DEPARTMENT OF STATE

Washington, D.C. 20520

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MEMORANDUM

TO : INR - Mr. Montgomery

FROM : INR/PMA - Robert A. Martin

SUBJECT : Consequences of a Bomb Attack on a Nuclear Reactor

Dr. Jerry Mullins of Lawrence Livermore Laboratory gave a briefing yesterday on the radiological consequences on an attack, using conventional 2,000-lb bombs, on Pakistan's Karachi Nuclear Power Plant (KANUPP). He concluded that, in a worst-case scenario (which is unlikely to occur), there is a 10% chance that 20,000 latent cancers might be caused in Karachi by radioactive iodine from the plant. His presentation made it clear that the health risks of an attack, while possibly severe, could be less important in political terms than exaggerated casualty claims by Pakistan.

Discussion

Mullins reported on a study, commissioned by PM and DOE, on the radiological effects of an attack on KANUPP. Although the study is confined to Pakistan, it has obvious implications for other parts of the world -- for example, it suggests what conceivably could happen if Israel strikes power reactors when they eventually come on line in the Middle East.

KANUPP itself is strongly-built and a hard target to damage, although it is not presently protected by anti-aircraft systems. Since it is Pakistan's only significant source of plutonium, India might conceivably try to knock it out of commission and destroy the spent fuel (and hence the plutonium) in the core of the reactor and in the spent fuel pond.

Mullins noted that for radiation to escape from KANUPP, the containment of the reactor would have to be breached and the fuel itself damaged. The most lethal consequences would occur only if the fuel in KANUPP's core melted down. (A meltdown occurs when the fuel overheats because the cooling system fails; if containment is breached, radiation will escape into the environment).

Gaseous fission products and small particles can be blown great distances by the wind, making contamination of wide areas possible if weather conditions are unfavorable. Nevertheless, the impact on health is hard to predict. Different radioisotopes have

different health effects; there are various ways of being exposed to them (inhalation, ingestion, or radioactive "shine" from the atmosphere or the ground); age and diet play a role; and the long term (delayed) effects of radiation are not well understood.

Mullins emphasized that Livermore's computer analyses of an attack on KANUPP are based on a worst-case scenario which, though conceivable, is not likely. They posit that at the time of an attack the reactor is operating at near full power, containment is penetrated, the cooling system ruptured, safety and back-up systems knocked out, meltdown occurs, and steam and hot gases carry radioactive materials into the atmosphere. It is further assumed that 2,000-lb. iron bombs (the kind the Israelis used in Iraq) blow at least a one square meter hole in the thick concrete and steel containment shell. Finally, it is assumed that 1/6 of the plant's total iodine inventory (or 800,000 curies of I-131) escapes through this hole.

Under these extreme conditions, Karachi residents would probably receive a 10 to 20 REM inhalation dose as far as 25 km down wind. Mullins said that an iodine release of this magnitude would be 20 times as great as the serious escape of iodine during an accident at a UK reactor at Windscale in the 1960s. Since Karachi is 20 km down wind from KANUPP and has a population of at least 5 million (but more probably 8 million), it could suffer heavy casualties.

The worst result of iodine inhalation is latent thyroid cancer, which may take 15 to 30 years to develop. In this worst-case scenario, there is a 70% probability that there will be 10 additional latent thyroid cancers in Karachi as a result of the attack; a 60% chance there will be 100 cancers; a 50% chance there will be 200; a 30% chance there will be a 1,000; and a 10% chance there will be 20,000. About 10% of thyroid cancers are fatal.

Mullins commented that casualties might be higher than the middle ranges of these estimates suggest. The current Livermore study deals only with iodine, chiefly because its health effects are well-documented, but other radioisotopes would also be released by an attack. Prompt, as distinct from delayed, radiation could also be a threat. Blast and heat would have localized effects at KANUPP, if not in Karachi itself. Any Indian attack probably would also be directed against KANUPP's fuel pond, since irradiated fuel stored there forms the bulk of Pakistan's plutonium resources (the rest in the core of the reactor itself);

this could produce further radiation. And finally, if countermeasures (e.g., evacuation) were not taken promptly by Karachi authorities, iodine could get into the food chain and harm consumers of cattle and goat milk.

Mullins closed by observing that, if an attack did occur, Pakistan would almost certainly use a series of worst-case projections to arrive at a total casualty figure to put before the world. Given the methodology Pakistani scientists would be inclined to use, the final figure could be a huge one. Its political and propaganda impact would be considerable.

On the other hand, he said, India's projections of radiation-related casualties from an attack on KANUPP would probably be higher than Livermore's. This might dissuade the Indians from hitting KANUPP and, along with other factors, might encourage them to go after softer targets (e.g., the Kahuta enrichment plant near Islamabad). Destruction of these other targets would not present such a large radiation hazard.

Drafted: INR/PMA/NS:HJamin
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