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November 27, 2001

The Honorable Richard A. Meserve
Chairman
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Chairman:

I am writing to request clarification regarding what actions have been taken over the years by the Commission and its licensees to protect against the impact of a large commercial aircraft on a nuclear reactor, and the consequences of such an event if it were to result in the shut-down of the external electricity supply or secondary cooling system of the reactor.

Immediately following the events of September 11, spokespersons for both the Nuclear Regulatory Commission as well as the nuclear industry made public statements indicating that a large commercial aircraft would not be able to penetrate the containment structure of a nuclear reactor. For example, on September 18, 2001, a story in Dow Jones Newswire stated:

> "U.S. Nuclear Regulatory Commission spokesman William Beecher stood firmly behind the agency's assurances, offered last week in the wake of the attacks on the World Trade Center and the Pentagon, that the steel and cement containment structures ringing U.S. nuclear reactor cores would hold back a crashing airplane. "It is the considered opinion of the NRC that these are very robust, and it is unlikely that a large airliner could penetrate the containment," Beecher said.... "It is still the NRC's belief that the containment can't be penetrated," he said."

Then, just 3 days later, on September 21, 2001, the NRC issued a press release that stated:

> "However, the NRC did not specifically contemplate attacks by aircraft such as Boeing 757s or 767s and nuclear power plants were not designed to withstand such crashes. Detailed engineering analyses of a large airliner crash have not yet been performed."

The Commission made identical statements in your letter to me dated October 16, 2001. Shortly after I received your letter, however, a 1982 study

written for the NRC by Argonne National Laboratory was found in NRC's public reading room by a public interest group. That report was in fact a detailed engineering analysis of a large airliner crash on a nuclear reactor, and it and other press reports referenced numerous other similar NRC analyses.

While the NRC was modifying its public stance on the ability of nuclear plants to withstand aircraft attacks, the nuclear industry has continued to maintain that existing power plants are fully capable of withstanding a strike by a large commercial aircraft. Spokespersons from the Nuclear Energy Institute have been quoted in numerous news articles over the last several weeks as claiming that the plants could withstand such an attack, and the NEI web site contains the following statement:

> Nuclear plants are equipped for, and prepared to defend against, most types of attacks. They are structurally fortified to withstand the impact of natural forces like hurricanes and tornadoes and airborne objects up to a very substantial force.
>
> Reactors at nuclear power plants are enclosed in containment buildings made of steel and reinforced concrete up to four feet thick. Containments at nuclear power plants along the glide paths into airports are designed to withstand airliner accidents.

In light of these statements by the Commission and by the industry, I have directed my staff to carefully review the Argonne report. Based on this review, I am concerned by what appear to be conflicting and possibly inaccurate statements by the NRC and the nuclear industry regarding this matter.

It appears that the NRC and the nuclear industry have been downplaying the risk of a terrorist attack on a nuclear reactor on the basis of containment structures that have not been engineered to withstand the impact of a large commercial aircraft. But it also appears that the consequences of an aircraft (or truck bomb, or other) attack on the auxiliary facilities at a nuclear reactor could be a core meltdown and release of radioactivity into the surrounding communities. In other words, an aircraft would not even necessarily have to penetrate the containment structure in order to cause a catastrophic core meltdown.

For example, the Argonne report states that "a crash of an aircraft on a switchyard would very likely eliminate the plant's offsite power.... Should massive electrical failure leading to total loss of power be possible (with the diesel generators failing or unable to deliver power because of short circuits or other equipment failures) it would leave the plant vulnerable to core melt." It also states that if the secondary cooling system as well as the external electrical power were attacked, the result would be a re-criticality of the core, even if the containment structure wasn't penetrated at all

by the attack on or accident at the reactor. The Argonne report concludes that in such circumstances, "the core would most probably be headed for serious damage if not total meltdown. Core meltdown, without the availability of electrical power, would probably result in containment over-pressurization and release of radioactive materials to the environment far in excess of 10 CFR 100 guidelines."

In light of the serious public health and safety issues raised by this situation, I request your prompt assistance in answering the following questions.

Questions about NRC and Industry Efforts to Assure the Ability of a Reactor to Withstand the Impact of a Large Airplane

An October 7 article in the St. Louis Post-Dispatch contained the following excerpt:

> "The design standards called for the plants to withstand the accidental crash of a 727, an early passenger jet. Beginning in the mid-1970s, many NRC engineers responsible for safety design at new plants fought to strengthen the standards so plants would be protected from larger aircraft that were being flown at the time or on the design boards. The issue hit critical mass while the Seabrook plant in New Hampshire was being licensed for construction in 1976 and the Three Mile Island Unit 2 plant near Harrisburg was being rebuilt after its near meltdown in 1979. Both plants are situated in the flight paths of major airports. Dozens of reports were prepared by NRC's engineers documenting that even Seabrook's double containment might not withstand the impact of a 747, let alone newer, larger aircraft. Nuclear industry lobbyists opposed any plan to increase the strength of the containment, and the agency ended its internal debate."

1) Is it true that beginning in the mid-1970s, many NRC engineers responsible for safety design at new plants fought to strengthen the standards so plants would be protected from larger aircraft that were being flown at the time or on the design boards?
2) If so, were such efforts opposed by the nuclear utilities industry?
3) Why weren't the strengthened standards adopted?
4) Please provide copies of all of the NRC engineering reports, studies or memoranda prepared during this period that raise questions or concerns about the ability of nuclear power plants (including but not limited to Seabrook's double containment structures) to withstand the impact of a 747 or a larger aircraft.
5) Why did the NRC state first that reactors could withstand the impact of a large aircraft, and then subsequently that no such engineering analysis had ever been performed, if numerous reports had been prepared by NRC staff or

NRC contractors or consultants indicating that even the strongest containment system could not survive such an event?

6) In your October 16, 2001 letter to me, you stated that "the NRC has not routinely required all plants to be designed to withstand a particular aircraft crash, but such considerations have entered into siting evaluations."
   a) Which plants has the NRC required be designed to withstand a particular airline crash?
   b) What types of airplane crashes are these plants designed to withstand?
   c) What types of design features, structures, systems, components, and shut down features have been required for these plants?
   d) In light of the September 11th events, does the NRC view these design features, structures, systems, components, and shut down features to be adequate to protect such plants against a hit by a large commercial aircraft?
   e) In light of the events of September 11th, has the NRC considered requiring other licensees to undertake retrofits to incorporate similar design features, structures, systems, components, and shut down features? If not, why not?

Questions on the June 1982 Argonne National Laboratory Study entitled "Evaluation of Aircraft Crash Hazards Analyses for Nuclear Power Plants"

In June 1982, Argonne National Laboratory (ANL) published a study prepared for the NRC entitled "Evaluation of Aircraft Crash Hazards Analyses for Nuclear Power Plants."

1) Why did NRC state that "detailed engineering analyses of a large airliner crash have not yet been performed" in its September 21, 2001 press release given that this study was prepared for the NRC and found in NRC's reading room?

2) The report concludes that "Aircraft crashes may result in multiple failure initiating events, and a propagating failure originating with a nonsafety system malfunction may be possible." Do you agree with this statement? If not, why not?

3) The report stated that an NRC Task Force, based on the assumption that a plane crash at a nuclear reactor would be an accidental occurrence, recommended that reactors should only be sited 5 miles or further from airports. This Task Force published its recommendations in NUREG-0625.Did the NRC adopt the task force's recommendation? If not, why not? Are any of the U.S. nuclear facilities located less than 5 miles from an airport? If so, please list them.

4) The Argonne report states that "A review of past nuclear power plant siting experience indicated that hazards arising from aircraft crashes were analyzed in at least 12 cases in the U.S.A."

   a) Please provide copies of all such analyses.
   b) What actions, if any, resulted from the analyses performed at these plants. If no actions resulted, why not?
   c) Why did NRC state that "detailed engineering analyses of a large airliner crash have not yet been performed" in its September 21, 2001 press release, and in your October 16, 2001 letter to me, given the fact that these analyses apparently existed?
   d) Have any subsequent analyses been conducted of this matter? If so, please provide me with copies of such analyses.

5) According to the report, Germany requires essentially all nuclear containment structures to withstand the crash of certain types of military and commercial aircraft, and the International Atomic Energy Agency has also recommended a systematic approach to the problem of aircraft hazards.
   a) Does the NRC require its licensees to follow the IAEA system? If not, why not?
   b) Given that the NRC was aware that other nations required nuclear containment structures to be able to withstand the crash of certain types of military and commercial aircraft as long as 20 years ago, why didn't it require U.S. nuclear facilities to ensure they had the same capabilities?

6) The report states that while the control rods can be dropped quickly without electrical power to halt a core meltdown, this will only succeed in bringing the plant from full power down to hot standby conditions. Bringing the plant down to cold shutdown conditions would require the injection of boron, which does require electrical power.
   a) How long can a reactor stay in hot standby mode before it becomes a problem, in the event that electrical power is shut down by a terrorist attack or accident?
   b) Please describe the consequences of a prolonged electrical power shutdown on the reactor. How long would it take before a core meltdown was initiated?

7) The report states that the "condenser and condenser cooling water system, parts of the feedwater system and the steam lines, as well as the water intakes and ultimate heat sink(s) are not protected inside hardened structures; they are thus vulnerable to direct impact. Moreover, though the residual heat removal system itself is fully contained in the hardened containment and auxiliary buildings, its intermediate heat removal circuit and ultimate heat sink are not protected in that way."

a) What would happen if any of these auxiliary structures were destroyed by an airplane crash, truck bomb, or other means of attack or accident?
b) Will the NRC be requiring these auxiliary structures to be better protected in the future in order to prevent releases of radioactive materials? If not, why not?

8) The report states that "A crash of an aircraft on a switchyard would very likely eliminate the plant's offsite power.... Should massive electrical failure leading to total loss of power be possible (with the diesel generators failing or unable to deliver power because of short circuits or other equipment failures) it would leave the plant vulnerable to core melt."
   a) Do you agree with these statements? If not, why not?
   b) How long would it take after an attack or accident caused a massive electrical failure for a core melt of the reactor to occur?

9) The report states that "additional ways in which a nuclear power plant could be seriously affected, different from a direct impact on a hardened structure, would be by impact on systems affecting long-term heat removal capability such as the turbine hall (severing the steam lines) and the water intakes. It should be kept in mind that the <u>combined effects of impact and fire due to an aircraft crash open the possibility for numerous multiple failures;"</u>
   a) Do you agree with these statements? If not, why not?
   b) How long would it take for a core melt of the reactor to occur if the long-term heat removal capabilities were destroyed? What are you doing to ensure that this will not occur?

10) According to the report, if the secondary cooling system of the plant and a total electrical power failure were to simultaneously occur at a reactor, the result would be a re-criticality of the core, even if the containment structure wasn't penetrated at all by the attack on or accident at the reactor. It concludes that in these circumstances, "the core would most probably be headed for serious damage if not total meltdown. Core meltdown, without the availability of electrical power, would probably result in containment over-pressurization and release of radioactive materials to the environment far in excess of 10 CFR 100 guidelines."
   a) Do you agree with the report's conclusion that it would be possible for terrorists to cause a core melt at a nuclear reactor even without breaching the containment? If not, why not?
   b) What steps are you taking to protect the electrical power supply and secondary cooling systems of the reactors, especially in light of the events of September 11?
   c) Have these systems' security been tested using Operational Safeguards Response Evaluation exercises at any of the nation's nuclear facilities? If

so, what were the results? If not, then how do you know such systems are not vulnerable to terrorist attack?

11) The Argonne report concludes that "based on the review of past licensing experience, it appears that fire and explosion hazards have been treated with much less care than the direct aircraft impact and the resulting structural response. Therefore, the claim that these fire/explosion effects do not represent a threat to nuclear power plant facilities has not been clearly demonstrated." Has the NRC analyzed the threat of fire/explosion effects associated with an aircraft impact since the Argonne report was published in 1982? If not, why not, and do you plan to do so now, in light of the events of September 11?

Thank you for your assistance and cooperation in this matter. Should you have any questions about this request, please have your staff contact Mr. Jeffrey S. Duncan or Dr. Michal I. Freedhoff of my staff at 202-225-2836.

Sincerely,

Edward J. Markey

Edward J. Markey
Member of Congress