

CRS Report for Congress

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Nuclear Powerplants: Vulnerability to Terrorist Attack

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Summary

Protection of nuclear powerplants from terrorist attack has become a current concern in light of the September 11 attacks. Assault by land from armed terrorists, and the threat of crashing a hijacked airliner into a reactor, are possibilities being studied as regulations and protection measures are reviewed. Legislation to increase security measures and requirements, including proposals to form a federal nuclear guard force, has been introduced.

Nuclear powerplants have long been recognized as potential targets of terrorist attacks, and critics have long questioned the adequacy of the measures required of nuclear plant operators to defend against such attacks. Following the September 11 attacks on the Pentagon and the World Trade Centers the Nuclear Regulatory Commission (NRC) activated its Emergency Response Center and advised all plant operators to go to the highest level of security alert, where they have since remained. NRC also began a “top-to-bottom” review of its security requirements, but has not yet added any additional requirements to those in place before the attack.

Current Regulations

All commercial nuclear powerplants licensed by NRC have a series of physical barriers to accessing the operating reactor area, and are required to maintain a trained security force to protect them. The plant sites are divided into three zones: an “owner-controlled” buffer region, a “protected area,” and a “vital area.” Access to the protected area is restricted to a portion of plant employees and monitored visitors, with stringent access barriers. The vital area is further restricted, with numerous additional barriers and access requirements. The security force is subject to stringent pre-hiring investigation and undergoes extensive training.

Design Basis Threat. A key element in protecting nuclear plants is the requirement that simulated terrorist attack exercises, monitored by NRC, be carried out to test the ability of the plant operator to defend against them. The severity of attacks to be prepared for are specified in the form of a “design basis threat” (DBT), which has come

under attack by critics of NRC's regulatory system. A widely expected outcome of NRC's "top-to-bottom" review of security regulations is a revised and expanded definition of the DBT.

Emergency Response. After the 1979 accident at the Three Mile Island nuclear plant near Harrisburg, PA, Congress required that all nuclear powerplants be covered by emergency plans. NRC requires that within an approximately 10-mile Emergency Planning Zone (EPZ) around the plant the operator must maintain warning sirens and regularly conduct evacuation exercises monitored by NRC and the Federal Emergency Management Agency (FEMA). In light of the increased possibility of terrorist attack that, if successful, could result in release of radioactive material, critics have renewed calls for expanding the EPZ to include larger population centers.

Another controversial issue regarding emergency response to a radioactive release from a nuclear powerplant is the distribution of iodine pills. A significant component of an accidental or terrorist release from a nuclear reactor would be a radioactive form of iodine, which tends to concentrate in the thyroid gland of persons exposed to it. Taking a pill containing non-radioactive iodine before exposure would prevent absorption of the radioactive iodine. Emergency plans include distribution of iodine pills to the population within the EPZ, which would protect from exposure to radioactive iodine, although giving no protection against other radioactive elements in the release. Proposals to strengthen emergency procedures often include wider stockpiling and distribution of iodine pills.

Nuclear Plant Vulnerability

Operating nuclear reactors contain large amounts of radioactive fission products which, if dispersed, could contaminate soil and vegetation, and be ingested by humans and animals. Human exposure at high enough levels can cause both short term illness and death, and longer term deaths by cancer and other means.

To prevent dispersal of radioactive material, nuclear fuel and its fission products are enclosed in metal cladding within the reactor vessel. Because the heat from the radioactive fission products could melt the fuel-rod cladding even if the reactor was shut down, the fuel core is kept constantly covered with circulating water. A major concern in operating a nuclear powerplant, in addition to controlling the nuclear reaction, is assuring that the core does not lose its coolant and "melt down" from the heat produced by the radioactive fission products within the fuel rods.

To protect the reactor and its associated control equipment, a large "containment" building, made of steel-reinforced concrete often many feet thick, is built over the central part of the plant. If a reactor did lose its coolant and experience a melt-down, the containment if intact would prevent dispersal of most of the radioactive material in the reactor, except perhaps for some radioactive elements that are in the form of gases. Without a breach in the containment, and without some source of dispersal energy such as a chemical explosion or fire, the radioactive fission products that escaped from the melting fuel cladding mostly would remain where they were. The two melt-down accidents that have taken place in power reactors, at Three Mile Island and at Chernobyl in the Soviet Union in 1986, illustrate this phenomenon. At Three Mile Island, loss of coolant caused the fuel to melt, but there was no fire or explosion, and the containment prevented the escape of significant amounts of radioactivity. At Chernobyl, which had no

containment, a hydrogen explosion and a fierce graphite fire caused almost the entire radioactive core to be blown into the atmosphere, where it contaminated large areas of the surrounding countryside and was detected in smaller amounts literally around the world.

Vulnerability from Air Attack. Nuclear powerplants were designed to withstand hurricanes, earthquakes, and other extreme events, but attacks by large airliners loaded with fuel, such as those that crashed into the World Trade Center, were not contemplated when design requirements were determined. NRC announced that its review of security regulations would include a detailed engineering analysis of the effects of such a crash, but that analysis has not yet been completed.

In light of possibility that an air attack might penetrate the containment building of a nuclear plant, some interest groups have suggested that such an event could be followed by a melt-down and contamination and exposure of a large numbers of persons to escaping radioactivity. Nuclear industry spokespersons have countered by pointing out that small, low-lying nuclear powerplants are poor targets for attack, and have argued that penetration of the containment is unlikely, that even if it occurred it probably would not reach the reactor vessel. They suggest that a sustained fire, such as that which melted the structures in the World Trade Center building, would be impossible unless an attacking plane penetrated the containment completely, including its fuel-bearing wings.

Regulatory and Legislative Proposals

Critics of NRC's security measures have demanded both short-term regulatory changes and legislative reforms. Among the former are calls for National Guard troops at all nuclear sites, as well as installation of anti-aircraft weapons to defend against air attack.

Expedited action to strengthen and broaden the DBT is also being called for. Critics complain that the terrorist attack specified in the DBT is unrealistically small, and should be increased to include a number of separate, coordinated attacks. They also claim that nearly half of the plants tested in NRC-monitored mock attacks failed to repel even the small forces specified in the DBT, a charge that industry sources vigorously deny. Critics also point out that licensees are required to employ only a minimum of five security personnel on duty per plant, which they argue is not enough for the job. Nuclear spokespersons respond that the actual security force for the 100-odd nuclear reactors numbers more than 5,000, an average of 50 per reactor.

Legislation. Several bills have been introduced dealing with security in nuclear powerplants. The House on November 27, 2001, passed H.R. 2983, reauthorizing the Price-Anderson nuclear indemnification act; included in the bill is a section on "Nuclear Facility Threats" (Sec. 12). The act would require NRC to identify threats to nuclear plants, issue regulations changing the DBT to meet those threats within 270 days, and carry out periodic force-on-force tests based on the new DBT.

More comprehensive changes in nuclear powerplant security are contained in Senator Reid's Nuclear Security Act (S. 1746) and a similar bill, H. R. 3382, introduced by Representative Markey. A principle feature of these bills would be to create a federal force within the NRC to replace the private guards now carrying out the task of defending against terrorist attack. The proposal has created alarm in the nuclear industry, and also

at NRC, where Chairman Richard Meserve declared that the current system is satisfactory and complained that having to hire a federal force would triple the size of the NRC and divert it from its function as an independent regulator of nuclear safety and security. The sponsors of federalization draw an analogy to the action in the recently passed Aviation and Transportation Security Act (P.L. 107-71) to federalize airport security personnel, but Meserve and other critics point to the stringent hiring and training requirements, the higher pay, and 90% retention rate of the nuclear security force to refute the comparison with airport personnel.

Other provisions in the Reid and Markey bills would require stockpiling of iodine pills in regions around nuclear plants, and would require exercises by federal, state and local emergency response personnel within a 50-mile radius of plants.

NRC Chairman Meserve, testifying before the House Energy and Commerce subcommittee on oversight and investigations December 5, 2001, identified several legislative initiatives which he said would help the agency upgrade nuclear powerplant security. One proposal would authorize guards at NRC regulated facilities to carry and use firearms to protect property of significance to the common defense and security, a measure he said would protect guards from state criminal prosecution for actions taken during performance of their duties. A similar measure would counter some state laws that preclude private guard forces from utilizing some weapons by authorizing them to possess and use weapons comparable to those available to DOE guard forces to protect against the DBT.