Jan. 6, 1980

Secretary, U.S. Nuclear Regulatory Commission

Washington, D.C. 20555

Attention: Chief, Docketing and Service Section

Petition: I petition that the U.S. Nuclear Regulatory Commission replace the language of Paragraph 13 of Part 50 of Chapter 10 of the Code of Federal Regulations, which now reads:

"An applicant for a license to construct and operate a production or utilization facility, or for an amendment to such license, is not required to provide for design features or other measures for the specific purpose of protection against the effects of (a) attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government or other person, or (b) use or deployment of weapons incident to U.S. defense activities."

I petition that this language be replaced with the following:

"An applicant for a license to construct a production or utilization facility, or for an amendment to such licnese, wherein it is contemplated there will be stored anywhere within the facility nuclear products with a radioactive half-life of one year or more in quantities in excess of 100,000 Curies, shall be required to design the facility in such a manner that the nuclear products cannot be released to the atmosphere by the use of a nuclear weapon with an equivalent yield of less than 5 Megatons which is detonated at ground level at the geographical location of any structures at the facility which contain the aforesaid quantities of radioactive material."

The basis for the petition is that nuclear armed cruise missiles with a target accuracy of 100 feet or less are now able with reasonable probability to directly impact the core containment building or spent fuel holding pond building of a nuclear power plant, or a high level waste storage tank, and disseminate its contents over a wide region, and that the consequences of such dissemination are sufficiently serious to justify requiring that the facility be specifically designed to forestall the possibility of success of such an attack with a weapon of less than 5 Megatons yield.

The enclosed article goes into more detail, and in particular quotes government studies which indicate that nuclear weapons in the 20 to 100 kiloton class which directly impact the core containment building of a nuclear power plant can be expected to crush the core containment vessel and release its contents, although there is some difference over how much of the fission products are likely to

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entrain in the stem of the mushroom cloud to be distributed widely over the surrounding region.

I would appreciate your keeping me informed of any actions taken on this petition.

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WHY NUCLEAR POWER SHOULD GO UNDERGROUND

Do you live within 150 miles of a nuclear power station? Then be advised: the U.S. Nuclear Regulatory Commission (NRC) and your friendly local untility apparently are willing to gamble your health, your wealth, and possibly your life that this power station will not turn into a military target for a small, accurately delivered nuclear weapon. The gamble is being taken to save the utilities a 6% to 30% increase in construction costs for putting the plants far enough underground to make them nearly invulnerable--at least a portion of which costs would be recovered in reduced costs for decommissioning the plants at the end of their 30 year or so useful life.

The odds against the success of this cost cutting gamble grow steadily worse as ever increasing numbers of countries master the technology of nuclear reactors and of sophisticated weapon delivery systems. Over 50 countries currently have research reactors and thus are on the way to developing the nuclear know-how needed to develop nuclear weaponry. The U.S. semi-conductor industry will happily sell Lower Slobbovia the chips it may need for developing terrain following guidance systems for a cruise missile capable of an aiming accuracy of 100 ft or less after travelling in excess of 1000 miles, after being launched, say, from a tramp steamer 300 miles off the coast.

The consequences of losing the gamble? Studies by the government establish the probability that a direct hit by a nuclear weapon in the 20 to 100 kiloton class on a core contaiment building will smash the heavy steel core containment vessel and release its highly radioactive contents. The only unresolved question is how far some 8 billion Curies of radioactivity in the core will be dispersed over the surrounding countryside. One government study envisions your picking up a dangerous dose of radiation within a year's time if you live 150 miles downwind and don't flee the area. Other studies indicate that most of the core will be deposited closer to the plant site, so you'll be safer at a distance of 150 miles , but much more in peril if you happen to live close to the plant--say 10 miles away.

Who's right? We may have to wait until the first plant goes up in a mushroom cloud to find out, but here's something to think about: Measured 25 years later, the residual radioactivity in the spent core from a 1000 MWe power plant will be slightly over 15,000,000 Curies. (See fig. 1 AT END OF ARTICLE) 25 years after a 25 Megaton weapon has gone off, the residual radioactivity will measure about 10,000,000 Curies, two thirds as much. (Scaled from the figure for a 1 Megaton burst, fig. 2)

Altogether, 23 nuclear weapon tests were conducted at the Northwest corner of Bikini, an atoll bout 20 miles long in the Marshal Island group of the Pacific Ocean. The series included one weapon burst of 15 Megatons, and another of "several" Megatons. Taken altogether, the total yield was probably less than the aforesaid 25 Megatons.

client, and let them deal the U.S. a crippling blow? The question that would face whoever targets the weapons would be: "How do I use a few weapons of low yield to cause the longest lasting disruption within the U.S.?" For this purpose, above ground nuclear power plants must certainly be considered inviting targets, as we shall see later.

A Mr. Lee V. Gossick, Executive Director for Operations for the NRC, defends the same regulation in a Sept. 1979 letter: "National defense is a governmental function, not one that private industry, even though heavily regulated, should be responsible for." Here we are probably getting closer to the NRC's current thinking on the subject. Private industry shouldn't be saddled with the additional costs of undergrounding nuclear power plants, because one would do that for national defense reasons, which are a governmental responsibility. But this certainly doesn't prevent the government from insisting that the plants be undergrounded for defense reasons, and then picking up the added tab itself. The taxpayer has already heavily subsidized nuclear power; he might be willing when informed of the current situation to accept the added cost of undergroud_ing the plants in order to eliminate the looming threat of being hoisted on our own radioactive petard if these plants become enemy targets.

What makes a nuclear power plant, above ground, an inviting target for someone with a few nuclear armed cruise missiles at his disposal?

1. These plants are often built with the core containment buildings in pairs, with a spent fuel holding pond in between. A cruise missile aimed at the spent fuel holding pond could simultaineously vaporize the pond's contents and destroy the reactor cores in the building to either side. 2,000 MWe of electrical generating capacity, $2 to $4 billion dollars worth of capital plant permanently destroyed for the $1 or $2 million dollar price of nuclear armed cruise missile. Not a bad trade, even for the military planner who doesn't give a fig about the radioactive aftermath.
2. There is the further possibility one can paralyze the productive capacity of an entire region as inhabitants flee the prospect of contamination by long lived radioactivity distributed in fallout from the destroyed power plant. To repeat: the long lived radioactivity in a single 1000 MWe power plant exceeds that of all 23 weapons detonated in the Bikini Atoll series. The Bikini residents were evacuated for 15 years, and are to be exiled again indefinitely. Are we to believe that mainlanders are built of sterner stuff and will be willing to stick around no matter how much Strontium, Cesium, and Plutonium gets into their systems?

But I haven't yet proved a nuclear armed cruise missile can destroy a nuclear reactor core in a working power plant. The core, after all, is protected by up to a foot of steel and up to 10 feet of reinforced concrete, and is located at the center of a round building about 120 feet in diameter. Ironically, the two articles on which I shall mainly rely for proof were written by two members of the Oak Ridge

The Atomic Energy Commission (AEC) at the conclusion of the tests determined to show it was possible to restore Bikini as a liveable environment even after this massive subjection to radioactive fallout; large amounts of contaminated soil were taken out to sea and dumped. The original inhabitants of Bikini Atoll, exiled in advance of the tests, were brought back in 1968, presumably to live happily ever after. However, by 1975 it was found that levels of Strontium, Cesium, and Plutonium were becoming alarmingly high in the returned islanders; they will have to be evacuated again. Authorities now believe Bikini Atoll will not be safe for long term occupation for another 35 to 50 years.

Only a small fraction of the fallout from the series of 23 weapon tests fell on Bikini and a few neighboring atolls; the great majority fell in the surrounding ocean. That won't happen if a nuclear power plant becomes the target for a small, accurately targeted nuclear weapon. Remember, the long term radioactivity in the core of a 1000 MWe reactor exceeds the total long term radioactivity released by all 23 weapons detonated in the Bikini series.

Does the NRC (Nuclear Regulatory Commission) give much thought to the vulnerability of nuclear power plants to enemy attack? A direct question to the NRC as to whether it consults with the Department of Defense about this problem on a regular, statutory basis has so far gone unanswered. But the NRC does have a regulation (10 CFR 50:13) which specifically exempts the designers of nuclear power plants from having to take into consideration their possible vulnerability to enemy action.

The regulation was promulgated over a decade ago (September, 1967) by the Atomic Energy Commission (AEC) as Paragraph 13 of Part 50 of Chapter 10 of the Code of Federal Regulations (thus 10 CFR 50:13). It reads: "An applicant for a nuclear power plant license for a license to construct and operate a production or utilization facility, or for an amendment to such license, is not required to provide for design features or other measures for the specific purpose of protection against the effects of (a) attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government or other person, or (b) use or deployment of weapons incident to U.S. defense activities."

In defending this regulation, NRC spokesmen have made some interesting statements. Mr. Frank L. Ingram of the Office of Public Affairs, in an Aug. 1977 letter: "In this regard, we believe that it is highly likely that the consequences of a nuclear attack on the United States would be so severe as to make the question of the actual target irrelevant--be it a nuclear power plant or not." This would certainly be true of a major Russian strike. but how does Mr. Ingram know that some small country with a grudge to settle won't consider how to use the few small nuclear weapons it possesses to best advantage? For that matter, what's to prevent the Russians from shipping a few nuclear tipped cruise missiles to some future Viet Nam

National Laboratory, a bastion of the nuclear technology establishment, and were written specifically to prove that a nuclear power plant did not make an inviting target for an enemy, because the accuracy in aiming available at the time (one half a mile) would have required an excessive number of weapons to ensure a direct hit on a core containment building. The authors obviously did not foresee the startling speed with which the military would improve this aiming accuracy, to the point where terrain following guidance will now deliver a weapon to within 100 ft or less of the target aiming point - after having travelled in excess of 1000 miles.

The first article was published Dec. 1970 in the magazine "Nuclear Technology" and is entitled "Civil Defense Implication of a Pressurized Water Reactor in a Thermonuclear Target Area." The authors are C. V. Chester and R. O. Chester, then if not now employed at the aforesaid Oak Ridge National Laboratory. A synopsis begins: "The Turkey Point pressurized water reactor was analyzed as a Civil Defense problem in a nuclear attack. .....High explosive tests on scale models of the pressure vessel and pertinent shielding were employed to determine the required delivery accuracy of nuclear weapons to rupture the pressure vessel and release the core fission product inventory. We conclude that the presence of a power reactor in a target area will not add significantly to the number of casualties produced by a nuclear weapon unless the reactor receives essentially a direct hit.

The authors continue in an introductory section: "The problem can best be described by examining fig. 1. The figure compares the activity from a 100 KT fission weapon after detonation and the activity from the total inventory of fission products in a 1000 MWe reactor core after shutdown. The reactor core activity consists primarily of the longer-lived isotopes, and although initially there is less activity in the reactor core than in the weapon, in less than a day the activity levels are reversed. Not it takes the reactor activity 2½ years to decay to the level of the weapon activity at two weeks. After 10 years, nearly 50% of the reactor activity is the biologically active isotope 28 year ^{90}Sr and the 29 year ^{137}Cs." (From the same figure it will be noted that at 25 years the reactor residue will still be emitting over 10,000,000 Curies, while the weapon's radioactivity will have fallen to less than 50,000 Curies.)

The authors continue: "For the fission products in the core to produce significant additional casualties, they must first be moved from the area of immediate weapons effects and then deposited in concentrations that produce dangerous radiation levels. .....As will be shown in the experimental portion of this work, this will occur when a nuclear weapon is detonated close enough to the reactor that the impulse per unit area delivered to the containment wall is greater than 100 to 200 psi-sec." (Fig. 3 shows psi-sec impact vs detonation distance and weapon yield.)

A 100 KT weapon detonated less than 200 ft from the reactor ....will provide this impulse. In this case the reactor pressure vessel is broken open, and the fragmented core is ejected from the ruptured pressure vessel and entrained in the stem of the cloud. Fission product release could be significant while the core fragments are in the stem, and essentially all of the reactor fission products could be added to the weapon fallout. If this third case were logistically and economically obtainable to the weapon targeteer, a PWR Pressurized Water Reactor would make an attractive target." (Emphasis mine.)

Now let us turn to fig. 2 of a subsequent article by the same authors. (March 1974, p. 191, same magazine.) Here we have a drawing which compares the residual activity from a 1 Megaton weapon with that of a 2700 MW th (equivalent to a 1000 MWe) breeder reactor. Careful comparison will show that the amount and rate of decay for the radioactive contents of the two different types of reactor are very nearly equal. They also show that at 25 years the remnant radioactivity of the reactor vastly exceeds that of a 1 Megaton weapon - the basis of my earlier statement that after 25 years the remnant radioactivity from a blown up 1000 MWe nuclear power plant will exceed that of the whole series of weapon tests at Bikini Atoll.

How much land area will be affected? Let us turn next to fig. 4 of the later article. Assume that instead of a 1 Megaton weapon, a very accurate 20 Kiloton weapon has been used to blow up the reactor, so that the major effect is from the reactor rather than the weapon. If you were standing in the open on the line marked 2700 MW th Reactor Only, for a period from one hour to one month after the explosion you would receive a dose of 400 Roentgen, which would make you very sick indeed. But of course you aren't going to be standing out in the open all that time if you can help it; neverthelesss it seems fair to say that you will find it difficult to avoid picking up a good deal more radiation than is healthy for you by the end of that first month, and by the end of the year you could be exhibiting some of the Hiroshima symptoms. There are areas inside this line where you would receive far higher dosages.

Ah, but perhaps that 8 billion Curies of radioactivity in the core won't be distributed nearly as widely as indicated in fig. 4 . While not disputing the probability that a small nuclear weapon detonated on the wall of a core containment building will be sufficient to smash the reactor vessel and release its contents, Mr. James L. Liverman, then Director of the Division of Biomedicine & Environment at ERDA, in a Sept. 1975 letter states: "Analyses to date indicate that if a nuclear weapon explodes on the containment building of a light water reactor (LWR), the core will be exposed and crushed (although for intermediate sized weapons not vaporized), and mixed with other crater debris. For low-yield weapon explosions, the reactor core would remain in fairly large pieces and will not be distributed as widely as the radioactive fallout from the weapon itself."

So perhaps the enemy targeteer cannot, after all, count on his weapon spreading some 8 billion Curies from a nuclear reactor core over several thousand square miles, as indicated in fig. 4 . Perhaps most of it will fall within a few miles, or even within a few hundred feet of the reactor crater, where it can be cordoned off for a century or two. Unfortunately, the targeteer has an option - the spent fuel holding pond, where some 1 billion Curies of the longer lasting radioactive fission products from some 10 years or so of reactor operation sit in a pool of water, far less heavily protected than is the reactor core. The relative lack of cover should make it a good deal more likly that the spent fuel rods can be vaporized, entrained in the stem of the mushroom cloud, and thence widely distributed.

Thus by aiming at the spent fuel holding pond of a twin reactor installation the targeteer can hope to hit the jackpot: (1) Vaporize the spent cores in the holding pond, thereby insuring their widespread dispersal, (2) Crush the reactor cores in the reactor buildings to either side and possibly add their radioactive burden to that of the spent fuel holding pond as it spreads out over the surrounding region downwind, (3) Thereby render several thousand square miles unfit for extended human habitation for a generation or more, and, at the minimum, (4) Wipe out 2,000 MWe of generating capacity and $2 to $4 billion dollars of capital plant, all for the price of a $2 million dollar weapon.

But cheer up! We now have a report from the National Radiobiological Protection Board of Great Britain titled "Some Aspects of the Safety of Nuclear Installations in Great Britain" as reported in New Scientist, 22 Sept. 1977, p. 717. The Board reports that an "extreme" accident in a fast breeder nuclear reactor could be as serious as the toll of cigarette smoking! The report states that "If 10% of the reactor's core were released from a reactor on a semi-urban site, there would be 56,000 extra deaths from cancer in an area up to 150 miles from the plant, over a 30 year period. For comparison, there would be 280,000 deaths from cancer in the same population over the same time from 'natural' causes." Of course if 100% of the reactor's core were released things would be a little more serious, and if the equivalent of 200% of the reactor's core were released in the evaporation of a spent fuel holding pond by a nuclear weapon, I imagine not even the NRPB would take the situation calmly.

Sleep tight tonight, and hope the Good Fairies will look after you. The NRC and your friendly local utility seem to be looking the other way.

If you want to do something about this situation, I suggest clipping out this article and sending it to your Congressman. Ask him if he thinks it is more important to avoid a 6% to 30% increase in the costs of nuclear power plants to underground them, than to protect you against the possible consequences, as described in this article, of the destruction of an above ground plant by a nuclear tipped cruise missile.

Point out that at least part of the added cost for undergrounding would be recovered from reduced costs of decommissioning the plant after its useful life is over. Point out that out of sight is out of mind for much of the anti-nuclear power crowd. Point out that no one denies an underground plant would be far more resistant to an enemy attack.

Now that you are aware of the stakes, what kind of nuclear power plant do you want for a neighbor, up or down? It's up to you.

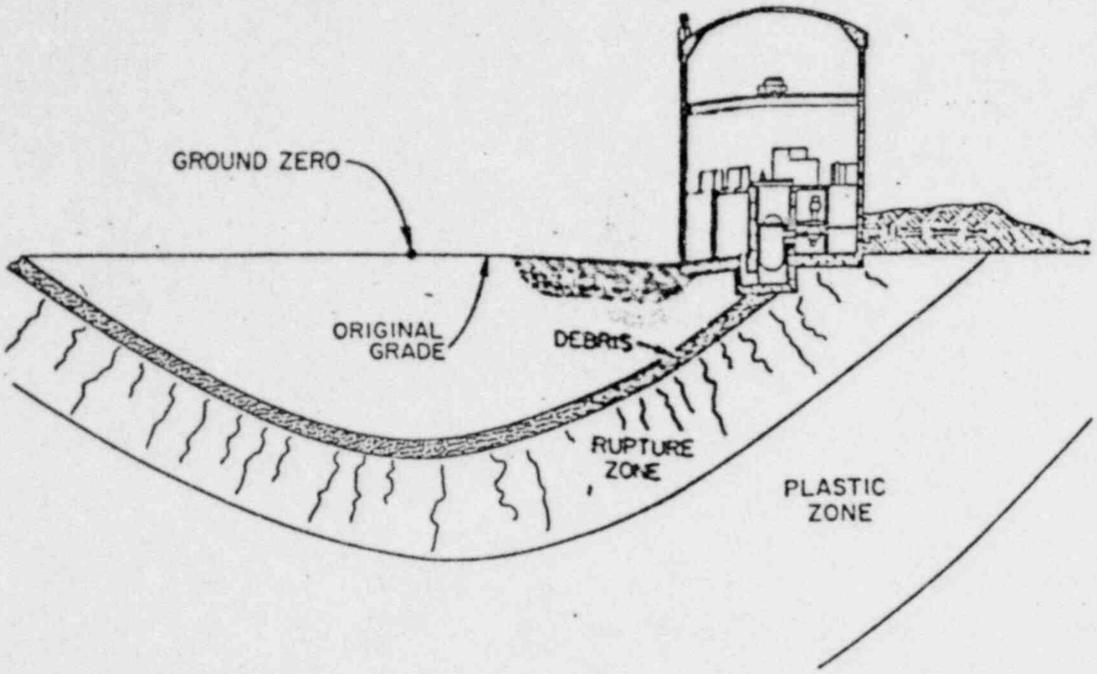

Fig. 9. Crater outline of a 100-kT nuclear weapon detonated 220 ft from the reactor containment wall.

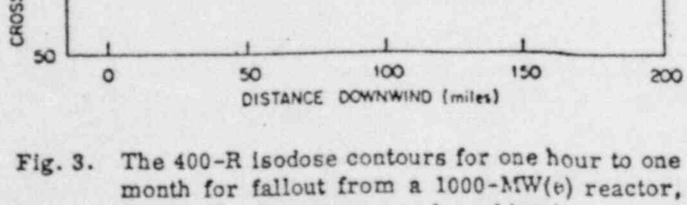

Fig. 3. The 400-R isodose contours for one hour to one month for fallout from a 1000-MW(e) reactor, 1-Mton fission weapon, and combination.

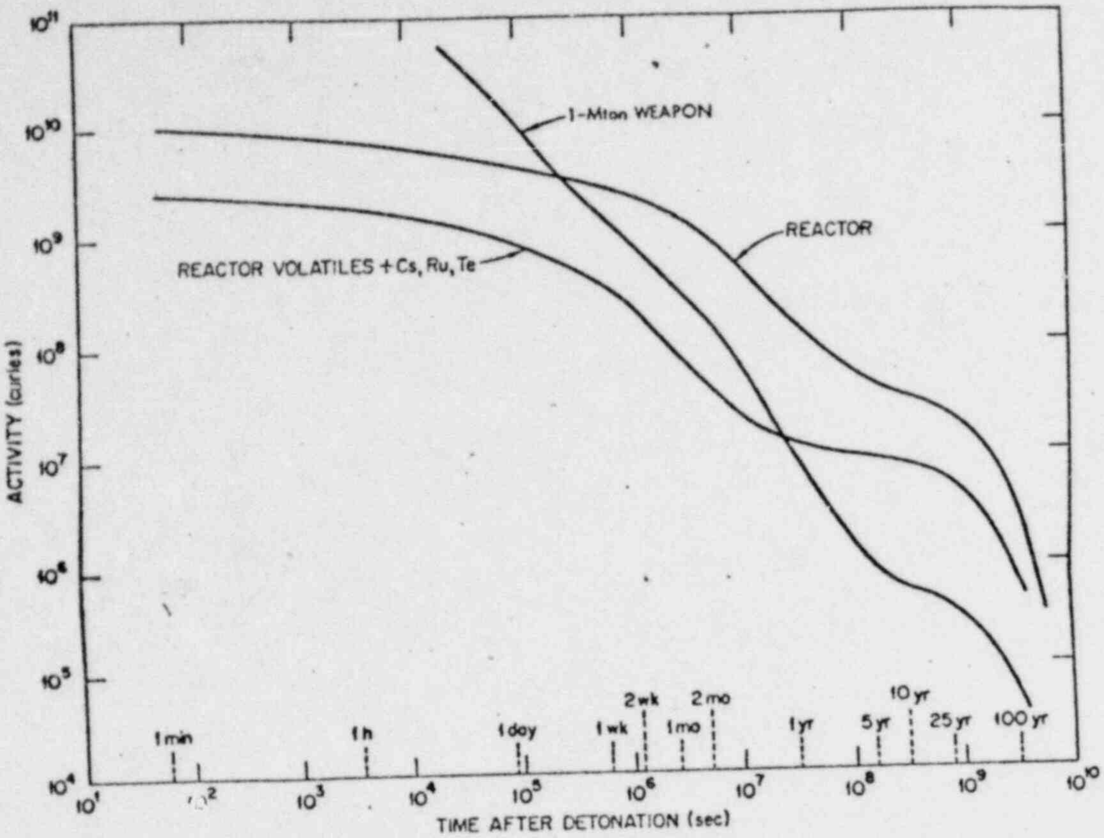

Fig. 1. Residual activity from a 1000-MW(e) fast reactor and a 1-Mton weapon versus time.

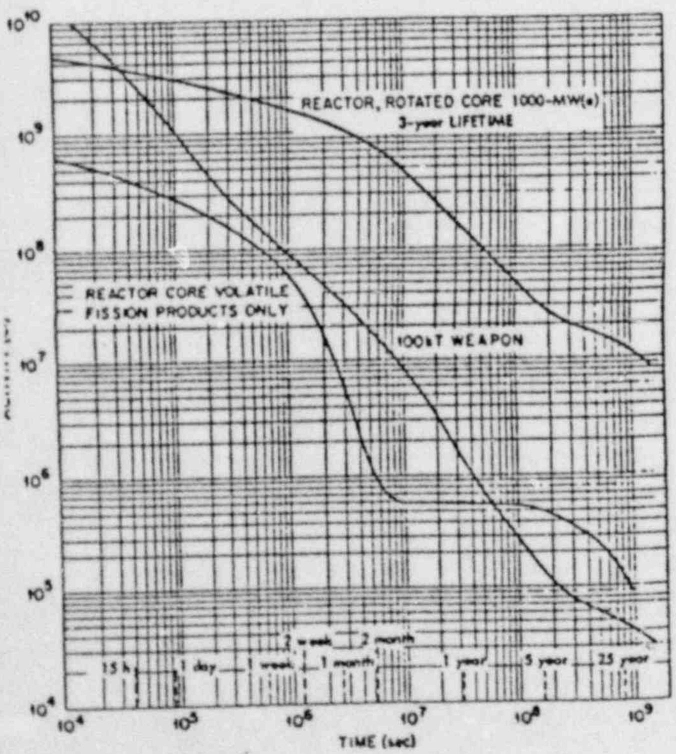

Fig. 1. Residual activity from a 1000-MW(e) reactor and a 100-kT weapon vs time after weapon detonation or reactor shutdown.

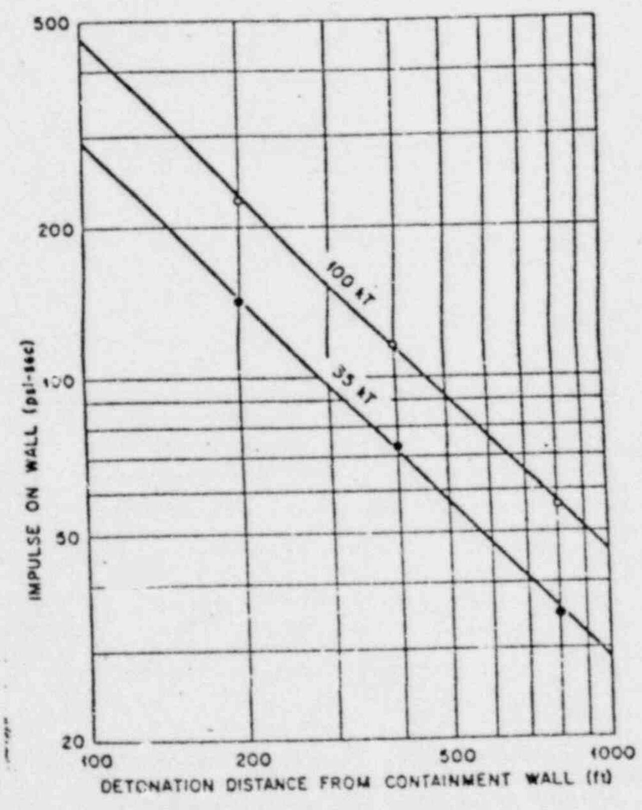

Fig. 7. Impulse delivered to containment wall vs detonation distance from the wall.

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