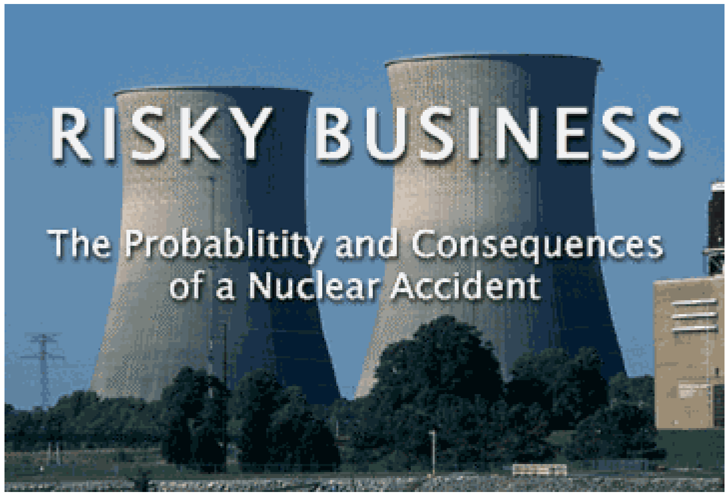

by Jim Riccio

GREENPEACE

Introduction

The 103 operating nuclear reactors in the U.S. have always posed the risk of a catastrophic accident that could cost thousands of lives and billions of dollars. The American public has, over time, become inured to this risk. After the tragedy of September 11th, Greenpeace felt that it was important to re-examine the consequences of a nuclear accident. And to question why the Bush/Cheney energy plan would continue to support an electricity source that also constitutes a national security threat.

This report will not discuss the many vulnerabilities of nuclear power plants. Suffice it to say that you don't even need to be on the reactor site to cause a nuclear accident. Rather this report will address the threat posed by each of these reactors and the long-lived radioactive wastes they produce. We will discuss the risk of a nuclear accident: both the probability of such an accident and its consequences.

Nuclear industry propagandists are already busy denouncing anyone who would speak of the threat posed by their nuclear reactors. The Nuclear Regulatory Commission has shut down its web site, virtually eliminating all information concerning the performance and regulation of the nuclear industry. We at Greenpeace believe that the public has a right to know of the risks posed by the nuclear power. We believe that an informed citizenry will be better able to make decisions concerning the important choices that face our nation as we plan to meet our energy needs in the new century.

Earlier this year, Vice President Cheney told CNN, that the administration's energy policy will give nuclear power "a fresh look." As the Bush/Cheney Administration attempts to extend the licenses of nuclear reactors and subsidize the construction of new reactors, the public deserves a frank discussion of the risk posed by this most unforgiving technology. This report provides a starting point for that discussion based upon the government's own findings of the consequences of a nuclear reactor accident.

As James Madison noted,

> "A popular Government, without popular information, or the means of acquiring it, is but a prologue to a farce or a tragedy."[1]

Regrettably, the NRC's regulation of the nuclear industry is already a farce. Greenpeace hopes that by providing this information to the public and the media we can accelerate the phase out of nuclear reactors and avoid a tragedy.

The New Reality

As the events of September 11th tragically demonstrated, the risk of a nuclear reactor meltdown must encompass not only the potential for an accident but also the possibility of sabotage. The U.S. government has known since at least the mid- 1990's that terrorists were targeting nuclear power plants. According to the Associated Press:

> Ramzi Yousef, the convicted mastermind of the 1993 World Trade Center bombing, encouraged followers in 1994 to strike such a plant, officials say. An FBI agent has testified in court that one of Yousef's followers told him in 1995 of plans to blow up a nuclear plant. And in 1999 the NRC acknowledged to Congress that it had received a credible threat of a terrorist attack against a nuclear power facility.[2]

Prior to September 11th and despite the known threat, the U.S. Nuclear Regulatory Commission (NRC) staff repeatedly attempted to kill the government's program for testing security at nuclear reactors.[3] These attempts were in spite of an abysmal security record in which 47% of the reactors tested had significant security weaknesses and in over 40 exercises mock terrorists were able to simulate sabotaging safety equipment.[4] Rather than addressing the nuclear industry's inability to protect itself from mock terrorists, the NRC has moved to allow the nuclear industry to test itself.

Risk and the Nuclear Industry

Each nuclear reactor has the potential to devastate the region in which it operates. The potential for such devastation lies in the radioactive fuel that fires the nuclear power plant. The radioactive fuel rods, whether inside the reactor or in the spent fuel pool, must be cooled to prevent them from melting down. If a meltdown were to occur in either the reactor or the spent fuel pool, the accident could kill and injure tens of thousands of people, cost billions of dollars in damages and leave large regions uninhabitable.[5]

The threat of such an accident has long been the subject of debate among government regulators, the nuclear industry and a skeptical public. Not surprisingly, the nuclear industry and those that purport to regulate it have down played the potential of such an accident. However, if the nuclear industry is so confident in the "safety" of its reactors and the long-lived radioactive wastes that they produce, why must the American taxpayer indemnify the industry against the financial consequences of nuclear accident through the Price Anderson Act?[6]

In reality, nuclear power is an inherently dangerous activity. Splitting atoms is the most complicated and dangerous way to produce electricity. Until recently, we have spoken of the threat posed by a nuclear reactor in terms of the risk of an accident. A basic definition of risk is:

Risk = Probability x Consequences

The "risk" is the risk of a catastrophic accident. "Probability" is the likelihood of an event happening. "Consequences" are the effect that event has on people, property and the environment. According to the government's own studies, the consequences of an accident at one of the 103 nuclear reactors throughout the U.S. would be devastating. Even before the events of September 11th, the magnitude of the risk posed by nuclear power plants was so great that the federal government should have phased out nuclear power in the United States. The incalculable threat of sabotage makes the continued operation of these reactors unacceptable. Nuclear power now constitutes a national security threat.

Consequences of an Accident at a U.S. Nuclear Plant

On November 1, 1982, The Washington Post reported on a study of the consequences of a nuclear reactor accident. The Sandia National Laboratory prepared the study for the U.S. Nuclear Regulatory Commission sometime in 1981 entitled Calculation of Reactor Accident Consequences for U.S. Nuclear Power Plants (CRAC-2). This was not the first time that the government had looked at the consequences of a nuclear reactor accident, however, it was the last. Therefore, the Sandia work represents the best available estimates of the consequences of a nuclear reactor accident.

It appears the NRC never intended to release the most damning information that resulted from the Sandia study. The report itself only included the average consequences. However, when the Union of Concerned Scientists' (UCS) Freedom of Information Act requests seeking the report were stalled at the NRC, UCS sought the help the House Subcommittee on Oversight and Investigation. The subcommittee staff requested the report and again the NRC stalled. Finally, Edward Markey (D-MA), then Chairman of House Subcommittee on Oversight and Investigation, formally requested the documents from the NRC Chairman. A midst the reams of paper that made up the CRAC-2 computer printout were included not only the average consequences of a nuclear reactor accident but also the maximum results calculated by the computer model. The subcommittee staff analyzed the CRAC-2 printouts and the results of the "peak" consequences studied by the Sandia National Laboratory later appeared in the Washington Post.[7]

Explanation of Consequences in Crac-2

In the data released by the House Subcommittee on Oversight and Investigation, the consequences of severe nuclear accident are broken down into four categories:

1. Peak Early Fatalities
2. Peak Early Injuries
3. Peak Cancer Deaths
4. Scaled Costs

"Peak" refers to the highest calculated values from the CRAC-2 computer printouts for the Sandia study. However, peak does not mean the worst case scenario. This is due to the uncertainties in the meteorological modeling that have been acknowledged by the authors of the Sandia report. The CRAC2 model only considered one year's worth of data and does not model for precipitation beyond a thirty-mile radius from the reactor. According to the documents released by the Subcommittee, "(t)his is significant for peak consequences since the highest consequences from accidents are predicted to occur when a radioactive plume encounters rain over a relatively densely populated area."[8]

Peak Early Fatalities

Early Fatalities are deaths that result from radiation exposure occurring within the first year.9

	Reactor	**Owner**	**Location**	**Fatalities**
1	Salem 1 & 2	PSEG Nuclear	18 miles S of Wilmington, DE	100,000
2	Waterford 3	Entergy	21 miles W of New Orleans, LA	96,000
3	Limerick 1 & 2	Exelon	21 miles NW of Philadelphia, PA	74,000
4	Peach Bottom 2 & 3	Exelon	18 miles S of Lancaster, PA	72,000
5	Susquehanna 1 & 2	PP&L	7 miles NE of Berwick, PA	67,000
6	Indian Point 2 & 3	Entergy	24 miles N of New York, NY	50,000/46,000
7	Catawba 1 & 2	Duke Power	6 miles NNW of Rock Hill, NC	42,000
8	Three Mile Island 1	AmerGen	10 miles SE of Harrisburg, PA	42,000
9	Dresden 2 & 3	Exelon	9 miles E of Morris , IL	42,000

10	Surry 1 & 2	Dominion	17 miles NW of Newport News, VA	31,000
11	Turkey Point 3 & 4	Florida P&L	25 miles S of Miami, FL	29,000
12	Sequoyah 1 & 2	TVA	10 miles NE of Chattanooga, TN	29,000

Peak Early Injuries

Early injuries are radiation-related injuries occurring within one year of the accident, which require hospitalization or other medical attention. Early injuries include conditions such as sterility, thyroid nodules, vomiting and cataracts.[10]

	Reactor	Owner	Location	Fatalities
1	Limerick 1 & 2	Exelon	21 miles NW of Philadelphia, PA	610,000
2	Fermi 2	Detroit Edison	25 miles NE of Toledo, OH	340,000
3	Waterford 3	Entergy	21 miles W of New Orleans, LA	279,000
4	Perry 1	First Energy	7 miles NE of Painesville, OH	180,000
5	Indian Point 2 & 3	Entergy	24 miles N of New York, NY	156,000/141,000
6	Beaver Valley 1 & 2	First Energy	17 miles W of McCandless, PA	156,000
7	Catawba 1 & 2	Duke Power	6 miles NNW of Rock Hill, NC	88,000
8	D.C. Cook 1 & 2	AEP	11 miles S of Benton Harbor, MI	80,000/88,000
9	Byron 1 & 2	Exelon	17 miles SW of Rockford, IL	79,000
10	Salem 1 & 2	PSEG Nuclear	18 miles S of Wilmington, DE	75,000/70,000
11	Davis-Besse	First Energy	21 miles ESE of Toledo, OH	73,000
12	Summer	SCE&G	25 miles NW of Columbia, SC	73,000

Peak Cancer Deaths

Peak cancer deaths are predicted to occur over the lifetime of the population exposed to the radioactive release. This however, is not the case with leukemia, which is assumed to have occurred within the first 30 years following the accident.[11]

	Reactor	Owner	Location	Deaths
1	Salem 1 & 2	PSEG Nuclear	18 mi S of Wilmington, DE	40,000
2	Millstone 3 & 2	Dominion	3 mi SW of New London, CT	38,000/33,000
3	Peach Bottom 2 & 3	Exelon	18 mi S of Lancaster, PA	37,000
4	Limerick 1 & 2	Exelon	21 mi NW of Philadelphia, PA	34,000
5	North Anna 1 & 2	Dominion	40 mi NW of Richmond, VA	29,000
6	Susquehanna 1 & 2	PP&L	7 mi NE of Berwick, PA	28,000
7	Three Mile Island 1	AmerGen	10 mi SE of Harrisburg, PA	26,000
8	McGuire 1 & 2	Duke	17 mi N of Charlotte, NC	26,000
9	Beaver Valley 1 & 2	First Energy	17 mi W of McCandless, PA	24,000
10	Pilgrim 1	Entergy	4 mi SE of Plymouth , MA	23,000
11	Oyster Creek	AmerGen	9 miles S of Toms River, NJ	23,000
12	Calvert Cliffs 1 & 2	Constellation	40 miles S of Annapolis, MD	23,000

Scaled Costs

Scaled costs include estimates of lost wages, relocation expenses, decontamination costs, lost property and the cost of interdiction for property and farmland. "Scaled" means that the costs have been adjusted for the size of the reactor. Costs which are not calculated in the CRAC2 figures include the costs of providing health care to the affected population, all on site cost, litigation costs, direct costs of health effects and indirect costs. The Subcommittee on Oversight and Investigation noted that a separate report on accident consequences was prepared for the NRC by the Bureau of Economic Analysis, U.S. Department of Commerce and determined that the indirect cost not included in the CRAC2 calculations could be substantial.[12]

	Reactor	**Owner**	**Location**	**Cost in Billions***
1	Indian Point 2 & 3	Entergy	24 miles N of New York, NY	314/274
2	Limerick 1 & 2	Exelon	21 miles NW of Philadelphia, PA	213/197
3	San Onofre 2 & 3	SCE	4 miles SE of San Clemente, CA	186/182
4	Millstone 3 & 2	Dominion	3 miles SSW of New London, CT	174/135
5	Seabrook 1	North Atlantic	13 miles S of Portsmouth, NH	164
6	Diablo Canyon 1 & 2	PG&E	12 miles SSW of San Luis Obispo	158/155
7	Salem 2 & 1	PSEG Nuclear	18 miles S of Wilmington, DE	150/135
8	Susquehanna 1 & 2	PP&L	7 miles NE of Berwick, PA	143/137
9	Fermi 2	Detroit Edison	25 miles NE of Toledo, OH	136
10	Nine Mile Point 2	Constellation	6 miles NE of Oswego, NY	134
11	Waterford 3	Entergy	21 miles W of New Orleans, LA	131
12	Braidwood 1 & 2	Exelon	24 miles SSW of Joliet, IL	127/122

(*1980 dollars)

Had the NRC not stalled the Union of Concerned Scientists' attempts to secure a copy of the CRAC-2 report and had Congressman Markey not intervened, these peak consequences would, in all likelihood, never have been reported. As noted earlier, the Sandia report only included average not peak consequences. However, even the average consequences of a nuclear accident are staggering. When the U.S. General Accounting Office (GAO) reported on the financial consequences of a nuclear power plant accident in 1986, they drew upon the Sandia study. The GAO found that the average financial consequences of an accident at the Indian Point nuclear plant could still reach $15.3 billion and that adverse whether conditions could increase the cost ten fold.[13]

Nuclear Power Plant Maps

We have provided maps for those reactors with the greatest peak early fatalities. (See maps in appendices to report.)

The first ring is the ten-mile Emergency Planning Zone (EPZ). As a result of the meltdown at Three Mile Island, each utility that owns a commercial nuclear power plant in the United States was required to have both an onsite and offsite emergency response plan as a condition of obtaining and maintaining a license to operate that plant. The Nuclear Regulatory Commission (NRC) approves Onsite emergency response plans. Offsite plans are evaluated by the Federal Emergency Management Agency (FEMA) and provided to the NRC, who must consider the FEMA findings when issuing or maintaining a license. Federal law establishes the criterion for determining the adequacy of offsite planning and preparedness. Basically, emergency plans and preparedness must be determined to adequately protect the public health and safety by providing "reasonable assurance that appropriate measures can be taken offsite in the event of a radiological emergency."[14]

The second ring represents the zone for peak fatalities. This radius is the largest calculated distance from the plant at which early fatalities are expected to occur. This distance is different for each nuclear plant.[15]

The third ring represents the zone for peak early injuries. This radius is the largest calculated distance from the plant at which early fatalities are expected to occur. Again, this distance is different for each nuclear plant.[16]

Greenpeace has provided these maps so that the public and the press will have an accurate representation of the regions placed at risk by the continued operation of nuclear reactors in the U.S.

NRC Downplays Probability

After the Washington Post had run the story and Sandia had released the final version of the CRAC-2 report, the Union of Concerned Scientists reviewed the data and discovered that the NRC had attempted to down play the most damaging results. The regulators used the lowest probability figures for largest radioactive releases studied. The NRC used a probability per reactor year of one in 100,000. However, according to UCS' research the probability for some reactors was as high as 1 in 8,333 per reactor year.[17] As the Union of Concerned Scientists pointed out:

> Significantly, these probability figures do not include any consideration of sabotage or "external events" (such as earthquakes, hurricanes, tornadoes and aircraft crashes) as possible accident causes, nor do they adequately treat human error. **Thus these figures must be considered optimistic**. The NRC staff, however … treated the 1 in 100,000 figure as though it were engraved in stone.[18]

The consequences in the CRAC-2 computer printouts are projected to occur from a core melt accident in which all installed safety equipment fails and the reactor containment is breached directly to the atmosphere.[19] This scenario is not unthinkable when you realize that none of the containment structures at U.S. reactors were designed to withstand a core melt accident.[20] Furthermore, the pressure suppression containment systems incorporated into many General Electric and Westinghouse designed reactors are virtually certain to fail in the event of a melt down.[21]

Containment or the Lack There Of

As early as 1971, government regulators knew that the public's last line of defense against the radiation, the reactor containment, was worthless yet licensed the General Electric (GE) reactors anyway. When staff members suggested that this type of containment be banned, the Commission's deputy director for technical review responded that it "**could well be the end of nuclear power. It would throw into**

question the continued operation of licensed plants, could make un-licensable the GE and Westinghouse ice condenser plants now in review and would generally create more turmoil than I can think about."[22]

In 1986 Harold Denton, former director of NRC's Office of Nuclear Reactor Regulation, acknowledged this vulnerability while speaking to utilities executives at Brookhaven National Laboratory. Denton noted that, according to NRC studies the GE Mark I reactors had "something like a 90% probability of that containment failing."[23] However, it's not only the GE and Westinghouse designs that are more sieve than shield. In a version of the Nuclear Regulatory Commission's 1987 Reactor Risk Reference Document released for public comment, the agency again acknowledged the inability of the containment to protect the public during a meltdown. The draft report contained this disturbing admission**,"(i)n general, these data indicate that early containment failure cannot be ruled out with high confidence for any of the plants**."[24] This sentence was deleted from the final version of the report however later studies contained this admission, **"(a)ll five major reactor containment types were found to be subject to failure in such accidents, for which they were not designed**." [25]

Faulty Safety Equipment Shuts Down Nuclear Plants

Since the containment structures on U.S. reactors are incapable of protecting the public in the event of a meltdown, the public must rely on safety systems to prevent a meltdown in the first place. However, it is not unimaginable that safety equipment at U.S. reactors would fail. In fact, the failure of safety systems to perform their function has contributed to the shutdown of several nuclear reactors since the mid 1990s including: Big Rock Point, Maine Yankee, Millstone 1 and Haddam Neck.

Maine Yankee

In December 1995, in response to whistleblower allegations at Maine Yankee, the NRC staff was compelled to audit the analyses used to demonstrate the adequacy of the emergency core cooling system. There are two purposes of the Emergency Core Cooling Systems (ECCS). The first is to provide cooling to the reactor core to prevent a meltdown following a loss of coolant accident or LOCA. This is accomplished by the injection of large amounts of borated water into the reactor coolant system. The borated water helps to quell the chain reaction in the reactor's core. The second purpose of the ECCS is to ensure the reactor remains shut down. This is accomplished by the use of the same borated water source.[26] The staff concluded Maine Yankee's analysis was unreliable.[27]

Based upon further investigations into design deficiencies, Maine Yankee identified cable separation problems that could have resulted in the inability of the reactor operators to manually shut down the reactor. The reactor was taken offline to address these issues. Once the reactor shut down, the NRC prohibited its restart until the cable separation problems had been addressed. The NRC noted that "the proper separation of cables is important in nuclear power plants to ensure that if one or more set of cables is damaged, the plant will be able to achieve a safe shutdown."[28] After the utility's attempts to sell the reactor, either whole or in parts, failed to find a buyer Maine Yankee moved to decommission the nuclear reactor.

Millstone & Haddam Neck

On March 4, 1996, the Millstone nuclear power plant in Connecticut graced the cover of Time magazine. In a special investigation, Time detailed how "two gutsy engineers in Connecticut have caught the Nuclear Regulatory Commission at a dangerous game it has played for years: routinely waiving safety rules to let plant keep costs down and stay on line."[29] The Time magazine cover story forced the NRC to shutdown Millstone 1 and every other reactor in the state of Connecticut. Due to the bad publicity the NRC was compelled to investigate whether similar problems existed at other reactors operated by Northeast Utilities.

The subsequent investigations found that Haddam Neck's emergency core cooling system (ECCS) would have been unable to perform its function of cooling the reactor core in the event of an accident.

In other words, if Haddam Neck had experienced a loss of coolant accident the nuclear reactor would likely have had a meltdown. Equally disturbing is the fact that this problem existed since the plant was licensed. For 28 years, Northeast Utilities operated a nuclear reactor with an ECCS that would not have cooled the reactor core in the event of an accident. Subsequent NRC inspections revealed that:

> Inspectors also found that safety margins were reduced, and in some cases technical specifications were violated a result of poor engineering. For example, too small pipes leading from the containment sump system to the residual heat removal pump left insufficient suction to support pump operation without relying on containment building backpressure. **This violation is significant because it could have caused a failure of the system needed to keep the reactor core cool in the event of an accident**.[30]

On July 22, 1996, operators were forced to shut down the Haddam Neck reactor due to concerns over the operability of safety systems. On December 4, 1996, NU announced its decision to permanently shut down Haddam Neck. Despite the idling of every reactor in the state of Connecticut, and the permanent closure of two of the four reactors in the state, the lights remained on.

Big Rock Point

In 1997, the Big Rock Point nuclear plant in Michigan “discovered” that the reactor had operated for thirteen years without a major safety system. The piping that was supposed to supply borated water to the reactor core in the event of an emergency had been completely severed. Without this safety system, operators would have been unable to shut down the reactor in the event of an accident. The borated water was the only backup system for shutting down the reactor core. If the primary system failed, the backup system would have been unable to stop the chain reaction.[31] The Big Rock Point nuclear plant permanently ceased operation in August 1997, the public was only informed of the flawed safety system after the shutdown.

The problems that shutdown Maine Yankee, Millstone 1, Haddam Neck and Big Rock Point are not isolated instances. Over the past several years, the NRC and nuclear plant owners have reported several hundred instances where safety equipment was discovered to be faulty.[32] In 1997, a report from the NRC’s Office for Analysis and Evaluation of Operational Data (AEOD), reviewed design errors that had been reported by nuclear reactors from 1985 – 1995. The AEOD identified three instances where the probability of an accident that damaged the reactor core was unacceptably high. The AEOD reported two events where the probability of damaging the core was 1 in 1000 and one event with a core damage probability of 1 in 100. All three of these events are exponentially more dangerous than NRC standards allow.[33]

The Probability of a Nuclear Accident

The nuclear industry and the Nuclear Regulatory Commission (NRC) have always maintained that the probability of an accident was low. Even if we were to take the nuclear industry or the NRC at its word, the risk of a meltdown would still be great because the consequences of such an event are potentially so devastating. However, neither the nuclear industry nor the NRC has been very good at estimating the probability of an accident.

On March 9, 1979, the NRC staff produced a memo for then Commissioner Peter Bradford entitled, "Probabilities That The Next Major Accident Occurs Within Prescribed Intervals." The memorandum states that:

a) The probability is less than .5 that the next (i.e., the first) major accident occurs within the next 400 reactor years.

b) The probability is less than .05 that the next major accident occurs within the next 21 reactor years.

c) The probability is larger than .5 that the next major accident occurs after the next 400 reactor years. This is equivalent to statement (a).[34]

(Note: one nuclear reactor operating for one year equals a reactor year.)

Less than three weeks later, the unit 2 reactor at Three Mile Island suffered a meltdown of the radioactive fuel in the reactor core.

The Nuclear Regulatory Commission ignores the fact that meltdowns have occurred at U.S. nuclear reactors. The NRC's latest risk assessments don't even account for the meltdown at Three Mile Island or the earlier meltdowns at Fermi-1 and other test reactors. The U.S. nuclear reactors that have experienced partial core melt accidents include:

EBR-1 (Experimental Breeder Reactor)	11/29/55	Idaho Falls, ID
WTR (Westinghouse Testing Reactor)	04/03/60	Waltz Mill, PA
SL-1 (Stationary Low Power Reactor)	01/03/61	Idaho Falls, ID
Fermi-1	10/05/66	Lagoona Beach, MI
Three Mile Island	03/28/79	Harrisburg, PA[35]

Even if you exclude the core-melt accidents at the test reactors, the U.S. commercial nuclear industry has melted down two nuclear reactors in less than 3000 reactor years. This reality makes nuclear power anything but "safe." However, it wasn't until after the Chernobyl disaster that the Nuclear Regulatory Commission acknowledged the risk posed by nuclear reactors in the U.S.

In the wake of the 1986 accident at Chernobyl, the U.S. Nuclear Regulatory Commission was asked to testify before Congress concerning the potential for severe accident in the U.S. According to NRC Commissioner James K. Asselstine:

> …given the present level of safety being achieved by the operating nuclear power plants in this country, we can expect to see a core meltdown accident with in the next 20 years…[36]

The U.S. nuclear industry was quick to point out that you can't have a "Chernobyl" here. Public pronouncements by nuclear industry officials included assertions that Soviet technology was so different from U.S. commercial reactors that the causes and consequences of the Chernobyl accident had little relevance.[37] The American Nuclear Society's fact sheet on nuclear energy stated that, “Because of major differences in technology, a Chernobyl-type accident can not occur in a light water reactor such as those in the U.S. A reactor similar to the Chernobyl design could not be licensed in the U.S. either now or before the accident.”[38]

Unfortunately, the nuclear industry was merely playing with words. Their protestations rely on the fact that there are no reactors of Chernobyl’s design operating here in the United States, but that’s not the point. The reality is that a nuclear accident can occur at a U.S. nuclear power plant that would have off-site releases of radiation comparable to that of Chernobyl. Again in testimony before Congress in 1986, NRC Commissioner James Asselstine stated that:

> While we hope that their occurrence is unlikely, there are accident sequences for U.S. plants that can lead to rupture or bypassing of containment in U.S. reactors which would result in the off-site release of fission products comparable or worse than the releases estimated by the NRC staff to have taken place during the Chernobyl accident.
>
> **That is why the Commission told Congress recently that it could not rule out a commercial nuclear power plant accident in the United States resulting in tens of billions of dollars of property losses and injuries to the public**.[39]

In 1990, the Nuclear Regulatory Commission was again asked the probability of a severe core melt accident at a U.S. nuclear reactor. However, the NRC refused to provide the National Academy of Science’s National Research Council with the number they were seeking. In the Nuclear Regulatory Commission’s response to the National Research Council, the agency stated that it “would strongly encourage your committee not to use any number based on assuming an average severe core damage frequency….” Rather, the NRC suggested that the National Research Council state that “there is reasonable assurance that the health and safety of the public are adequately protected.”[40]

At least on member of the NRC’s Advisory Committee on Reactor Safeguards (ACRS), doesn’t hold the same overly optimistic view espoused by the Commission. Hal Lewis, a former member of the NRC’s Advisory Committee on Reactor Safeguards, critiqued the Commission’s position when the ACRS was addressing the renewal of nuclear reactor licenses, noting that:

> **the Commission certainly doesn't know that its current regulatory process provides adequate protection to the public**. It has declared that it does, and it's the operating definition, but the Commission has also promulgated safety goals and the commission doesn't know that the current licensing basis will meet the safety goals, although it believes it to be the case.[41]

The public should not be lulled into a false sense of security by the mere fact that the U.S. nuclear power industry has not melted down a reactor since Three Mile Island. Operating without a meltdown for a finite period of time does not mean that safety is adequate. Again, Mr. Lewis, of the NRC’s Advisory Committee on Reactor Safeguards, recognized this fallacy. Mr. Lewis stated that:

> The general argument that the fact that one has operated safely for a finite period of time proves that the safety level is adequate is just not statistically right, because there isn't that much history in the industry. And it's a trap. Because other agencies, for example, people have used the argument that they had 24 successful Shuttle flights, to show the level of safety was adequate. And in retrospect, after one disaster, it turned out not to be. The Soviets, after Chernobyl, suddenly discovered that the level of safety they had before Chernobyl was not adequate. But the day before Chernobyl they would have said it was adequate on the basis of operating history.

> So it is a general trap, a psychological trap, to believe that because something has not happened, you are doing just fine.[42]

The NRC and the nuclear industry have already fallen into the trap. The NRC and the NEI have already begun to deregulate nuclear safety regulations, including those dealing with the security of nuclear reactors, based upon the limited operating history of reactors in the U.S. The risk posed by nuclear power plants was significant before September 11th. When we take into consideration the terrorist threat to nuclear power plants their continued operation is unacceptable.

As NRC Commissioner Asselstine pointed out, U.S. nuclear reactors are capable of releasing enormous amounts of radiation into the environment. Since each reactor has the potential for a Chernobyl sized release of radiation, it is important to recognize the consequences of such an accident.

In 1990, the Wall Street Journal reported on a study conducted by a Soviet nuclear industry economist on the continuing economic disaster of the Chernobyl accident. The study found that the cost of the disaster had originally been underestimated. Yuri Koryakin, chief economist of the Research and Development Institute of Power Engineering, the institute that originally designed the Chernobyl reactor, found that the accident may cost 20 times more than Moscow's original estimates. By 2000, the report estimated that the Chernobyl accident would cost the country between 170 and 215 billion rubles from contaminated farm land, lost electricity production and other economic fall-out. The accident contaminated approximately 31,000 square kilometers or 12,400 square miles. When the Wall Street Journal article was published in 1990, the contaminated land was considered a total loss for at least two generations.[43]

The Wall Street Journal article concludes that, "**The total bill suggests that the Soviet Union may have been better off if they had never begun building nuclear reactors in the first place**."[44]

The Nuclear Energy Institute (NEI) attempt to down play the impact of the disaster. According to NEI:

> The accident destroyed the reactor in Unit 4, killed 31 people (one immediately and 30 within three months) and contaminated large areas of Belarus (formerly Byelorussia), Ukraine and the Russian Federation. In addition, one person has subsequently died from a confirmed diagnosis of acute radiation syndrome, and three children have died from thyroid cancer.[45]

The consequences of the accident are severely understated by NEI. According to an article published by the Associated Press the consequences of the Chernobyl disaster are "grimly visible."

> an estimated 4,000 deaths among those who took part in the hasty and poorly organized cleanup; 70,000 people disabled by radiation, according to government figures. Overall, about 3.4 million of Ukraine's 50 million people, including some 1.26 million children, are considered affected by Chernobyl, and many may not show the affects for years.[46]

The grim reality of the Chernobyl accident will be with the people of the former Soviet Union for generations.

Shutdown Before Meltdown

The United States can avoid the next nuclear accident by phasing out the remaining 103 commercial nuclear reactors. Rather than coddling the nuclear industry with more taxpayer subsidies and less regulation the federal government should replace nuclear reactors with energy efficiency and other clean, renewable sources of electricity.

A study conducted by the five national energy laboratories in November 2000 for the U.S. Department of Energy found that renewable energy could supply at least 7.5 percent of U.S. electricity by 2010.[47] Such an expansion in renewable technologies would allow for the phase-out of the most dangerous reactors in the U.S. When combined with increases in energy efficiency the potential to phase-out nuclear power is even greater.

According to the Union of Concerned Scientists' Clean Energy Blueprint, renewable energy could supply 20 percent of U.S. electricity by 2020.[48] Coupled with an increase in energy efficiency, this increase in renewable resources would produce enough electricity to supplant every nuclear reactor currently operating in the United States. [49]

Rather than extending the licenses of nuclear reactors and thereby extending the duration of the threat posed by these reactors, the Bush/Cheney energy plan should heed the advice of its own government laboratories and increase our nation's energy efficiency and use of renewable sources of electricity.

Conclusions

The 103 operating nuclear reactors in the U.S. present a clear and present danger to the states and regions in which they operate. Nuclear power plants have always presented a risk of a catastrophic accident. The risk is exacerbated by the threat of sabotage. While the risk of a melt down at an existing reactor is significant, the government figures actually underestimate the risk because none of their studies encompass the threat of a terrorist act.

Prior to September 11th, nuclear power posed such an unacceptable risk to the public heath and safety that it should have been phased out. Since the nuclear industry has proven itself incapable of defending nuclear reactors and the NRC has proven itself unwilling to regulate the industry, Greenpeace believes that it is time to phase out nuclear power in the United States. Those reactors that pose the greatest threat should be shut down first. The charts detailing the consequences of a catastrophic accident provide a list of those reactors.

Greenpeace has provided the public and the media with the government's own data on the probability and the peak consequences of a nuclear accident. We believe that the public has a right to know the threat posed by each of the nuclear power plants operating in their midst. Nuclear reactors are not merely an expensive and complicated way to boil water but also constitute a national security threat. As has been noted elsewhere, terrorists are not targeting windmills and solar panels.

Recommendations

Rather than attempting to protect a power source that threatens the very land, air and water we need to survive, we should phase out these atomic atrocities and replacing nuclear reactors with increased efficiency and other, renewable sources of electricity which do not threaten our families, homes and communities. The federal government should immediately take steps to reduce the risk posed by the nuclear industry. Greenpeace makes the following recommendations:

- The federal government should phase out nuclear power in the U.S. Those reactors that pose the greatest risk should be shut down first.

- The Nuclear Regulatory Commission should not extend the licenses of nuclear reactors and should rescind those licenses that have already been renewed.

- New construction of any nuclear reactors in the United States should be prohibited.

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