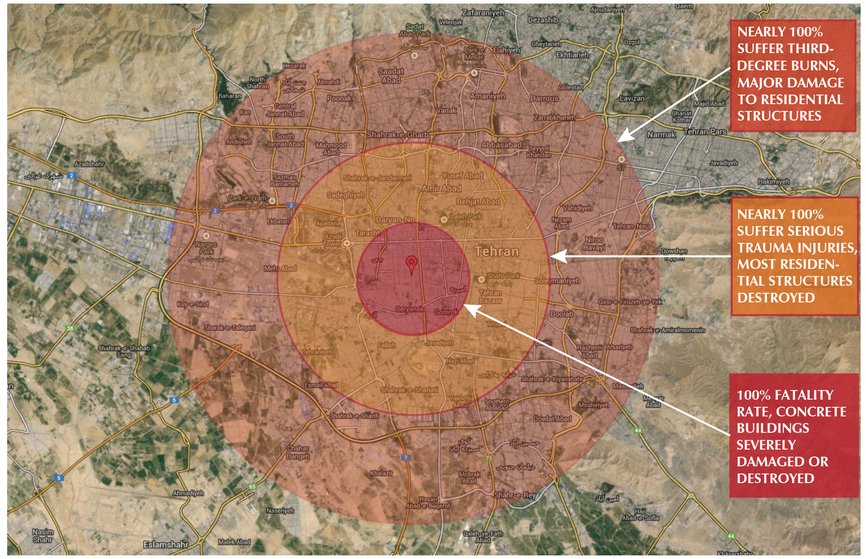

FIG 1. Effects radii for a 1 MT nuclear weapon detonated over Tehran SOURCE: ADAPTED FROM NUKEMAP 2.0

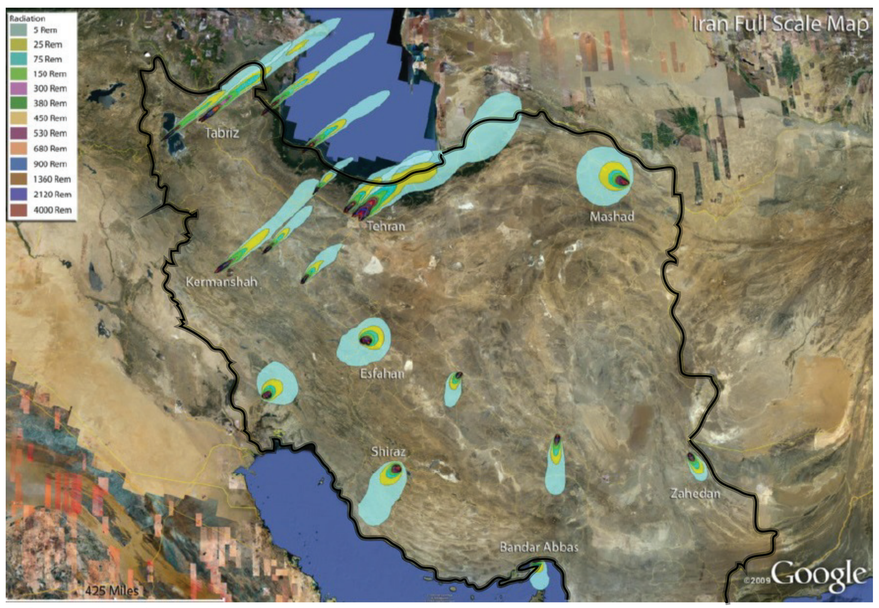

FIG 2. Predicted fallout plumes for a limited Israeli nuclear strike on Iran SOURCE: *CONFLICT AND HEALTH*

EFFECTS OF A NUCLEAR STRIKE ON IRAN'S LARGEST CITIES

A recent study by researchers associated with the Institute for Disaster Management at the University of Georgia simulated the consequences of a nuclear war between Israel and Iran using weapons effects and fallout prediction software developed by the U.S. Department of Defense. The study assumed that an Israeli strike would consist of some 42 weapons (about one quarter to one half of its presumed arsenal) of various yields (15-500 kt) against Iran's 18 largest cities, including Tehran, Mashhad, Esfahan, Karaj, Tabriz, and Shiraz. It assumed that a number of larger cities, including Tehran, would be subjected to multiple strikes.

It predicted extremely high numbers of fatalities due to the compact pattern of settlement characteristic of Iranian cities, poor building construction standards, and inability of Iran's healthcare system to handle massive numbers of burn, trauma, and radiation patients—many of whom would die due to inadequate care. Casualty estimates exceeded 20 million dead (including nearly all the residents of Tehran) and 2 million injured. A more extensive Israeli strike would result in correspondingly greater casualties. In either case, the consequences for Iran would be devastating.

EFFECTS OF ACCIDENTS, TERRORIST ATTACKS, OR MILITARY STRIKES ON NUCLEAR POWER PLANTS

Iran's sole nuclear power plant at Bushehr has been plagued by delays, operating only intermittently due to technical problems and safety concerns. The Bushehr plant is built on a fault line, though nearly all of Iran is an active seismic zone. More than 175,000 Iranians have died as a result of earthquakes in the past century.

Radiation released from the Bushehr reactor as a result of an accident, earthquake, or a terrorist attack would be carried by prevailing winds and coastal currents up and down the length of the Gulf, potentially affecting the health and livelihood of millions of Iranians, Gulf Arabs, and third-country nationals. This would have a particularly dramatic impact on the Gulf Arab states, as nearly all rely on desalination for 50–100% of their drinking water. Such a scenario would also have dramatic consequences for the oil and gas industries in the Gulf, possibly leading to a prolonged shutdown of oil and gas production and export operations.

Iran's vulnerability would be increased manifold were it to eventually build some 20 nuclear power plants, as reportedly planned. Were these reactors to be targeted by terrorists, or by military strikes in wartime, the radiation released could spread far and wide. In this way, terrorists, and neighboring states with relatively small but capable air forces, could effectively transform Iran's network of nuclear power plants into massive radiological dispersal devices that could pose a significant public health threat to the people of Iran.

FIG 3. French nuclear weapons test (1971) SOURCE: CTBTO

RECONSTRUCTION AND RECOVERY

The immediate and long-term consequences of a nuclear strike would dwarf—by many orders of magnitude—the effects of the many natural disasters that have struck Iran in the modern era (such as the Bam earthquake in 2003 that killed 30,000 and left more than 80,000 homeless).

Tens of millions would die immediately, and many more would die in the months and years afterwards as they succumbed to their injuries, hunger, disease, and radiation exposure.

Much of the country's healthcare system and utilities (electricity, water, sewage) would be destroyed in a strike, and what remained would be overwhelmed by the needs of survivors. The likely result would be a public health crisis and epidemics that would claim many additional lives.

Moreover, the breakdown of the food distribution system could lead to mass starvation in some areas, and malnutrition elsewhere. Many areas would also experience a breakdown in public order, resulting in looting and widespread lawlessness, and a loss of social cohesion.

The functioning of the national economy would be severely disrupted through mass casualties to the work force and damage to the manufacturing and agricultural sectors. This, plus the destruction of central government institutions in the greater Tehran area would greatly hinder the country's recovery.

Iran's stature in the region would be greatly diminished, as it struggled to recover from the impact of nuclear war. Even a limited strike would constitute a catastrophe on the scale of the Mongol invasion of Iran in the 13th century, whose impact was felt for centuries afterwards.

TEXT: Michael Eisenstadt

SOURCES: Cham E. Dallas et al. "Nuclear War Between Israel and Iran," Conflict and Health (2013); Alex Wellerstein, NUKEMAP 2.0; Anthony Cordesman, *Iran, Israel and Nuclear War* (CSIS, 2007); Arthur Katz and Sima R. Osdoby, *The Social and Economic Effects of Nuclear War* (Cato, 1982); *The Effects of Nuclear Weapons*, Department of Defense (1977); *The Effects of Nuclear War*, Office of Technology Assessment (1979).