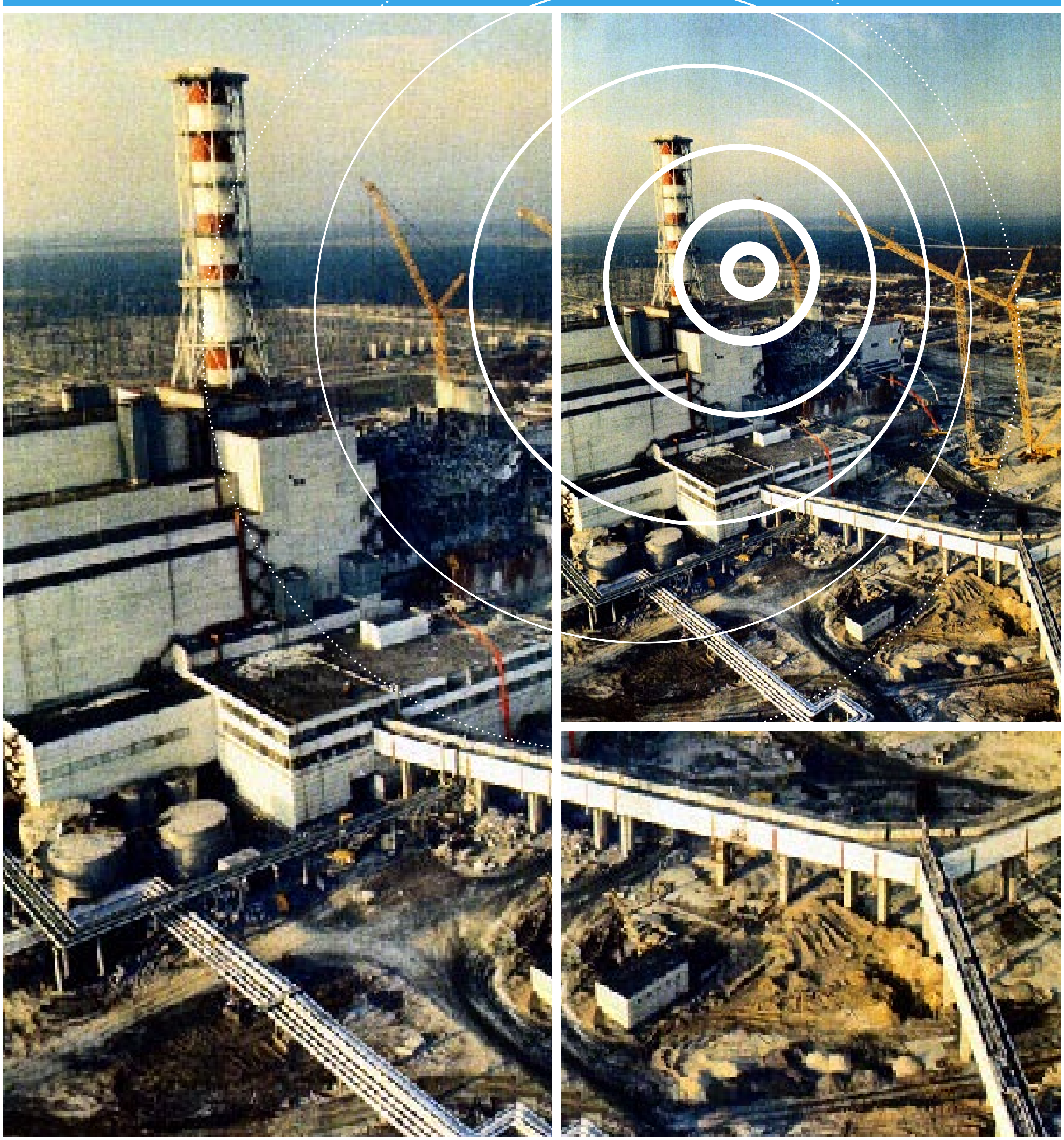
AN AMERICAN CHERNOBYL:
Nuclear "Near Misses" at U.S. Reactors Since 1986



Photograph Source: U.S. Department of Energy.

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+ Executive Summary

On the 20th anniversary of the Chernobyl disaster, the worst commercial nuclear power accident in history, Greenpeace has documented nearly 200 “near misses” at U.S. nuclear reactors since 1986.

Of the nearly 200 “near misses” to a meltdown cited in US Nuclear Regulatory Commission (NRC) documents, eight “near misses” are considered the most significant. This means that according to the NRC, the risk of a core meltdown is greater than one in 1,000. Only one of the eight reactors that experienced the most significant “near misses” was on the NRC’s regulatory radar prior to the problems occurring.

Significant “Near Misses” Since Chernobyl

DATE	REACTOR	DESCRIPTION	STATE	RISK	NRC RADAR
2/27/2002	Davis Besse	Vessel Head Degradation	OH	6.00 E-03	NO
4/3/1991	Shearon Harris	High Pressure Injection Unavailable	NC	6.00 E-03	NO
6/13/1986	Catawba 1	Small Break Loss of Coolant Accident	SC	3.00 E-03	NO
9/17/1994	Wolf Creek	Reactor Coolant System Blow Down	KS	3.00 E-03	NO
2/6/1996	Catawba 2	Loss of Offsite Power (LOOP)	SC	2.10 E-03	NO
12/271986	Turkey Point 3	Control Rods Failed to Insert	FL	1.00 E-03	YES
3/20/1990	Vogtle 1	Loss of Offsite Power during shutdown	GA	1.00 E-03	NO
3/20/1990	Vogtle 2	Loss of Offsite Power during shutdown	GA	1.00 E-03	NO

An additional 49 “near misses” occurred that are considered important accident precursors with a risk of meltdown greater than one chance in 10,000.

Important “Near Misses” Since Chernobyl

DATE	REACTOR	DESCRIPTION	RISK
1/22/1997	Maine Yankee	Reactor Coolant System Valves Inoperable.	8.20E-04
11/29/2001	Point Beach Unit 1	Potential Common Mode Failure of All Aux Feed Water Pumps	7.00E-04
11/29/2001	Point Beach Unit 2	Potential Common Mode Failure of All Aux Feed Water Pumps	7.00E-04
6/15/1991	Yankee Rowe	Loss of Offsite Power	6.10E-04
5/19/1996	Arkansas Nuclear 1	Reactor Trip And Subsequent Steam Generator Dry Out	5.60E-04
6/24/1998	Davis-Besse	Loss Of Offsite Power Due To Tornado	5.60E-04
7/23/1987	Calvert Cliffs 1	Loss Of Offsite Power Caused Tree Contact With Power Line.	4.80E-04
7/23/1987	Calvert Cliffs 2	Loss Of Offsite Power Caused Tree Contact With Power Line.	4.80E-04
10/22/1999	DC Cook 1	Potential High-Energy Line Break (HELB) Affects Safety Systems	4.50E-04
10/22/1999	DC Cook 2	Potential High-Energy Line Break (HELB) Affects Safety Systems	4.50E-04
7/14/1987	Palisades	Loss Of Offsite Power	4.30E-04
10/29/2002	Point Beach 2	Potential Failure Of All EFW Pumps	4.00E-04
11/2/1997	St. Lucie 1	Non-Conservative Recirculation Actuation Setpoint	3.40E-04
5/15/2000	Diablo Canyon 1	Reactor Trip And Loss Of Offsite Power	3.10E-04
2/24/1999	Oconee 1	Potential High-Energy Line Break (HELB) Affecting Safety System	3.10E-04
4/23/1991	Vermont Yankee	Loss Of Offsite Power	2.90E-04
2/11/1991	McGuire	Loss Of Offsite Power	2.60E-04

DATE	REACTOR	DESCRIPTION	RISK
7/3/1992	Fort Calhoun	Reactor Trip On High Pressure And Loss Of Coolant Accident	2.50E-04
1/26/2000	Hatch	Automatic Scram With Complications	2.50E-04
3/29/1989	Point Beach 2	Loss Of Offsite Power	2.50E-04
4/21/1997	Oconee 2	Unisolable Reactor Coolant System Leak	2.20E-04
10/19/1992	Oconee 2	Loss Of Offsite Power & Failed Emergency Power	2.10E-04
1/30/96	Wolf Creek	Frazzle Ice Causes Loss Of Cooling	2.10E-04
8/24/1992	HB Robinson	Loss Of Offsite Power	2.10E-04
7/8/1992	HB Robinson	Loss Of Offsite Power	2.10E-04
3/21/1991	Zion 2	Loss Of Offsite Power	2.10E-04
8/31/1999	Indian Point 2	Loss Of Offsite Power Following A Reactor Trip	2.00E-04
10/16/1988	Braidwood	Loss Of Offsite Power	1.80E-04
12/31/1992	Sequoyah 1	Loss Of Offsite Power And Dual Unit Reactor Trip	1.80E-04
12/31/1992	Sequoyah 2	Loss Of Offsite Power And Dual Unit Reactor Trip	1.80E-04
8/24/1992	Turkey Point 3	Loss Of Off Site Power Due To Hurricane Andrew	1.60E-04
8/24/1992	Turkey Point 4	Loss Of Off Site Power Due To Hurricane Andrew	1.60E-04
1/16/1990	Byron 2	Loss Of Offsite Power	1.50E-04
2/25/1993	Catawba 1	Potentially Unavailability Of Essential Service Water	1.50E-04
2/25/1993	Catawba 2	Potentially Unavailability Of Essential Service Water	1.50E-04
7/11/1989	Summer	Loss Of Offsite Power	1.50E-04
1/11/1989	Summer	Loss Of Offsite Power Caused By Grid Instability	1.50E-04
2/16/1994	Haddam Neck	Reactor Operating With Degraded Relief Valves	1.40E-04
9/14/1993	LaSalle 1	Reactor Scram Complicated By Loss Of Offsite Power	1.30E-04
3/26/1993	Perry	Clogged Suppression Pool Strainers	1.20E-04
8/13/1988	Maine Yankee	Loss Of Offsite Power	1.20E-04
10/30/1991	Pilgrim	Loss Of Offsite Power Due To Severe Weather	1.20E-04
8/1/1996	Haddam Neck	Potentially Inadequate Reactor Core Cooling During Accident.	1.10E-04
2/15/2000	Indian Point 2	Steam Generator Tube Rupture	1.10E-04
8/2/1995	St. Lucie 1	Multiple Equipment Failures	1.10E-04
10/27/1997	St. Lucie 1	Non Conservative Emergency Core Cooling System Set Point	1.10E-04
1/9/1995	St. Lucie 1	Reactor Operating With Failed Valves & Cooling System Problems	1.10E-04
2/24/1999	Oconee 2	Postulated High-Energy Line Break & Failure Of Safety System	1.00E-04
2/24/1999	Oconee 3	Postulated High-Energy Line Break & Failure Of Safety System	1.00E-04

Of those nuclear reactors that experienced important “near misses” since the NRC began its new oversight process in 2000, only one reactor was on NRC’s radar prior to the “near miss.” The NRC’s inability to identify and prevent these “near misses” is disturbing. While, the nuclear industry and the agency continue to claim that Chernobyl can’t happen here, we’ve already come disturbingly close.

If any of these “near misses” had progressed to a meltdown, the government regulators have little confidence that any of the nuclear reactor containments would survive. In fact, some containment designs used in General Electric and Westinghouse reactors are virtually certain to fail after a meltdown of the radioactive fuel. A nuclear reactor meltdown and the subsequent failure of containment is an “American Chernobyl.”

The reactors that experienced the most “near misses” since Chernobyl, DC Cook 1 and Dresden 3, both have containments that offer the public little or no defense in the event of a meltdown.

Most "Near Misses" Since Chernobyl

REACTOR	OWNER	NEAR MISSES	LOCATION	STATE
DC Cook 1	Indiana/ Michigan Power	6	11 miles S of Benton Harbor	MI
Dresden 3	Exelon	6	9 miles E of Morris	IL
Oconee 2	Duke Energy Nuclear LLC	6	30 miles W of Greenville	SC
Oconee 3	Duke Energy Nuclear LLC	6	30 miles W of Greenville	S
St. Lucie 1	Florida Power & Light	6	12 miles SE of Ft. Pierce	FL
DC Cook 2	Indiana/ Michigan Power	5	11 miles S of Benton Harbor	MI
Oconee 1	Duke Energy Nuclear LLC	5	30 miles W of Greenville	IL
Dresden 2	Exelon	4	9 miles E of Morris	IL
Shearon Harris	Carolina Power & Light	4	20 miles SW of Raleigh	NC
Haddam Neck	Northeast Utilities	4	13 miles E of Meriden	CT
Seabrook	FPL Energy	4	13 miles S of Portsmouth	NH

These "near misses" make it disturbingly clear that nuclear reactors are as dangerous today as they were 20 years ago when Chernobyl reawakened millions to the realities of nuclear power.

In this post-9/11 age, Americans are more concerned than ever about safety and national security. This report is a stark reminder that not only is an American Chernobyl possible, but that nuclear reactors in the U.S. have already come disturbing close to another meltdown. Equally troubling is the fact that neither the government regulators nor the nuclear industry are likely to prevent an "American Chernobyl." Regrettably, the nuclear industry and the NRC have been more concerned with ensuring that reactors are profitable than safe.

Although Chernobyl took place twenty years ago in the former Soviet Union, its legacy lives on today. The effects on the lives of millions who live in the Ukraine, in Belarus and in Russia have not gone unnoticed. But, here in the United States, the nuclear industry, their lobbyists and their allies in government are working hard to keep Chernobyl but a distant memory to the average American.

As U.S. corporations contemplate building more nuclear reactors, it is important that our government regulators remember Chernobyl and speak honestly and forthrightly about the very real dangers posed by splitting atoms. Nuclear reactors are, by their very nature, inherently dangerous. Each reactor has the potential to devastate the state or region in which it operates. Unless the nuclear industry and the government regulators re-learn this lesson of Chernobyl more nuclear disasters are likely to follow.

+ Introduction

Twenty years ago, a nuclear reactor in the former Soviet Union experienced a “reactivity excursion” and as the radioactive cloud released by the explosion began to travel around the globe the word “Chernobyl” was seared into the minds of people around the planet.

The nuclear industry’s premature response was to denigrate the Soviet design, deny that the reactor had a containment and claim that such an accident was impossible in the U.S.

However, the U.S. Nuclear Regulatory Commission (NRC) testified before Congress that the chances that a U.S. reactor would experience such an accident in the twenty years following Chernobyl were slightly better than flipping a coin. In testimony, the NRC also acknowledged that the Chernobyl reactor had a pressure-suppression containment design that was similar in philosophy to the containments used in General Electric Mark I and Mark II and Westinghouse Ice condenser reactors.

This report reveals that the nuclear industry and its regulators have flipped the meltdown coin repeatedly at US reactors; at times proving the adage that “its better to be lucky than good.” The U.S. industry has thus far avoided another core meltdown since the accident at Three Mile Island in 1979; however that doesn’t mean that they haven’t come close.

Since the accidents at Three Mile Island and Chernobyl, the nuclear industry and its allies in government have been attempting to rewrite history. Once again, they are claiming that an American Chernobyl is not possible.

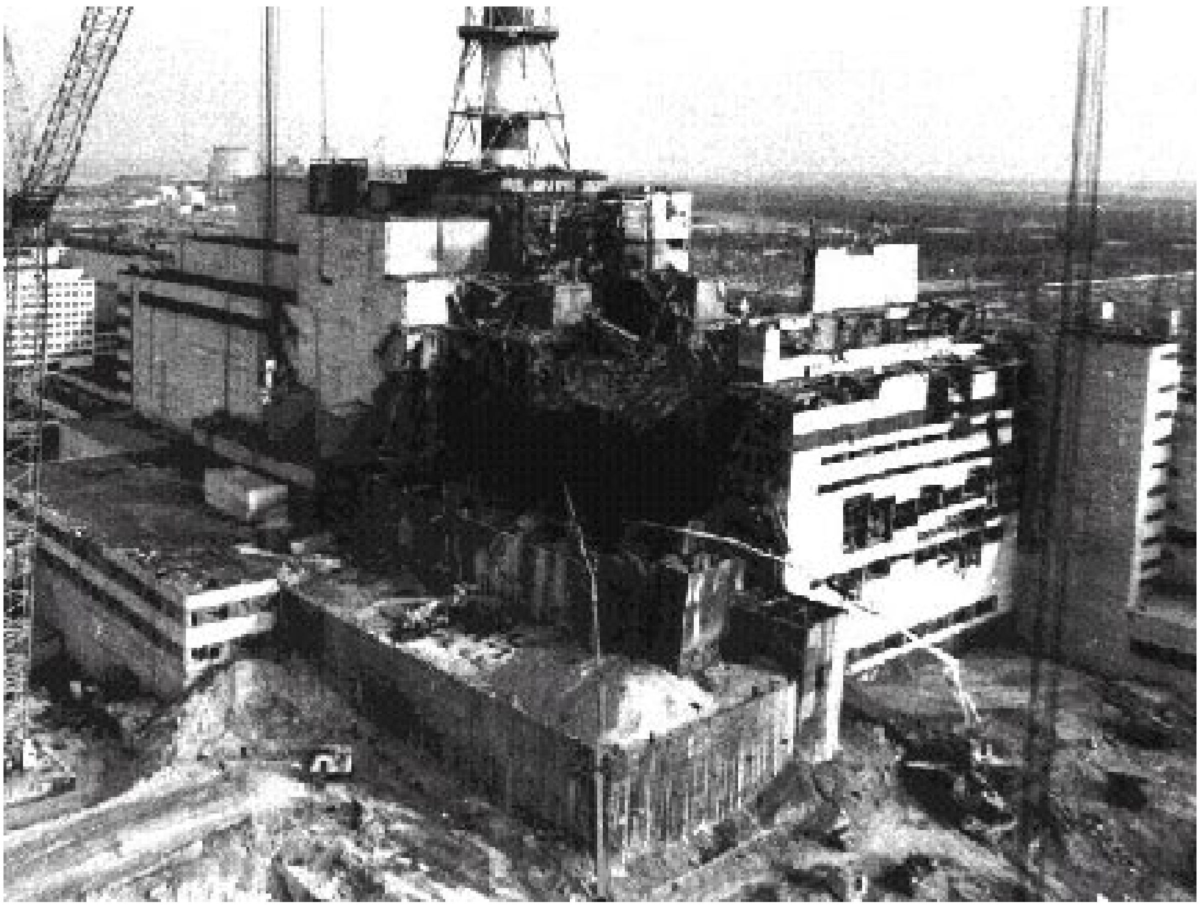
Greenpeace documents those near misses at U.S. reactors that have been recognized by the government’s regulators as precursors to meltdowns. If these accidents had resulted in a meltdown the government has little confidence that any of the reactor containments could withstand the accident for which they were not designed.

Greenpeace believes that the public has a right to know of the threats posed by the 104 reactors still licensed to operate in the US. As the anniversary of the Chernobyl disaster nears it is imperative that our government officials and regulators speak openly and honestly about the accident, its aftermath, and the continuing tragedy. This report is an effort to address the nuclear propagandist’s attempts to downplay the dangers of nuclear power in the United States. Chernobyl is now a distant memory for most Americans, but as George Santayana wrote, “those who cannot remember the past are condemned to repeat it.”

This report shows that an accident comparable to Chernobyl is a possibility and that nuclear power poses an ever-present danger to our families, our communities and our nation.

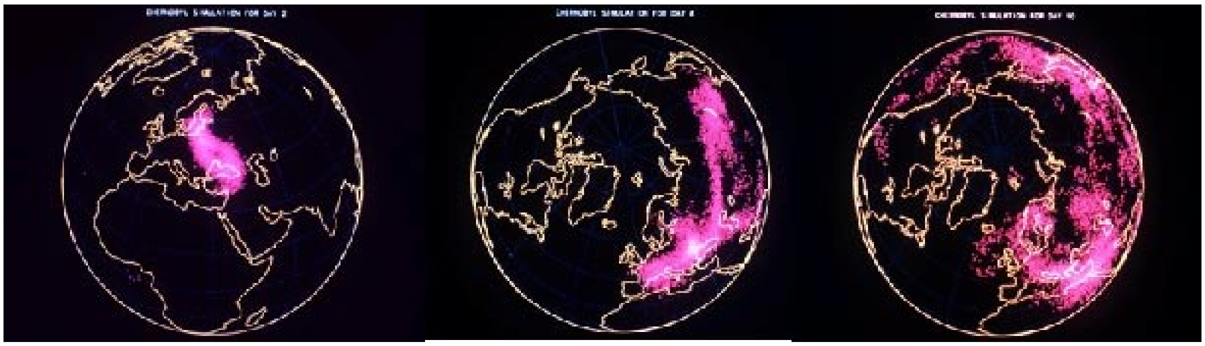
+ Chernobyl and The U.S. Nuclear Industry's Two Decades in Denial

On April 26, 1986, the number 4 reactor at the Chernobyl nuclear power plant in the former Soviet Union experienced the worst commercial nuclear accident in history. The accident occurred while operators were conducting tests, the reactor operators had turned off the plant's safety systems and then lost control of the reactivity in the reactor. The explosion and subsequent fire spewed massive amounts of radiation into the surrounding community & the environment.[1]



Chernobyl Unit 4 damage showing sand and other materials dropped by helicopter to quell the graphite fire.
Source: U.S. Department of Energy (DOE).

In the wake of the Chernobyl disaster, the U.S. nuclear industry began a campaign of denial and obfuscation. Even before the causes of the accident were known, the U.S. nuclear industry claimed that there was little for the United States to learn from the Chernobyl disaster and that it couldn't happen here.[2]



Simulation of Chernobyl Plume: Day 3, Day 6 and Day 10.
Source: US DOE.

Even as the radioactive plume was making it's way around the planet; U.S. nuclear industry representatives belittled Soviet technology. According to *Time* Magazine:

Soviet engineers and scientists have tended to show much less concern for safety than their Western counterparts. Says Physicist Robert Sachs, director of the Enrico Fermi Institute at the University of Chicago and a strong nuclear power proponent: ''Those of us who know something about Soviet safety policy have wondered how they have gotten away without a big accident for as long as they have.'' The lack of a containment structure for the Chernobyl reactor, which might have limited the emission of radioactivity into the atmosphere after the explosion, is only the most glaring example.[3]

Despite the U.S. nuclear industry's attempts to deflect attention from the safety problems with their own reactors, the reality of the threat posed by nuclear power was testified to in the wake of the disaster and ongoing tragedy.

+ A Commissioner Sets the Record Straight

The U.S. Nuclear Regulatory Commission (NRC) acknowledged before Congress that U.S. reactors were capable of catastrophic accidents that could release a radioactive plume of contamination equal to or greater than that from the Chernobyl reactor.

Less than a month after the disaster, NRC Commissioner James K. Asselstine testified that,

> 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 within the next 20 years and it is possible that such an accident could result in off site releases of radiation which are as large as or larger than the releases estimated to have occurred at Chernobyl.
>
> 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.[4]

The U.S. nuclear industry has thus far been fortunate enough to avoid the catastrophic accident testified to by Commissioner Asselstine; however, his assessment of the potential losses resulting from such an accident was no exaggeration.

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, conducted by the same institute that designed Chernobyl, found that the cost of the disaster had originally been underestimated and may cost twenty 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 farmland, 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.[5]

The *Wall Street Journal* concluded 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.” [6]

[7]

Of course the nuclear industry and its proponents were none too pleased with the commissioner's testimony and the Atomic Industrial Forum, a predecessor of today's propagandists at the Nuclear Energy Institute, challenged his testimony. In his response to a letter from the president of the Atomic Industrial Forum, Commissioner Asselstine stated that:

> I recall reading in the newspapers in recent months statements by senior officials within the nuclear industry that our plants are "perfectly safe" and we "will not have a Chernobyl-type plant accident here."....To convey the impression that Chernobyl-type releases are impossible in this country is as inaccurate as conveying the message that a similar disaster is a certainty.... [8]

The commissioner pointed out that the U.S nuclear industry was already experiencing serious events due to improper maintenance, equipment failures, design deficiencies and human error. Asselstine stated that "these contributors are causing the total loss of one or more safety systems and multiple equipment failures at plants that can substantially erode defense in depth and lead to accident conditions beyond the design basis of the plant." [9]

The commissioner was courageous enough to challenge the nuclear industry's rhetoric and acknowledge that an "American Chernobyl" was indeed possible.

+ An “American Chernobyl”

Now, twenty years later, nuclear propagandists are again making misleading claims about the Chernobyl accident and its aftermath. However, this time it is not merely the nuclear industry and their lobbyists that are engaging in this nonsense, its those that supposedly regulate the nuclear industry.

The Chairman of the U.S. Nuclear Regulatory Commission, Nils Diaz, has repeatedly claimed that there would not be an “American Chernobyl.” According to the NRC Chairman, what really happened at Chernobyl was, “a catastrophic release of radioactivity fueled by a fire in a combustible graphite reactor core, without a containment, that burned for many hours.” [10]

Unfortunately Mr. Diaz’s statement before the American Nuclear Society would lead one to believe that Chernobyl did not have containment.

That is factually inaccurate and is at odds with the NRC testimony to Congress in the wake of the Chernobyl accident. NRC testimony stated:

> Unit 4 at Chernobyl contains characteristics of both containment and confinement. There appear to be two regions that appear to be designed to withstand 27 psi and 57 psi. These volumes are in turn interconnected with two suppression pools via pressure relief valves and downcomers. The remaining portions of the plant are housed within a confinement structure. [11] (See Appendix A.)

The NRC Chairman is again displaying the technological arrogance that so concerned Wall Street in the wake of the Chernobyl accident:

> I am not trying to compare in any way American reactors to Chernobyl-type reactors because there is no comparison. Our reactors are so much better and so is our society. What I am trying to portray is that the failure of the former Soviet Union to do what was needed to mitigate the accident significantly contributed to its consequences. [12]

The Chairman’s hubris is quite remarkable given the fact that his agency had to back away from claims that U.S. reactors were invulnerable to airliner attack after 9-11 and that a football sized hole had recently been discovered in the reactor at Davis Besse. However, the smug attitude displayed by the NRC Chairman does not stop there. In another speech, Chairman Diaz drew a stark comparison between the Soviet response to the disaster and how America would respond to a nuclear disaster:

> What I am going to rule out is that the health consequences of a Chernobyl-like scenario would be applicable to the United States. Chernobyl was much more than a cata-strophic reactor failure and the release of enormous quantities of radioactivity to the environment. Chernobyl’s failure was the failure of a totalitarian society to protect and care for its people after a disaster...and this horrific mis-handling of public health and safety cannot and is not going to happen in America.... Make no mistake, America will deliver the necessary responses to protect public health and safety, and therefore, there will be no American Chernobyl. [13]

The NRC Chairman’s comments are almost laughable in light of the governments failed response to Hurricane Katrina. The NRC’ Chairman’s attitude is cause for concern. This same attitude raised concerns on Wall Street twenty years ago. In the wake of the disaster, the Wall Street securities firm of Donaldson, Lufkin and Jenrette (DLJ) hired former NRC Commissioner Victor Gilinsky. DLJ wanted to address the nuclear industry’s inability to acknowledge the reality of the Chernobyl accident and its implications for the U.S. industry. According to the DLJ report:

> The nuclear industry mind-set that the Chernobyl accident "cannot happen here" is troublesome because it seems to ignore a key lesson from Three Mile Island. Perhaps the most fundamental conclusion reached by The President's Commission on the Accident at Three Mile Island (the Kemeny Commission) in its 1979 report to President Carter was:
>
> > "To prevent nuclear accidents as serious as Three Mile Island, fundamental changes will be necessary in the organization, procedures, and practices -- and above all -- in the attitudes of the Nuclear Regulatory Commission and, to the extent that the institutions we investigated are typical, of the nuclear industry."[14]

The DLJ report, entitled Chernobyl: Some Lessons and Implications for Lower Quality Electric Utilities, discussed the nuclear industry’s motives for downplaying the Chernobyl accident and attempting to draw distinctions between U.S. and Soviet designs. According to the Wall Street analysis, the nuclear industry was under severe financial strain due to the massive cost overruns for their nuclear projects and the industry was attempting to minimize additional delays. [15]

Donaldson, Lufkin & Jenrette report suggested that the industry’s response to the Chernobyl accident was, at best, short sighted. The wall street firm quotes the Report of the Presidential Commission on the Accident at Three Mile Island, informally known as the Kemeny Commission report.

According to DLJ:

> The Kemeny Commission found the prevailing attitude within the nuclear utility industry at the time of the TMI accident was that large reactor accidents will not occur and that nuclear power plants are sufficiently safe. This attitude was not acceptable to the TMI investigators, who concluded:
>
> > "The (Kemeny) Commission is convinced that this attitude must be changed to one that says nuclear power is by its very nature potentially dangerous, and, therefore, one must continually question whether the safeguards already in place are sufficient to prevent major accidents."[16]

The report by former NRC Commissioner Gilinsky & DLJ concluded that:

> Much of the industry response to date to the Chernobyl accident suggests that one of the most important lessons from TMI has been forgotten, or was never fully learned.[17]

Only after the meltdown at TMI and the explosion at Chernobyl has the nuclear industry acknowledged that the public's concerns over nuclear power plant risk are well founded. In a speech to his nuclear brethren at the American Nuclear Society in 1988, the Executive Vice President of the GPU Nuclear Corporation, owner of Three Mile Island acknowledged that:

> Many people in the nuclear industry feel that our problem is primarily the fault of the public, or the media, or the schools, or the anti-nukes. But if we step a back one pace and are honest with ourselves, we must agree in a broad sense that the public's mistrust has its foundation. We said we were designing and building plants in which a core meltdown was essentially impossible—and then came TMI-2. We then argued we could have meltdowns but not energetic reactivity accidents—and then came Chernobyl. We argued that we might contaminate a power plant but not a neighborhood—and now reindeer in Lapland and lambs in Wales are part of the nuclear debate. The public—our public—citizens, media, public utility commissions—come away doubtful and with a feeling of having been mislead (sic).[18]

The public has been misled and the nuclear propagandists both in industry and government are at it again. However, this time the pro-nuclear spin is due to the fact that the nuclear industry is attempting to build new reactors for the first time in over a generation. Once again the nuclear industry and its allies in government are claiming that a Chernobyl accident can not happen here.

Greenpeace begs to differ:

+ U.S. reactors can have accidents with consequences equal to or greater than the Chernobyl disaster.
+ U.S. reactors have and will continue to experience “near misses” that could result in a meltdown.
+ U.S. reactor containments were not designed to withstand a reactor meltdown and the government has little confidence that any of them could.

Below, Greenpeace documents the nuclear “near misses” at U.S. reactors since the Chernobyl disaster.

+ Nuclear “Near Misses” Terminology

In order to compile the nuclear near misses since Chernobyl, Greenpeace reviewed the U.S. Nuclear Regulatory Commission’s program for tracking and evaluating near misses or as the agency terms them “precursors to severe core damage accidents” or “accident precursors.” Accident precursors are those actual events or conditions at nuclear reactors that if additional failures had occurred, would have resulted in inadequate cooling of the radioactive fuel and could have caused severe core damage; i.e., a meltdown. [19]

The U.S. Nuclear Regulatory Commission analyses event reports submitted by the nuclear corporations to capture those events or conditions that could have led to a meltdown. The NRC has been tracking accident precursors since 1979. For the purpose of analyzing risk, the NRC breaks nuclear reactor events into two categories: Initiating Events and Degraded Conditions. [20]

Initiating Events are actual occurrences such as a loss of offsite power (LOOP) or an automatic or manual shutdown (SCRAM) of the reactor with complications like any additional equipment failures or degradation of safety system function. [21]

Degraded Conditions are those recognized safety system or equipment degradations or unavailability that came to light without an occurrence of an initiating event. [22]

To analyze Initiating Events, the NRC calculates a conditional core damage probability or CCDP. CCDP represents the probability that the nuclear reactor would experience core damage or a meltdown of the radioactive fuel rods, given an occurrence of the initiating event and any subsequent equipment failure or degradation. [23]

To analyze Degraded Conditions, the NRC calculates the increase in core damage probability or CDP. CDP represents the increase in the probability that the reactor would damage the core for the period that safety equipment was unavailable or incapable or performing its function. However, the NRC’s risk models do not account for the unavailability of equipment greater than a year. [24]

Once the NRC has assessed the events, they determine the probability that it could have led to core melt. The NRC's Accident Sequence Precursor (ASP) program uses CCDP and CDP interchangeably and uses scientific notation to describe the significance. So for Three Mile Island or Chernobyl the core damage probability is 1 in 1. For those accidents that did not result in core damage the NRC assess a probability expressed as a negative function. So an accident with a probability of 1 X 10-1 has a one in ten chance of causing core damage. To simplify the risk equation, the scientific community and the NRC's risk analysts use E to represent X10.

So a probability of:

1.0 0 E10-1 = 1/10;

1.0 0 E1010-2 = 1/100;

1.0 0 E1010-3 = 1/1,000,

1.0 0 E1010-4 = 1/10,000,

1.0 0 E1010-5 = 1/100,000

1.0 0 E1010-6 = 1/1,000,000 [25]

For the purposes of assessing reactor risk the NRC breaks the events into categories based upon their perceived significance. According to the NRC, accident precursors with a Conditional Core Damage Probability or CCDP or CDP of 1 in 1000 are considered significant, accident precursors with a CCDP of 1 in 10,000 are considered important and those with a CCDP of greater than 1 in a Million are consider precursors. [26]

+ Methodology & Sensitive Information

In order to compile the Nuclear "Near Misses" since the Chernobyl Accident, Greenpeace attempted to review the entire history of the NRC's efforts to understand the events and conditions that could lead to a meltdown at a U.S. nuclear reactor. However, in the wake of the attacks of September 11, 2001, the NRC has repeatedly been forced or embarrassed into withdrawing information from the public domain. According to the NRC,

> detailed accident analyses were classified as "SENSITIVE - NOT FOR PUBLIC DISCLOSURE" based on the guidance provided by the Executive Director for Operations in the memorandum to the Commission (dated April 4, 2002), concerning the release of information to the public that could provide significant assistance to support an act of terrorism. [27]

In more recent guidance, the NRC allows for the public release of accident sequence precursor analyses "that do not contain information related to uncorrected configurations or conditions that could be useful to an adversary." [28]

NRC's efforts to close the proverbial barn door have proven to be a source of amusement & frustration as the NRC has been forced to confront the reality of the information in their possession. Greenpeace has made a good faith effort to compile all currently available information on those accidents that could have led to a meltdown.

While this compilation of near misses is thorough, it is by no means comprehensive. NRC has repeatedly identified events of interest that were impracticable or impossible to model. [29]

Additionally, in the course of our study Greenpeace has learned that the agency has performed a security review on Precursors to Potential Severe Core Damage Accidents, NUREG/CR 4674. The NRC has seen fit to remove from the public domain at least twenty-two volumes containing Oak Ridge National laboratory's assessments of accident precursors. The NRC has deemed these documents to be too dangerous to release to the public because they could either help terrorists or because the condition that poses the threat has not been corrected at the specific reactor. [30]

While it's rather hard to believe that analyses of reactor accident precursors that are decades old could still be of use to terrorists, Greenpeace has only used those documents that have already cleared the NRC's review process. In addition to the NRC annual analysis of accident precursors, Greenpeace used the latest available calculations from other NRC documents including NUREGS, Abnormal Occurrence Reports, Accident Sequence Precursor Analysis. When discrepancies were discovered in NRC's risk calculations Greenpeace used the most recent calculation provided by the NRC.

Greenpeace has submitted a Freedom of Information Act request to the NRC and requested that the agency redact only those portions of the reports that actually contain sensitive or safeguards information.

+ "The Map is not the Territory."
– Alfred Korzybski, American Scientist and Philosopher

It must be noted that the NRC risk models are a best attempt at under-standing the accident sequences that lead to damaging the radioactive fuel in the reactor core. However, they are only models. Some events can not be analyzed because they do not fit into the probabilistic risk assessment models. These models do not recognize the threat from sabotage, external events such as floods, earthquakes, tornadoes, hurricanes and aircraft crashes.[31] As the Union of Concerned Scientists (UCS) has repeatedly pointed out to the Commission, their risk assessments do not even reflect the fact that the reactor vessel can fail. [32]

A 2002 NRC memo, first obtained by Greenpeace through the Freedom of Information Act, shows that for even the most dangerous precursors the NRC's risk models are seriously lacking. For accident precursors from 1993 to 2000 with a conditional core damage probability of greater than 1 in 100,000 or CCDP > E-5 the NRC found that:

(1) approximately 42 percent of the cumulative CCDP from ASP (accident sequence precursor) events is not typically modeled in PRAs, despite the fact that they represent only 9 percent (5/54) of the number of ASP events with CCDP > E-5; and

(2) over 59 percent of the cumulative CCDP in the E-3 range was not typically modeled in PRAs - the fraction of the cumulative CCDP not modeled in typical PRAs increased for the higher CCDP ranges.[33]

This NRC analysis of reactor precursors over the last decade led the author to conclude that, "reliance on regulatory tools developed from current PRAs (probabilistic risk assessments) could miss a significant fraction of the actual risk and that defense in depth design and plant oversight activities which go beyond risk-based tools need to be maintained." [34]

For a more comprehensive discussion regarding the weaknesses of probabilistic risk assessments see: David Lochbaum, Nuclear Power Plant Risk Studies: Failing the Grade, Union of Concerned Scientists, August 2000. Additionally, for a more technical discussion of the limitations of risk analysis, see Hirsch, Einfalt, Schumacher & Thompson, IAEA Safety Targets And Probabilistic Risk Assessment: State of the Art, Merits & Shortcomings of Probabilistic Risk Assessment, Greenpeace International, August 1989. [35]

+ Nuclear “Near Misses” since Chernobyl

The U.S. Nuclear Regulatory Commission has analyzed hundreds of events since the Chernobyl disaster that could have led to a meltdown. Of those events, the NRC has identified nearly 200 as precursors to severe core damage accidents. According to the NRC, most events can be directly or indirectly associated with four initiators:

1. a reactor trip (which includes loss of main feed water);
2. a Loss of Off Site Power or LOOP;
3. a Small Break Loss of Coolant Accident or LOCA, and
4. Steam Generator Tube Ruptures. [36]

Despite NRC claims to the contrary an “American Chernobyl” is possible.If any of these “near misses” had progressed to a meltdown the government has little confidence that any of the reactor containments could withstand the accident. [37]

A reactor meltdown and the subsequent failure of the reactor containment is an “American Chernobyl.”

+ Significant "Near Misses" Since Chernobyl

DATE	REACTOR	DESCRIPTION	RISK	STATE
2/27/2002	Davis Besse	Vessel Head Degradation	6.00 E-03	OH
4/3/1991	Shearon Harris	High Pressure Injection Unavailable	6.00 E-03	NC
6/13/1986	Catawba 1	Small Break Loss of Coolant Accident	3.00 E-03	SC
9/17/1994	Wolf Creek	Reactor Coolant System Blow Down	3.00 E-03	KS
2/6/1996	Catawba 2	Loss of Offsite Power (LOOP)	2.10 E-03	SC
12/271986	Turkey Point 3	Control Rods Failed to Insert	1.00 E-03	FL
3/20/1990	Vogtle 1	Loss of Offsite Power during shutdown	1.00 E-03	GA
3/20/1990	Vogtle 2	Loss of Offsite Power during shutdown	1.00 E-03	GA

[38]

Not only is an "American Chernobyl" possible but the government regulators are not likely to prevent it from occurring. Greenpeace reviewed the most dangerous precursors to see if these reactors were among those captured by the NRC's oversight process. Of the eight significant near misses since Chernobyl, only one reactor was on NRC's radar screen prior to the near miss. Despite receiving additional regulatory attention and being listed on NRC's first "watch list" of problem reactors after the Chernobyl disaster, Turkey Point 3 in Florida still experienced one of the most significant "near misses" since the disaster.

None of the other seven reactors that experienced significant "near misses" since Chernobyl were on NRC's regulatory radar:

Davis Besse in Ohio in 2002;
Shearon Harris in North Carolina in 1991;
Catawba 1 in South Carolina in 1986;
Wolf Creek in Kansas in 1994;
Catawba 2 in South Carolina in 1996;
Vogtle 1 & 2 in Georgia in 1990;

The NRC has since scrapped the watch list process in favor of a supposedly risk-informed performance based approach to regulation.[39] Unfortunately, the new oversight process has not improved the NRC's ability to prevent reactors from posing a threat to the public health and safety.

The NRC's new oversight process failed to identify the most significant precursor since Chernobyl. Despite the NRC chairman's claims that the public was never at risk, the Davis Besse "near miss" was the most significant in the last two decades. According to NRC risk calculations, the Davis Besse precursor is rivaled only by another serious safety system degradation at Shearon Harris. NRC analysts have not calculated a greater risk at a reactor since 1991, when the NRC discovered that Shearon Harris had operated for an entire year without a high-head safety injection system capable of cooling the reactor core during an accident.[40]

Not only has the NRC oversight process failed to prevent declining performance from threatening the public health and safety, the process gave the NRC a false sense of assurance at Davis Besse.

According to the U.S. General Accounting Office (GAO):

> NRC also considered First Energy--Davis-Besse's owner--a good performer, which resulted in fewer NRC inspections and questions about plant conditions. NRC was aware of the potential for cracked tubes and corrosion at plants like Davis-Besse but did not view them as an immediate concern. Thus, NRC did not modify its inspections to identify these conditions.[41]

Unfortunately, GAO also found that it wasn't only NRC's oversight of Davis Besse that was flawed. GAO found that, "NRC's process for deciding to allow Davis Besse to delay its shutdown lacks credibility." And that, " the risk estimate NRC used to help decide whether the plant should shut down was flawed and underestimated the amount of risk that Davis-Besse posed." [42] The GAO concluded that even with the NRC underestimating the risk at Davis Besse, the agency risk calculations were high enough that the reactor should have been forced to shut down for inspections.

The NRC's regulatory failure at Davis Besse reconfirms that adage that "its better to be lucky than good." If the football sizes hole had not been discovered, the reactor vessel would have failed during the next operating cycle. The NRC calculated that the Davis Besse reactor vessel was within sixty days of failing and that the resulting accident would have rivaled the core meltdown at Three Mile Island in 1979.[43]

The Davis Besse "near miss" is also important because of what it revealed about those that regulate the nuclear industry. NRC senior management placed the economics of the nuclear industry ahead of public health and safety. According to the NRC's Inspector General report on Davis Besse, "(d)uring its review of the potentially hazardous condition at Davis Besse, the NRC staff considered the financial impact to the licensee of an unscheduled plant shutdown." [44]

Additionally, the NRC's Inspector General (OIG) found that:

> (w)ith respect to Davis-Besse, one NRR senior official noted to OIG that the staff considered the large cost FENOC (First Energy Nuclear Operating Company) would incur if ordered to shut down, particularly if no cracking was found upon inspection.... the NRR Director had spoken with the FENOC President and was aware of the licensee's financial concerns pertaining to an unscheduled shutdown. According to the memorandum, the FENOC President told the NRR Director that the impact of a shutdown prior to February 2002 would be significant, and that Davis-Besse would be better positioned to shut down in February because of the availability of replacement fuel. The FENOC President confirmed to OIG that this discussion took place.[45]

The NRC's Inspector General has also reported that, "NRC appears to have informally established an unreasonably high burden of requiring absolute proof of a safety problem, versus lack of reasonable assurance of maintaining public health and safety, before it will act to shut down a power plant." [46]

The inability of the NRC oversight process to detect poor performance before it devolves into a nuclear near miss should come as no surprise to the NRC commissioners. The NRC staff said as much when the Commission imposed the new regulatory oversight scheme.

When the NRC first instituted the revised reactor oversight process, the staff was surveyed. The results, as reported in *Inside NRC*, should have given the Commission cause for concern:

+ 70% of those surveyed believed that the new process would not catch declining performance "before a significant reduction in safety margins."
+ 70% of NRC's resident inspectors believed that the new process "may not identify and halt degrading performance."
+ 79% of NRC staff either had no opinion or believed that the new performance indicators did not provide an adequate indication of declining performance.
+ 75% of the NRC staff thought that the nuclear industry and NEI had too much influence and input into the new process.[47]

According to the latest NRC analysis of significant accident precursors, there is no common denominator when it comes to these high-risk events. NRC reviewed, "the nature, modes, causes, and systems affected by the precursors with CCDP of 10-3 revealed that the events in this group appear to exhibit no common (generic) characteristics." [48]

The NRC staff's report to the Commission is unable to draw any common themes from the most significant precursors, the agency has determined that we can expect these near misses with some regularity. According to the NRC's latest analysis, " the occurrence rate of precursors with CCDP 1.0×10-3 based on this data is approximately one event every 2 years, although there have been years in which two such events occurred." [49]

However, it is important to note that the NRC's review of significant precursors from 1993 – 2000 found that 59 % of the cumulative core damage probability in the 1 in 1000 range is not modeled in the current risk analyses. [50]

According to the NRC report, risk assessments did not capture the "near misses"at Davis Besse in 2002, Point Beach 1 & 2 in 2001, Cook 1 & 2 in 1999, Wolf Creek in 1994 and again in 1996, nor the 1996 revelation that the emergency core cooling system at Haddam Neck would have been unable to perform its function, i.e. cool the reactor core, for the entire life of the plant. [51]

+ Important "Near Misses" Since Chernobyl[52]

DATE	REACTOR	DESCRIPTION	RISK
1/22/1997	Maine Yankee	Reactor Coolant System Valves Inoperable.	8.20E-04
11/29/2001	Point Beach Unit 1	Potential Common Mode Failure of All Aux Feed Water Pumps	7.00E-04
11/29/2001	Point Beach Unit 2	Potential Common Mode Failure of All Aux Feed Water Pumps	7.00E-04
6/15/1991	Yankee Rowe	Loss of Offsite Power	6.10E-04
5/19/1996	Arkansas Nuclear 1	Reactor Trip And Subsequent Steam Generator Dry Out	5.60E-04
6/24/1998	Davis-Besse	Loss Of Offsite Power Due To Tornado	5.60E-04
7/23/1987	Calvert Cliffs 1	Loss Of Offsite Power Caused Tree Contact With Power Line.	4.80E-04
7/23/1987	Calvert Cliffs 2	Loss Of Offsite Power Caused Tree Contact With Power Line.	4.80E-04
10/22/1999	DC Cook 1	Potential High-Energy Line Break (HELB) Affects Safety Systems	4.50E-04
10/22/1999	DC Cook 2	Potential High-Energy Line Break (HELB) Affects Safety Systems	4.50E-04
7/14/1987	Palisades	Loss Of Offsite Power	4.30E-04
10/29/2002	Point Beach 2	Potential Failure Of All EFW Pumps	4.00E-04
11/2/1997	St. Lucie 1	Non-Conservative Recirculation Actuation Setpoint	3.40E-04
5/15/2000	Diablo Canyon 1	Reactor Trip And Loss Of Offsite Power	3.10E-04
2/24/1999	Oconee 1	Potential High-Energy Line Break (HELB) Affecting Safety System	3.10E-04
4/23/1991	Vermont Yankee	Loss Of Offsite Power	2.90E-04
2/11/1991	McGuire	Loss Of Offsite Power	2.60E-04
7/3/1992	Fort Calhoun	Reactor Trip On High Pressure And Loss Of Coolant Accident	2.50E-04
1/26/2000	Hatch	Automatic Scram With Complications	2.50E-04
3/29/1989	Point Beach 2	Loss Of Offsite Power	2.50E-04
4/21/1997	Oconee 2	Unisolable Reactor Coolant System Leak	2.20E-04
10/19/1992	Oconee 2	Loss Of Offsite Power & Failed Emergency Power	2.10E-04
1/30/96	Wolf Creek	Frazzle Ice Causes Loss Of Cooling	2.10E-04
8/24/1992	HB Robinson	Loss Of Offsite Power	2.10E-04
7/8/1992	HB Robinson	Loss Of Offsite Power	2.10E-04
3/21/1991	Zion 2	Loss Of Offsite Power	2.10E-04
8/31/1999	Indian Point 2	Loss Of Offsite Power Following A Reactor Trip	2.00E-04
10/16/1988	Braidwood	Loss Of Offsite Power	1.80E-04
12/31/1992	Sequoyah 1	Loss Of Offsite Power And Dual Unit Reactor Trip	1.80E-04
12/31/1992	Sequoyah 2	Loss Of Offsite Power And Dual Unit Reactor Trip	1.80E-04
8/24/1992	Turkey Point 3	Loss Of Off Site Power Due To Hurricane Andrew	1.60E-04
8/24/1992	Turkey Point 4	Loss Of Off Site Power Due To Hurricane Andrew	1.60E-04
1/16/1990	Byron 2	Loss Of Offsite Power	1.50E-04
2/25/1993	Catawba 1	Potentially Unavailability Of Essential Service Water	1.50E-04
2/25/1993	Catawba 2	Potentially Unavailability Of Essential Service Water	1.50E-04
7/11/1989	Summer	Loss Of Offsite Power	1.50E-04
1/11/1989	Summer	Loss Of Offsite Power Caused By Grid Instability	1.50E-04
2/16/1994	Haddam Neck	Reactor Operating With Degraded Relief Valves	1.40E-04

9/14/1993	LaSalle 1	Reactor Scram Complicated By Loss Of Offsite Power	1.30E-04
3/26/1993	Perry	Clogged Suppression Pool Strainers	1.20E-04
8/13/1988	Maine Yankee	Loss Of Offsite Power	1.20E-04
10/30/1991	Pilgrim	Loss Of Offsite Power Due To Severe Weather	1.20E-04
8/1/1996	Haddam Neck	Potentially Inadequate Reactor Core Cooling During Accident.	1.10E-04
2/15/2000	Indian Point 2	Steam Generator Tube Rupture	1.10E-04
8/2/1995	St. Lucie 1	Multiple Equipment Failures	1.10E-04
10/27/1997	St. Lucie 1	Non Conservative Emergency Core Cooling System Set Point	1.10E-04
1/9/1995	St. Lucie 1	Reactor Operating With Failed Valves & Cooling System Problems	1.10E-04
2/24/1999	Oconee 2	Postulated High-Energy Line Break & Failure Of Safety System	1.00E-04
2/24/1999	Oconee 3	Postulated High-Energy Line Break & Failure Of Safety System	1.00E-04

Since Chernobyl, the NRC has identified at least 49 "important precursors."

Unfortunately, the NRC's new oversight process has not proven itself capable of detecting problems at many of these reactors before they resulted in dangerous conditions or events. Greenpeace reviewed all of the historical assessments from the NRC's revised reactor oversight process for those reactors that experienced near misses since NRC began the new process in 2000:

Davis Besse in Ohio

Point Beach 1 & 2 in Wisconsin

Hatch 1 in Georgia

Diablo Canyon 1 in California and

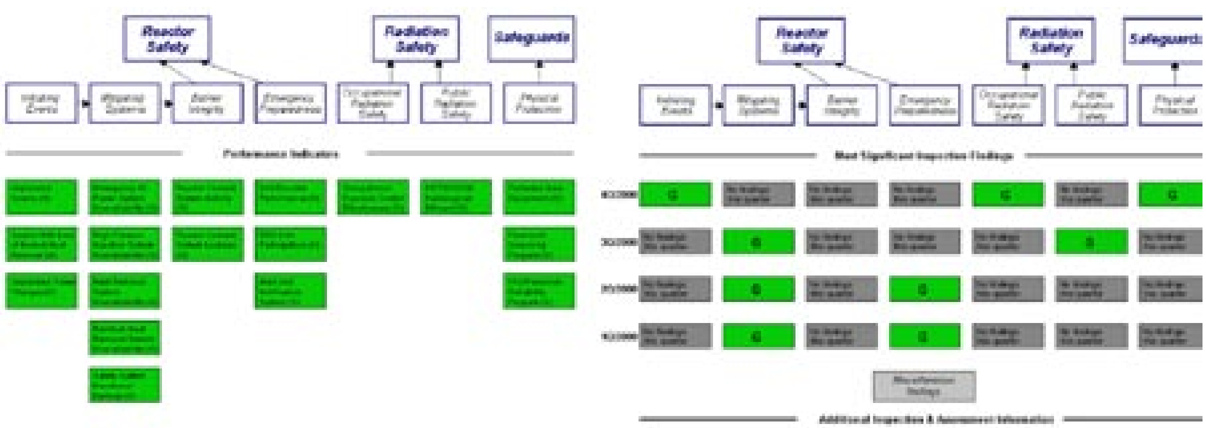
Indian Point 2 in New York

Only one of the reactors was on NRC's radar prior to the "near miss." [53]

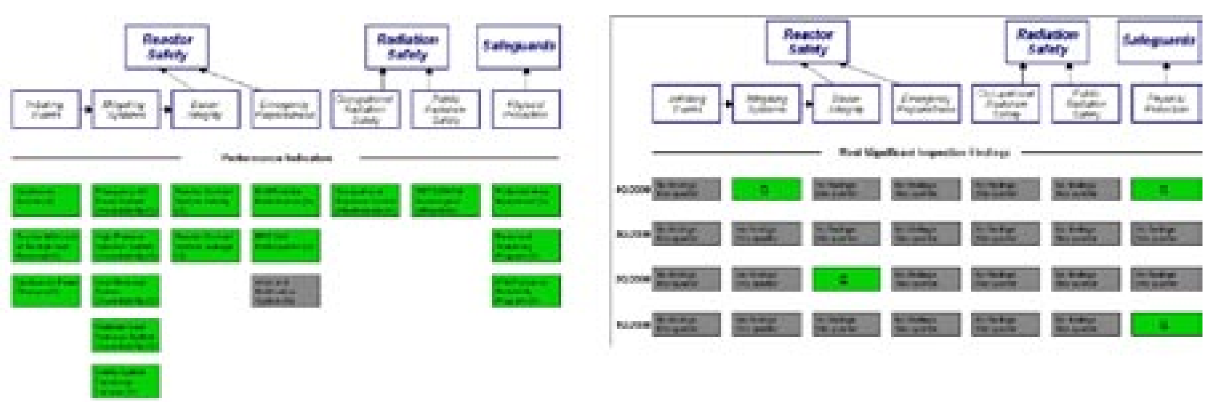
However, it's hard to credit the NRC's new process with capturing the accident precursor. In February of 2000, Indian Point 2 ruptured a steam generator tube and released radiation into the surrounding community. When the NRC Inspector General reviewed the Indian Point accident, the IG determined that NRC had missed opportunities to prevent the accident by waiving inspections. [54]

More disturbing is the fact that, even after the NRC recognized events as precursors to severe core damage accidents nothing changed. While the NRC's oversight process, documented the "near misses," there was no change in the level of regulatory scrutiny due to the important "near misses" at the Diablo Canyon 1 and Hatch 1 nuclear reactors. The NRC's color coded oversight process remained GREEN.

Diablo Canyon 1
4Q/2000 Performance Summary [55]



Hatch 1
4Q/2001 Performance Summary [56]



Not only did the oversight process fail to respond to an important precursor at Hatch 1 but the NRC's original response to the event was to issue a non-cited violation, a regulatory a slap on the wrist, for failure to accurately report the circumstances that caused the repeated reactor shutdowns. It was only after the owner of Hatch, Southern Nuclear Operating Company, failed to bring the reactor back into compliance with NRC regulations that the agency finally leveled a violation.[57]

Again, these blind spots in NRC's oversight process should not come as a surprise to the NRC commissioners. The public, as well as the NRC's own advisors on the Advisory Committee on Reactor Safeguards (ACRS) have repeatedly pointed out that the oversight process has been so manipulated by the industry that it fails to give the NRC an accurate perspective of reactor performance.

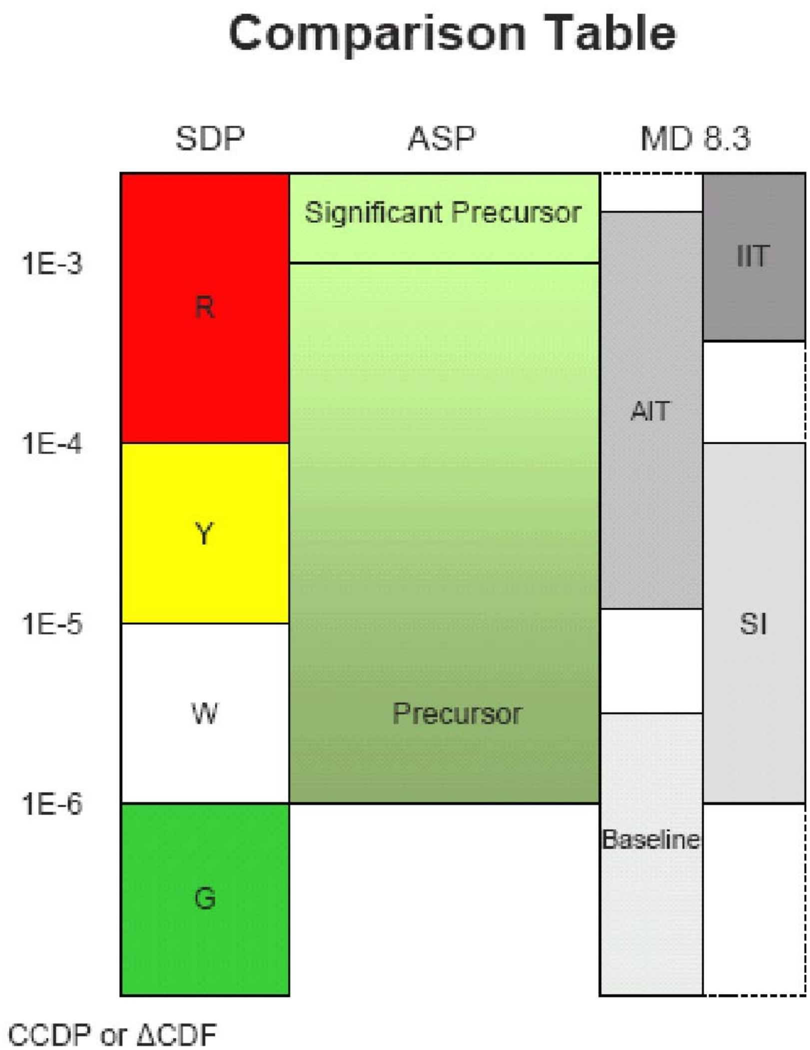
In April 2000, the Commission asked the ACRS to review the new Reactor Oversight Process. Specifically, the ACRS was asked to review the use of performance indicators in the Reactor Oversight Process to ensure that they provide meaningful insight into aspects of plant operation that are important to safety. The ACRS found that performance indicator thresholds for initiating events and mitigating systems are not meaningful. The ACRS has pointed out to the NRC staff that:

> it would take more than 20 reactor trips per year to effect the initiating event risk category in a sufficient amount to cause a licensee to enter the red band. Clearly, 20 trips in a year is far worse than industry performance has been for at least four decades to my memory.[58]

This may help explain why the oversight process failed to register a change in color and recognize the significance of the important precursors at Hatch and Diablo Canyon both involved reactor trips.

However, it does not excuse the fact that the NRC's new risk informed oversight process does not capture and recognize some of the most important precursors to a meltdown.

The graphic below shows how NRC’s risk informed oversight process is supposed to work.



[59]

If the NRC’s oversight process performed as advertised, the events at Hatch 1 and Diablo Canyon 1 should have resulted in at least a white or a yellow finding from the significance determination process (SDP) of the NRC’s Reactor Oversight Process (ROP) and an increase in regulatory oversight. However, NRC’s oversight process failed to acknowledge the severity of the events and saw nothing but green.

+ Additional "Near Misses" Since Chernobyl[60]

DATE	REACTOR	DESCRIPTION	RISK
12/27/1993	McGuire 2	Reactor Trip And Loss Of Offsite Power	9.30E-05
6/10/1995	Waterford	Reactor Trip And Equipment Failure And Fire	9.10E-05
1/25/1995	Millstone 2	Reactor Containment Isolation Valves Inoperable	7.70E-05
5/3/1992	Oyster Creek	Loss Of Offsite Power Due To A Forest Fire	7.10E-05
5/18/1989	Oyster Creek	Loss Of Offsite Power	7.10E-05
6/11/1995	Comanche Peak 1	Reactor Trip And Aux Feed Water Failure	6.50E-05
6/24/1993	Haddam Neck	Loss Of Offsite Power	6.50E-05
10/29/2002	Point Beach 1	Potential Common-Mode Failure Of All EFW Pumps	6.00E-05
2/14/2002	Columbia	Potential Unavailability Of Four Safety Breakers	6.00E-05
7/19/1995	Arkansas 2	Single Failure Could Disable Both EFW Trains	6.00E-05
4/22/1993	Quad Cities 2	Both Emergency Diesel Generators Degraded	6.00E-05
12/30/1999	DC Cook 1	Valves Required Post-Accident Could Fail To Open	5.70E-05
12/30/1999	DC Cook 2	Valves Required Post-Accident Could Fail To Open	5.70E-05
9/12/1998	Byron Unit 1	Emergency Diesel Generator Unavailable.	5.60E-05
10/12/1993	Beaver Valley 1	Loss Of Offsite Power	5.50E-05
10/12/1993	Beaver Valley 2	Loss Of Offsite Power	5.50E-05
7/29/1996	Prairie Island 1	Loss Of Offsite Power	5.30E-05
7/29/1996	Prairie Island 2	Loss Of Offsite Power	5.30E-05
6/29/1986	Prairie Island 1	Loss Of Offsite Power	5.30E-05
6/29/1986	Prairie Island 2	Loss Of Offsite Power	5.30E-05
6/11/1999	DC Cook 1	Emergency Service Water Inoperable In Seismic Event	5.20E-05
6/11/1999	DC Cook 2	Emergency Service Water Inoperable In Seismic Event	5.20E-05
9/30/1993	Arkansas 1	Emergency Recirculation Unavailable	5.10E-05
3/14/1993	Palo Verde 2	Steam Generator Tube Rupture	4.70E-05
5/21/1996	Seabrook	Emergency Feed Water Pump Unavailable In Accident	4.60E-05
6/27/1991	Seabrook	Loss Of Offsite Power	4.40E-05
7/17/1988	Diablo Canyon 2	Loss Of Offsite Power	4.10E-05
7/31/2004	Palo Verde 3	Containment Sump Recirculation Maybe Inoperable	4.00E-05
7/31/2004	Palo Verde 1	Containment Sump Recirculation Maybe Inoperable	4.00E-05
7/31/2004	Palo Verde 2	Containment Sump Recirculation Maybe Inoperable	4.00E-05
6/14/2004	Palo Verde 2	Loss Of Offsite Power With Complications	4.00E-05
9/12/1995	DC Cook 1	Safety Injection Unavailable For 6 Months Of Operation	3.70E-05
1/10/1996	Salem 1	Refueling Water Storage Tank Unavailable	3.60E-05
1/10/1996	Salem 2	Refueling Water Storage Tank Unavailable	3.60E-05
6/17/1989	Brunswick 2	Loss Of Offsite Power	3.60E-05
7/10/1992	HB Robinson	Inoperability Of Multiple Safety Components	3.50E-05
12/2/1992	Oconee 1	Backup Power Source Potentially Unavailable	3.20E-05
12/2/1992	Oconee 2	Backup Power Source Potentially Unavailable	3.20E-05
12/2/1992	Oconee 3	Backup Power Source Potentially Unavailable	3.20E-05
8/14/2003	Perry 1	Loss Of Offsite Power Due To Northeast Blackout	3.00E-05
8/14/2003	Ginna	Loss Of Offsite Power Due To Northeast Blackout	3.00E-05
5/15/1996	Dresden 3	Feed Water Valve Failed & Reactor Scram on Low Water	2.60E-05

3/7/1994	Zion Unit 2	Aux Feed Water & Emergency Diesel Inoperable	2.30E-05
7/15/1998	DC Cook 1	Potential High-Energy Line Break Affecting Safety Systems	2.20E-05
7/15/1998	DC Cook 2	Potential High-Energy Line Break Affecting Safety Systems	2.20E-05
3/5/2001	Seabrook	Reactor Trip With Complication	2.10E-05
1/4/2004	Calvert Cliff 2	Reactor Trip With Complication	2.00E-05
8/14/2003	Nine Mile Point 2	Loss Of Offsite Power Due To Northeast Blackout	2.00E-05
8/14/2003	Nine Mile Point 1	Loss Of Offsite Power Due To Northeast Blackout	2.00E-05
8/14/2003	Fermi 2	Loss Of Offsite Power Due To Northeast Blackout	2.00E-05
4/20/1995	Arkansas Nuclear 1	Reactor Trip With Emergency Feed Water Unavailable	2.00E-05
9/8/1994	River Bend	Reactor Scrams & Control Rod Drive Systems Unavailable	1.80E-05
5/23/1996	Bryron	Loss Of Offsite Power	1.70E-05
3/27/1992	Crystal River	Loss Of Offsite Power	1.70E-05
11/17/1987	Beaver Valley 2	Loss Of Offsite Power	1.70E-05
10/14/1998	Davis-Besse	Reactor Trip With Complications	1.40E-05
11/20/1995	St. Lucie	Emergency Diesel Generator Failure & Potential Failure	1.40E-05
9/11/1995	Limerick Unit 1	Reactor Trip & Clogging Of The Suppression Pool Strainers	1.30E-05
1/12/1994	Calvert Cliffs 2	Reactor Trip With Complications	1.30E-05
10/17/1992	Callaway	Loss Of Main Control Room Annunciators	1.30E-05
3/25/1989	Dresden	Loss Of Offsite Power	1.30E-05
2/8/1994	Point Beach 1	Both Emergency Diesel Generators (EDGs) Inoperable	1.20E-05
2/8/1994	Point Beach 2	Both Emergency Diesel Generators (EDGs)Inoperable	1.20E-05
1/22/1993	South Texas 1	Emergency Diesel Generator & Feed Water Unavailable	1.20E-05
7/14/1998	Big Rock Point	Reactor Operated 13 Years With Borated Water Unavailable	1.10E-05
1/19/1995	Arkansas 2	Single Failure May Disable 2 Emergency Feed Water Trains	1.10E-05
9/25/2004	St. Lucie 2	Loss Of Offsite Power	1.00E-05
9/25/2004	St. Lucie 1	Loss Of Offsite Power	1.00E-05
10/30/2002	Kewaunee	Potentially Unavailable Safety-Related Equipment	1.00E-05
12/3/2001	Callaway	Concurrent Unavailability Of Safety Systems	1.00E-05
9/3/2001	LaSalle 2	Reactor Trip	1.00E-05
8/29/2001	DC Cook 1	Degraded ESW Flow caused Both Unit 2 EDGs Inoperable	1.00E-05
5/16/2001	Calvert Cliffs 1	Auxiliary Feed Water (AFW) Pump Failed	1.00E-05
3/28/2001	Kewaunee	Absence Of Fire Suppression Impacts (AFW) Pump	1.00E-05
8/13/1991	Nine Mile Point 2	Site Area Emergency Due To Electrical Fault & Shutdown	1.00E-05
6/21/1997	Three Mile Island	Failure Of Both Generator Breakers Causes LOOP	9.60E-06
6/19/1997	Three Mile Island	Loss Of Offsite Power	9.60E-06
6/14/2004	Palo Verde 3	Loss Of Offsite Power With Complications	9.00E-06
6/14/2004	Palo Verde 1	Loss Of Offsite Power With Complications	9.00E-06
12/20/2002	Shearon Harris 1	Postulated Fire Could Disable Safety Equipment	9.00E-06
2/5/1998	San Onofre 2	Containment Sump Recirculation Valve Inoperable	7.20E-06
8/14/2003	Indian Point 3	Loss Of Offsite Power Due To Northeast Blackout	7.00E-06
7/19/2002	Indian Point 2	Degraded Control Room Fire Barrier	7.00E-06
8/29/2001	DC Cook 2	Degraded ESW Flow Both Unit 2 EDGs Inoperable	7.00E-06
6/24/1996	LaSalle 1	Concrete Sealant Fouls Cooling Water Systems	7.00E-06

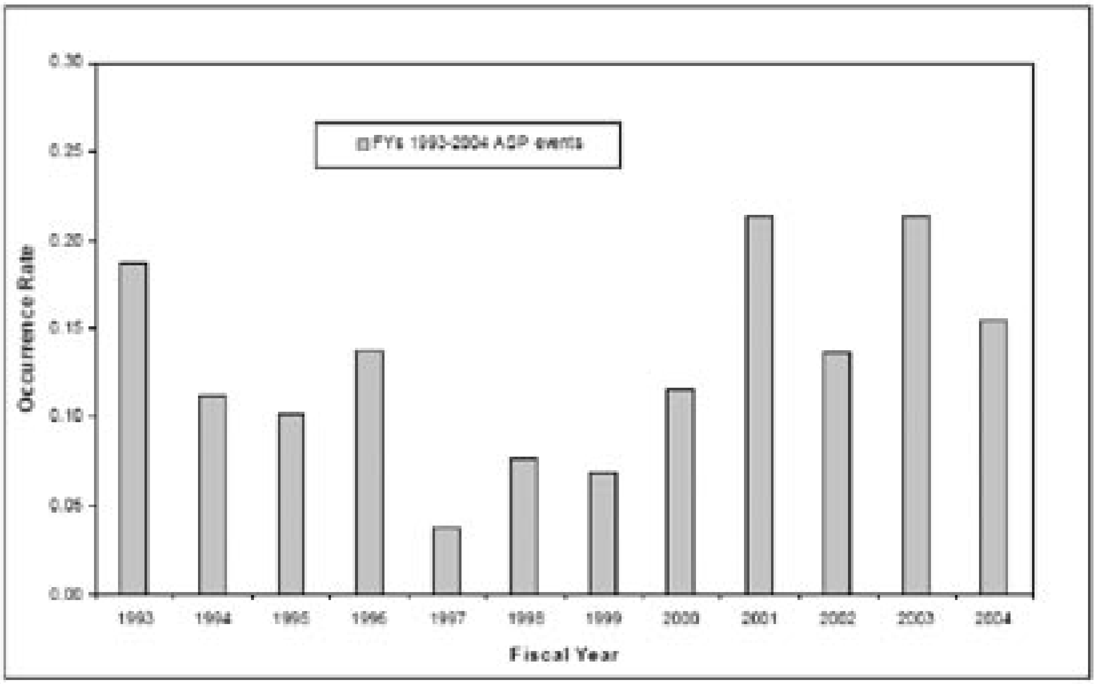
6/24/1996	LaSalle 2	Concrete Sealant Fouls Cooling Water Systems	7.00E-06
6/8/1994	Dresden 2	Improper Settings For Motor Control Center Trips	6.10E-06
8/14/2003	Indian Point 2	Loss Of Offsite Power Due To Northeast Blackout	6.00E-06
12/18/2001	Shearon Harris	Degraded Fire Barrier & Unavailable Safety Equipment	6.00E-06
10/8/2001	Shearon Harris	Both Trains Of Residual Heat Removal Unavailable	6.00E-06
4/23/2001	Surry 2	Emergency Diesel Generator Failed	6.00E-06
4/15/2001	Surry 2	Emergency Diesel Generator Failed	6.00E-06
6/24/1996	Arkansas 1	Loss Of Offsite Power	5.40E-06
5/15/2002	Nine Mile Point 1	Reactor Cooling System Leak Due To Corroded Piping	5.39E-06
8/2/2001	Quad Cities 2	Reactor Trip Due To Failure Of Main Power Transformer	5.00E-06
11/1/2000	Oconee 1	Potential Flooding If Pipe Ruptured In Seismic Event	5.00E-06
3/13/1993	Pilgrim	Loss Of Offsite Power	4.60E-06
5/3/1997	Oconee 3	Two High-Pressure Injection Pumps Were Damaged	4.30E-06
8/14/2003	FitzPatrick	Loss Of Offsite Power Due To Northeast Blackout	4.00E-06
3/7/2003	Nine Mile Point 1	Unavailability Of Cooling System Due To Degraded Piping	4.00E-06
2/26/2003	Kewaunee	Both Emergency Diesel Generators (EDGs) Unavailable	4.00E-06
4/16/2002	Braidwood 1	Inoperable Power Operated Relief Valve Bleed Path	4.00E-06
8/3/2001	Arkansas 1	Inadequate Fire Protection For The Switch Gear Room	4.00E-06
11/1/2000	Oconee 3	Potential Flooding If Pipe Had Ruptured In Seismic Event	4.00E-06
11/1/2000	Oconee 2	Potential Flooding If Pipe Had Ruptured In Seismic Event	4.00E-06
1/16/1990	Dresden 2	Loss Of Offsite Power	3.40E-06
8/4/1994	Dresden 2	Unavailability Of High-Pressure Coolant Injection. (HPCI)	3.10E-06
5/5/2004	Dresden 3	Loss Of Off Site Power Due To Breaker Malfunction	3.00E-06
1/30/2004	Dresden 3	HPCI Potentially Unavailable	3.00E-06
1/30/2004	Dresden 2	HPCI Potentially Unavailable	3.00E-06
9/15/2003	Peach Bottom 3	Loss Of Off Site Power & EDG Unavailable Relief Valve	3.00E-06
3/25/2003	Palisades	Loss Of Off Site Power And Loss Of Shutdown Cooling	3.00E-06
7/1/2002	Hope Creek 1	Station Service Water Train "A" Traveling Screen Failed	3.00E-06
5/30/2002	Oconee 3	Unavailability Of HPI Pump During LOOP or HELB	3.00E-06
4/23/2001	Dresden 3	Alert Declared, Loss Of Containment Cooling & Manual Trip	3.00E-06
7/5/2001	Dresden 3	HPCI Inoperable Due To Water Hammer Event	3.00E-06
4/23/2001	Surry 1	Emergency Diesel Generator Failed	3.00E-06
3/28/2001	Fermi 2	Emergency Diesel Generator Was Inoperable > 7days	3.00E-06
2/23/2001	Limerick 2	Manual Trip Due To Main Steam Relief Valve Failed	3.00E-06
9/1/1996	Haddam Neck	Seized RHR Pump Was Vulnerable To Failure Since 1987	2.90E-06
3/16/2004	Peach Bottom 3	HPCI Unavailable Due To Failed Flow Controller	2.00E-06
9/29/2003	Waterford 3	Degraded EDG Due To Failed Fuel Line	2.00E-06
3/6/1996	McGuire 2	Emergency Diesel Generator Declared Inoperable	1.80E-06
11/3/1994	Turkey Point 3	Reactor Electrical Load Sequencers Periodically Inoperable	1.80E-06
1/3/1994	Turkey Point 4	Reactor Electrical Load Sequencers Periodically Inoperable	1.80E-06
2/12/1998	Oconee 1	Refueling Water Storage Tank Errors Impair Core Cooling	1.70E-06
2/12/1998	Oconee 2	Refueling Water Storage Tank Errors Impair Core Cooling	1.70E-06
2/12/1998	Oconee 3	Refueling Water Storage Tank Errors Impair Core Cooling	1.40E-06
7/24/2002	Seabrook	Reactor At Full Power With Emergency Diesel Inoperable	1.30E-06

4/6/2001	LaSalle 2	Feed Water Pumps Trip And Reactor Scram	1.30E-06
11/3/2003	Surry 2	Potential Loss Of RCP Seal Cooling Due To Postulated Fire	1.00E-06
11/3/2003	Surry 1	Potential Loss Of RCP Seal Cooling due To Postulated Fire	1.00E-06
9/2/2003	Perry 1	Emergency Service Water Pump "A" Failure	1.00E-06
5/20/2003	Oyster Creek	Loss Of Emergency Bus due to Fault In Underground Cable	1.00E-06
4/24/2003	Grand Gulf	Loss Of Off Site Power & Loss Of Instrument Air	1.00E-06
9/11/2001	Palisades	Potential Unavailability Of Safety Equipment During Fire	1.00E-06
7/27/2001	Palisades	Smoke Detectors Were Never Installed In The Cable Room	1.00E-06
11/1/2000	Prairie Island 2	Loss Of Offsite Power And Degraded Cooling Water Pumps	1.00E-06
11/1/2000	Prairie Island 1	Loss Of Offsite Power And Degraded Cooling Water Pumps	1.00E-06

Greenpeace has documented nearly 200 precursors to meltdowns at U.S. nuclear plants since the Chernobyl Accident. The reactors that have experienced the most near misses in the past twenty years include:[61]

REACTOR	OWNER	NEAR MISSES	LOCATION	STATE
DC Cook 1	Indiana/ Michigan Power	6	11 miles S of Benton Harbor	MI
Dresden 3	Exelon	6	9 miles E of Morris	IL
Oconee 2	Duke Energy Nuclear LLC	6	30 miles W of Greenville	SC
Oconee 3	Duke Energy Nuclear LLC	6	30 miles W of Greenville	SC
St. Lucie 1	Florida Power & Light	6	12 miles SE of Ft. Pierce	FL
DC Cook 2	Indiana/ Michigan Power	5	11 miles S of Benton Harbor	MI
Oconee 1	Duke Energy Nuclear LLC	5	30 miles W of Greenville	IL
Dresden 2	Exelon	4	9 miles E of Morris	IL
Shearon Harris	Carolina Power & Light	4	20 miles SW of Raleigh	NC
Haddam Neck	Northeast Utilities	4	13 miles E of Meriden	CT
Seabrook	FPL Energy	4	13 miles S of Portsmouth	NH

The NRC’s latest annual analysis of accident precursors reviewed the past decade of events but fails to document any trends in these nuclear “near misses.”



[62]

Figure 1: Total Precursors– occurrence rate, by fiscal year. No trend line is shown because no trend was detected that was statistically significant (p-value = 0.1016). FY 2004 results include preliminary data and are subject to change.

However it is interesting to note that prior to imposition of the new oversight process in 2000, the NRC identified a statistically significant declining trend in accident precursors.

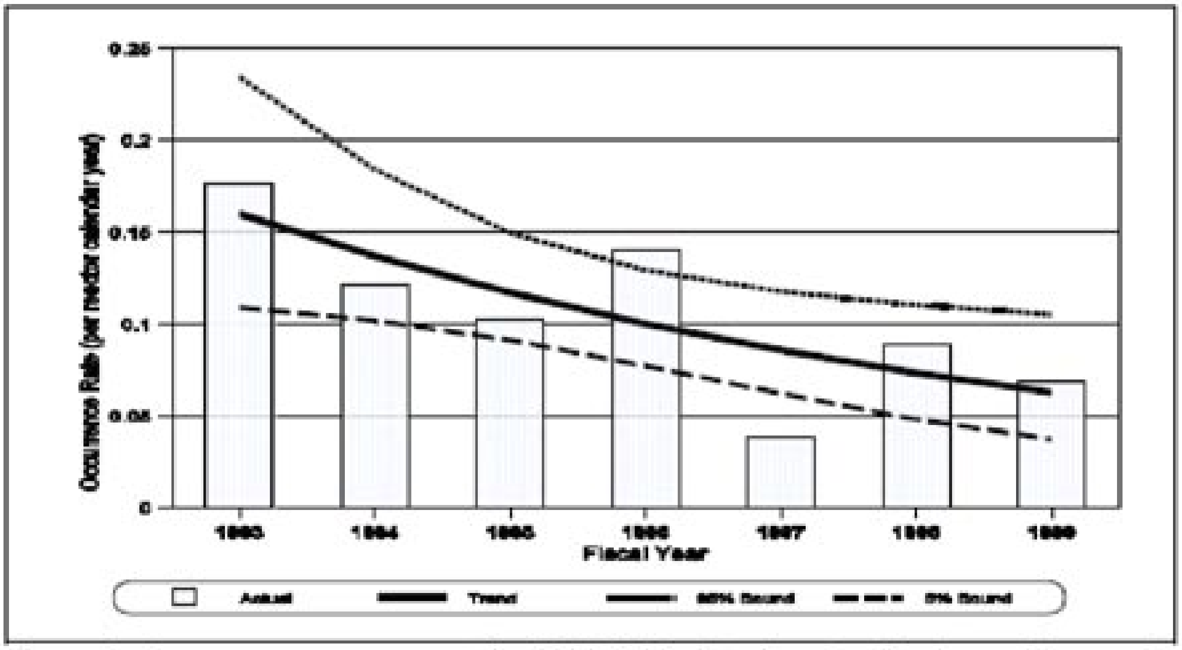


Figure 1. Precursor occurrence rate for 1993-1999 plotted against fiscal year. The trend is statistically significant (p-value = 0.0068). The result for 1999 is preliminary. [63]

Unfortunately the NRC’s annual reports to the Commission on the Accident Sequence Precursor program do not address this increase in

the total number of precursors since 2000. While it is not possible to attribute the reversal of the declining trend of near misses to the new oversight process, it is worth reiterating that 70% of the NRC staff did not believe the new oversight process would catch declining performance “before a significant reduction in safety margins.” [64]

The accident precursors identified by the NRC since 2000 have proven that the staff was right.

+ "Near Misses" & Questionable Containments

Of the over 200 near misses that occurred at U.S. reactors since Chernobyl, at least 56 precursors have occurred at reactors with questionable containments.

DATE	REACTOR	DESCRIPTION	RISK	TYPE
6/13/1986	Catawba 1	Small Break Loss Of Coolant Accident	3.00 E-03	ICE
2/6/1996	Catawba 2	Loss Of Offsite Power (LOOP)	2.10 E-03	ICE
10/22/1999	DC Cook 1	Potential High-Energy Line Break (HELB)	4.50E-04	ICE
10/22/1999	DC Cook 2	Potential High-Energy Line Break (HELB)	4.50E-04	ICE
4/23/1991	Vermont Yankee	Loss Of Offsite Power	2.90E-04	GE
2/11/1991	McGuire 1	Loss Of Offsite Power	2.60E-04	ICE
2/11/1991	McGuire 2	Loss Of Offsite Power	2.60E-04	ICE
1/26/2000	Hatch 1	Automatic Scram With Complications	2.50E-04	GE
12/31/1992	Sequoyah 1	Loss Of Offsite Power And Dual Unit Reactor Trip	1.80E-04	ICE
12/31/1992	Sequoyah 2	Loss Of Offsite Power And Dual Unit Reactor Trip	1.80E-04	ICE
2/25/1993	Catawba 1	Potentially Unavailability Of Essential Service Water	1.50E-04	ICE
2/25/1993	Catawba 2	Potentially Unavailability Of Essential Service Water	1.50E-04	ICE
9/14/1993	LaSalle 1	Reactor Scram Complicated By Loss Of Offsite Power	1.30E-04	GE
3/26/1993	Perry	Clogged Suppression Pool Strainers	1.20E-04	GE
10/30/1991	Pilgrim	Loss Of Offsite Power Due To Severe Weather	1.20E-04	GE
12/27/1993	McGuire 2	Reactor Trip And Loss Of Offsite Power	9.30E-05	ICE
5/3/1992	Oyster Creek	Loss Of Offsite Power Due To A Forest Fire	7.10E-05	GE
5/18/1989	Oyster Creek	Loss Of Offsite Power	7.10E-05	GE
4/22/1993	Quad Cities 2	Both Emergency Diesel Generators Degraded	6.00E-05	GE
12/30/1999	DC Cook 1	Valves Required Post-Accident Could Fail To Open	5.70E-05	ICE
12/30/1999	DC Cook 2	Valves Required Post-Accident Could Fail To Open	5.70E-05	ICE
6/11/1999	DC Cook 1	Emergency Service Water Inoperable In Seismic Event	5.20E-05	ICE
6/11/1999	DC Cook 2	Emergency Service Water Inoperable In Seismic Event	5.20E-05	ICE
9/12/1995	DC Cook 1	Safety Injection Unavailable For 6 Months Of Operation	3.70E-05	ICE
8/14/2003	Perry	Loss Of Offsite Power Due To Northeast Blackout	3.00E-05	GE
5/15/1996	Dresden 3	Feed Water Valve Failed & Reactor Scram On Low Water	2.60E-05	GE
7/15/1998	DC Cook 1	Potential High-Energy Line Break Affecting Safety Systems	2.20E-05	ICE
7/15/1998	DC Cook 2	Potential High-Energy Line Break Affecting Safety Systems	2.20E-05	ICE
8/14/2003	Nine Mile Point 2	Loss Of Offsite Power Due To Northeast Blackout	2.00E-05	GE
8/14/2003	Nine Mile Point 1	Loss Of Offsite Power Due To Northeast Blackout	2.00E-05	GE
8/14/2003	Fermi 2	Loss Of Offsite Power Due To Northeast Blackout	2.00E-05	GE
9/11/1995	Limerick 1	Reactor Trip & Clogging of the Suppression Pool Strainers	1.30E-05	GE
3/25/1989	Dresden	Loss Of Offsite Power	1.30E-05	GE
9/3/2001	La Salle 2	Reactor Trip	1.00E-05	GE
8/29/2001	DC Cook 1	Both Unit 2 EDGs Inoperable	1.00E-05	ICE
8/13/1991	Nine Mile Point 2	Site Emergency Due To Electrical Fault & Shutdown	1.00E-05	GE
8/29/2001	DC Cook 2	Both Unit 2 EDGs Inoperable	7.00E-06	ICE
6/24/1996	LaSalle 1	Concrete Sealant Fouls Cooling Water Systems	7.00E-06	GE
6/24/1996	LaSalle 2	Concrete Sealant Fouls Cooling Water Systems	7.00E-06	GE
6/8/1994	Dresden 2	Improper Settings For Motor Control Center Trips	6.10E-06	GE

DATE	REACTOR	DESCRIPTION	RISK	TYPE
5/15/2002	Nine Mile Point 1	Reactor Cooling System Leak Due To Corroded Piping	5.39E-06	GE
8/2/2001	Quad Cities 2	Reactor Trip Due To Failure Of Main Power Transformer	5.00E-06	GE
3/13/1993	Pilgrim	Loss Of Offsite Power	4.60E-06	GE
8/14/2003	FitzPatrick	Loss Of Offsite Power Due To Northeast Blackout	4.00E-06	GE
3/7/2003	Nine Mile Point 1	Unavailability Of Cooling System Due To Degraded Piping	4.00E-06	GE
1/16/1990	Dresden 2	Loss Of Offsite Power	3.40E-06	GE
8/4/1994	Dresden 2	Unavailability Of High-Pressure Coolant Injection. (HPCI)	3.10E-06	GE
5/5/2004	Dresden 3	Loss Of Off Site Power Due To Breaker Malfunction	3.00E-06	GE
1/30/2004	Dresden 3	HPCI Potentially Unavailable	3.00E-06	GE
1/30/2004	Dresden 2	HPCI Potentially Unavailable	3.00E-06	GE
9/15/2003	Peach Bottom 3	Loss Of Off Site Power and EDG Unavailable	3.00E-06	GE
7/5/2001	Dresden 3	HPCI Inoperable Due To Water Hammer Event	3.00E-06	GE
3/28/2001	Fermi 2	Emergency Diesel Generator Was Inoperable > 7days	3.00E-06	GE
2/23/2001	Limerick 2	Manual Trip Due To Main Steam Relief Valve Failed	3.00E-06	GE
3/16/2004	Peach Bottom 3	HPCI Unavailable Due To Failed Flow Controller	2.00E-06	GE
3/6/1996	McGuire 2	Emergency Diesel Generator Declared Inoperable	1.80E-06	ICE

In the chart above, those reactors that were designed with the General Electric Mark I & Mark II pressure suppression containments are designated as GE. While the Westinghouse reactors that use the Ice Condenser containments are designated as ICE.

While the NRC can have little confidence that any containment could withstand a meltdown, those General Electric and Westinghouse reactors that incorporate the pressure suppression containment design with small volume containment are virtually certain to release the radiation resulting from a meltdown.[65]

+ The MYTH of CONTAINMENT

For a reactor accident to have Chernobyl like consequences a meltdown must be accompanied by containment failure. Unfortunately the term "containment" belies the facts. The public interest community has long been aware that the containments around many of the US reactors are more myth than reality.[66]

As early as 1971, government regulators knew that the public's last line of defense against the radiation, the reactor containment, was virtually worthless yet licensed the General Electric (GE) and Westinghouse Ice Condenser reactors anyway. When an Atomic Energy Commission's (AEC) staff member suggested that this type of containment design be banned in the U.S. the AEC'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 unlicensable the GE and Westinghouse ice condenser plants now in review and would generally create more turmoil than I can think about."[67] (See Appendix B.)

Of course the nuclear bureaucrats did not want to reveal the truth about the fallibility of the nuclear reactors they had already licensed as "safe" and attempted to withhold the information from the public.

September 25, 1972

Note to John F. O'Leary

With regard to the attached, Steve's idea to [redacted] Dry containments have the notable advantage of brute simplicity in dealing with a primary blowdown, and are thereby free of the perils of bypass leakage.

However, the acceptance of pressure suppression containment concepts by all elements of the nuclear field, including Regulatory and the ACRS, is firmly imbedded in the conventional wisdom. [redacted]

Joseph M. Hendrie

Only though the efforts of the Union of Concerned Scientists, their attorneys and those at Public Citizen did the information eventually come to light under the Freedom of Information Act.

September 25, 1972

Note to John F. O'Leary

With regard to the attached, Steve's idea to ban pressure suppression containment schemes is an attractive one in some ways. Dry containments have the notable advantage of brute simplicity in dealing with a primary blowdown, and are thereby free of the perils of bypass leakage.

However, the acceptance of pressure suppression containment concepts by all elements of the nuclear field, including Regulatory and the ACRS, is firmly imbedded in the conventional wisdom. Reversal of this hallowed policy, particularly at this time, could well be the end of nuclear power. It would throw into question the continued operation of licensed plants, would make unlicensable the GE and Westinghouse ice condenser plants now in review, and would generally create more turmoil than I can stand thinking about.

Joseph M. Hendrie

In 1986 Harold Denton, former director of NRC's Office of Nuclear Reactor Regulation, again 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." [68]

NRC's revelations concerning the Westinghouse Ice condenser containments are equally disturbing. Recent safety studies conducted by Sandia National Laboratories for the NRC concluded that these Westinghouse reactors would be extremely vulnerable to severe accidents, such as a station blackout; the loss of both off-site and on-site power. Sandia's calculations showed that the ice condenser containment building would offer essentially no protection--the building would almost certainly rupture immediately after the meltdown.[69]

According to Kenneth Bergeron, who conducted the Sandia Labs analysis of the Westinghouse containments:

> I personally resisted pressure to whitewash the issues for four years...I think the IC (Ice Condenser) report underestimates the safety issues substantially. Time and time again, the project staff were asked to look into issues in greater detail if there seemed a possibility that the details would reveal a rosier picture, and time and time again other issues that might yield evidence of additional problems were glossed over.[70]

However, it's not only the GE and Westinghouse designs that are more sieve than shield. In a draft 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." [71]

Although this sentence was deleted from the final version of the report, 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." [72]

The chart below lists those reactors that use the GE Mark I and Mark II and the Westinghouse Ice Condenser containments.[73]

NUCLEAR REACTORS WITH QUESTIONABLE CONTAINMENTS

General Electric Mark I Reactors Licensed to Operate in the U.S.[74]

REACTOR	OWNER/OPERATOR	STATE
Browns Ferry 1	Tennessee Valley Authority	AL
Browns Ferry 2	Tennessee Valley Authority	AL
Browns Ferry 3	Tennessee Valley Authority	AL
Brunswick 1	Carolina Power & Light	NC
Brunswick 1	Carolina Power & Light	NC
Cooper	Nebraska Public Power	NE
Dresden 2	Exelon	IL
Dresden 3	Exelon	IL
Duane Arnold	Nuclear Management Co.	IA
Fermi 2	Detroit Edison	MI
Fitzpatrick	Energy	NY
Hatch 1	Southern Company	GA

[CONTINUED]

REACTOR	OWNER/OPERATOR	STATE
Hatch 2	Southern Company	GA
Hope Creek	PSE&G Nuclear LLC	NJ
Monticello	Nuclear Management Co.	MN
Nine Mile Point 1	Constellation	NY
Oyster Creek	Amergen Energy Co.	NJ
Peach Bottom 2	Exelon	PA
Peach Bottom 3	Exelon	PA
Pilgrim	Entergy	MA
Quad Cities 1	Exelon	IL
Quad Cities 2	Exelon	IL
Vermont Yankee	Entergy	VT

General Electric Mark II Reactors Licensed to Operate in the U.S.[75]

REACTOR	OWNER/OPERATOR	STATE
Columbia	Energy Northwest	WA
LaSalle 1	Exelon	IL
LaSalle 2	Exelon	IL
Limerick 1	Exelon	PA
Limerick 2	Exelon	PA
Nine Mile Point 2	Constellation	NY
Susquehanna 1	PPL Susquehanna LLC	PA
Susquehanna 2	PPL Susquehanna LLC	PA

Westinghouse Ice Condenser Reactors Licensed to Operate in the U.S.[76]

REACTOR	OWNER/OPERATOR	STATE
Catawba 1	Duke Energy Nuclear LLC	SC
Catawba 2	Duke Energy Nuclear LLC	SC
Cook 1	Indiana/Michigan Power Co.	MI
Cook 2	Indiana/Michigan Power Co.	MI
McGuire 1	Duke Power	NC
McGuire 2	Duke Power	NC
Sequoyah 1	Tennessee Valley Authority	TN
Sequoyah 2	Tennessee Valley Authority	TN
Watts Bar	Tennessee Valley Authority	TN

Remarkably, the NRC and the nuclear industry seem to have either forgotten or failed to learn their lessons on containment. Former NRC Commissioner Forest Remick admonished the industry on this point back in the 1990's. Remick stated that:

> Right now the conceptual designs submitted to the NRC for review of the DOE-supported modular high temperature gas reactor and the modular liquid metal reactor do not include containment structures.... I am concerned that efforts to reduce cost may be causing designers to forget the lessons learned. Cost control is a legitimate engineering effort, but it must not be at the expense of prudent and adequate protection of public health and safety and the environment.[77]

While the containments on many U.S. reactors are questionable at best, that doesn't mean we should do away the notion of containing a nuclear accident all together. Yet that is precisely what the nuclear industry has done with some of the advanced nuclear reactor designs. According to the NRC Advisory Committee on Reactor Safeguards,

> ...in all three designs, absence of containment helps to make feasible one of the major safety advantages, passive systems for removing decay heat. In each case, the reactor vessel surroundings are designed so that air from outside the plant will flow by natural buoyancy through the reactor vessel cavity and thereby remove decay heat. This seems to be a highly effective heat transfer means if the reactor vessel and core are intact. If they are not, this ready supply of oxygen and access to the environment might be a problem. This seems to be a major safety trade-off.[78]

It remains to be seen whether the Commission, in its desire to license new reactors, will ignore the lessons of Chernobyl and license reactors with either questionable or non-existent containments.

+ CONCLUSIONS

Greenpeace has documented nearly 200 “near misses” at U.S. reactors since the Chernobyl disaster in 1986. Despite the claims of the nuclear industry and their allies at the U.S. Nuclear Regulatory Commission, an “American Chernobyl” is possible.

If any of these “near misses” had progressed to a meltdown the government has little confidence that any of the reactor containments could withstand the accident. A reactor meltdown followed by containment failure is an “American Chernobyl.”

Unfortunately, the NRC’s oversight process has repeatedly failed to identify those reactors that needed additional regulatory attention before poor performance devolved into a “near miss.” Even more disturbing is the fact that the NRC’s oversight process may not result in increased scrutiny even after the reactor experiences a “near miss.”

Greenpeace has documented over 50 “near misses” at reactors with questionable containments. If the “near miss” or accident precursor had progressed to a meltdown, the containments on these reactors almost certainly would have failed, releasing radiation into the environment and surrounding community.

As U.S. nuclear corporations contemplate building more nuclear reactors, it is important that our government regulators remember Chernobyl and speak honestly and forthrightly about the very real dangers posed by splitting atoms. Nuclear reactors are by their very nature inherently dangerous. Each reactor has the potential to devastate the state or region in which it operates. Unless the nuclear industry and the government regulators re-learn this lesson of Chernobyl more nuclear disasters are likely to follow.

Appendix A: NRC Response to Congress on Chernobyl Containment

QUESTION C.4. WHAT DO WE KNOW ABOUT RUSSIAN PRACTICE REGARDING SAFETY FEATURES SUCH AS CONTAINMENT VS. CONFINEMENT?

ANSWER.

UNIT 4 AT CHERNOBYL CONTAINS CHARACTERISTICS OF BOTH CONTAINMENT AND CONFINEMENT. THERE ARE TWO REGIONS THAT APPEAR TO BE DESIGNED TO WITHSTAND 27 PSI AND 57 PSI. THESE VOLUMES ARE IN TURN INTERCONNECTED WITH TWO SUPPRESSION POOLS VIA PRESSURE RELIEF VALVES AND DOWNCOMERS. THE REMAINING PORTIONS OF THE PLANT ARE HOUSED WITHIN A CONFINEMENT STRUCTURE. FOR PURPOSES OF THIS DISCUSSION, THE CONFINEMENT BUILDING CAN BE CONSIDERED AS A FILTRATION SYSTEM WITH LITTLE OR NO PRESSURE RETENTION CAPABILITY.

THE FIRST CONTAINMENT REGION, REFERRED TO AS THE REACTOR VAULT, IS SHOWN IN THE ENCLOSED FIGURES. IT SURROUNDS THE REACTOR AND PORTIONS OF THE INLET AND OUTLET WATER PIPING. THE DESIGN PRESSURE IS .18 MPA (27 PSI). AT LEAST TWO RELIEF VALVES CONNECT THIS REGION TO THE SUPPRESSION POOL(S). THE SETPOINT OF THESE VALVES IS .02 MPA (3 PSI). ENCLOSED PIPING CONSISTS OF RELATIVELY SMALL DIAMETER (I.E., 6 INCH DIAMETER) TUBING THEREBY ELIMINATING THE NEED FOR A HIGHER DESIGN PRESSURE.

RUSSIAN EVENT/ITT
05/05/86

+ Appendix A: NRC Response to Congress on Chernobyl Containment

QUESTION C.4. (CONTINUED) - 2 -

THE SECOND CONTAINMENT REGION ENCLOSES THE MAJOR DIAMETER PIPING AND HEADERS OF THE SYSTEM. THE LARGEST PIPE IN THIS VOLUME IS 90 CM (35 INCH) IN DIAMETER. THE BOUNDARY OF THE ENCLOSED VOLUME IS SHOWN IN THE ATTACHED FIGURE. THIS REGION HAS A DESIGN PRESSURE OF .35 MPA (57 PSI). DOWNCOMERS CONNECT THIS REGION TO THE SUPPRESSION POOLS. THE SUPPRESSION POOLS ARE ARRANGED ONE ON TOP OF THE OTHER, AS SHOWN IN THE ATTACHED FIGURE. EACH POOL REGION IS APPROXIMATELY EIGHT FEET HIGH WITH A POOL DEPTH OF ABOUT 4 FT.

WE ARE NOT AWARE OF ANY OVERHEAD SPRAY SYSTEMS OR DYNAMIC COOLING SYSTEMS INSIDE OF THE CONFINEMENT BUILDING SIMILAR TO THOSE USED IN U.S. LWRS.

✛ Appendix B: AEC's Attempt to Ban Pressure Supression Containment Designs

Appendix A

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

September 20, 1972

J. F. O'Leary, L
F. E. Kruesi, RO
L. Rogers, RS

Here is an idea to kick around. Please let me have your reactions.

S. H. Hanauer, DRTA

Enclosure

cc: E. G. Case, L
J. M. Hendrie, L
D. F. Knuth, L
R. L. Tedesco, L
V. Stello, L
G. Lainas, L

+ Appendix B: AEC's Attempt to Ban Pressure Supression Containment Designs

DRAFT

Pressure-Suppression Containments

1. Conclusions and Recommendations

Recent events have highlighted the safety disadvantages of pressure-suppression containments. While they also have some safety advantages, on balance I believe the disadvantages are preponderant. I recommend that the AEC adopt a policy of discouraging further use of pressure-suppression containments, and that such designs not be accepted for construction permits filed after a date to be decided (say two years after the policy is adopted).

2. Discussion

A pressure-suppression containment system has some means of absorbing the heat of vaporization of the steam in the fluid released to the containment volume. In all three GE models, the steam is forced to bubble through a pool of water and is condensed. In the Westinghouse design, the steam is condensed by flowing it over ice cubes. The objective is to reduce the pressure in the containment through "suppressing" the partial pressure of the steam by condensing it. To be effective, pressure suppression must take place concurrent with the flow of steam into the containment, and its effectiveness is therefore dependent on the rate at which steam is generated or released. If some unexpected event should result in steam generation or flow greater than the suppression capability, then the steam that is not condensed would add an increment of containment pressure. Since the objective of pressure suppression is to permit use of a smaller containment, rated at lower pressure than would be required without suppression, then incomplete suppression would lead to overpressurizing a pressure-suppression containment so designed.

It may be noted that the Stone and Webster "subatmospheric" design has little effect on the initial containment pressure rise due to an accident, and is therefore not a "pressure-suppression containment" for the present discussion. In this design, chilled water sprays are used to reduce the containment pressure, and therefore the containment leakage, quickly after a postulated LOCA. The pressure capability and volume are designed to take the full accident, without credit for condensation.

Like all containments, the pressure-suppression designs are required to include margins in capability. Experiments have been conducted by GE and Westinghouse to establish the rate of steam generation that can be accommodated. The pressure-suppression pools, ice condenser, etc., are then sized for the double-ended break steam flow, with margins for unequal distribution of steam to the many modular units of which the condenser is composed. The rate and distribution margins are probably adequate.

More difficult to assess is the margin needed when applying the experimental data to the reactor design. Recently we have reevaluated the 10-year-old GE test results, and decided on a more conservative interpretation than has been used all these years by GE (and accepted by us). We

2

✛ Appendix B: AEC's Attempt to Ban Pressure Supression Containment Designs

now believe that the former interpretation was incorrect, using data from tests not applicable to accident conditions.

We are requiring an independent evaluation of the ice condenser design and its bases to make less probable any comparable misinterpretation of this design.

Since the pressure-suppression containments are smaller than conventional "dry" containments, the same amount of hydrogen, formed in a postulated accident, would constitute a higher volume or weight percentage of the containment atmosphere. Therefore, such hydrogen generation tends to be a more serious problem in pressure-suppression containments. The small GE designs (both the light-bulb-and-doughnut and the over-under configurations) have to be inerted because the hydrogen assumed (per Safety Guide 7) would immediately form an explosive mixture. The GE Mod 3 and the Westinghouse ice condenser designs (they have equal volumes) require high-flow circulation and mixing systems to ensure even dilution of the hydrogen to avoid flammable mixtures in one or more compartments (see following for an additional serious disadvantage of this needed recirculation and its valves). By contrast, the dry containments only require recombination or purging starting weeks after the accident.

All pressure-suppression containments are divided into two (or more) major volumes, the steam flowing from one to the other through the condensing water or ice. Any steam that flows from one of these volumes to the other without being condensed is a potential source of unsuppressed pressure. Neither the strength nor the leakage rate of the divider (between the volumes) is tested in the currently approved programs for initial or periodic inservice testing. Some effort is now underway to devise a leakage test, but none has so far been accomplished.

Because of limited strength against collapse, the "receiving" volume has to be provided with vacuum relief. In all designs except GE Mod 111, this function is performed by a group of valves. Such a valve stuck open is a large bypass of the condensation scheme; the amount of steam that thus escapes condensation can overpressurize the containment.

Valves do not have a very good reliability record. Recently, five of the vacuum relief valves for the pressure-suppression containment of Quad Cities 2 were found stuck partly open. Moreover, these valves had been modified to include redundant "valve-closed" position indicators and testing devices, because of recent Reg concerns. The redundant position indicators were found not to indicate correctly the particular partly open situation that obtained on the five failed valves. We have only recently begun to pay serious attention to these valves, so previous surveillance programs have not generally included them. The GE Mod 111 design has an elegant water-leg seal that obviates the need for vacuum relief valves.

The high-capacity atmosphere recirculation systems provided for hydrogen mixing involve additional valves which, if open at the wrong time, would constitute a serious steam bypass and thus a potential source of containment

+ Appendix B: AEC's Attempt to Ban Pressure Supression Containment Designs

- 3 -

over-pressurization. These valves are large, and must open quickly and reliably when recirculation is needed. In other engineered safety features, no single valve is relied on for such service, yet redundancy has not been provided even for single failures, open and closed, of these valves. This is a serious mission, since opening at the wrong time leads to over-pressurization, while failure to open when needed inhibits recirculation.

The smaller size of the pressure-suppression containment, plus the requirement for the primary system to be contained in one of the two volumes, has led to overcrowding and limitation of access to reactor and primary system components for surveillance and in-service testing. Separate shielding of components has tended to subdivide into compartments the volume occupied by the primary system. (Some compartmentation of dry containments also occurs.) A pipe break in one of these compartments creates a pressure differential; each compartment must be designed to withstand this pressure. A method of testing such designs has not been developed.

What are the safety advantages of pressure suppression, apart from the cost saving. GE people talk about a decontamination factor of 30,000 from scrubbing of iodine out of the steam by the water. This is hard to swallow, but some decontamination undoubtedly occurs. One wonders why GE doesn't do an experiment to measure it, and get credit for it. The ice condenser decontamination is measurable but not significant.

Recirculation of the containment atmosphere through the ice has the potential for rapidly reducing the containment pressure by cooling its atmosphere. But in the present design there's not enough ice for that, so containment sprays are furnished (in both volumes), just as in dry containments. Recirculation through the water in the GE designs seems not to have been tried, but may be necessary in Mod 111 for hydrogen control. We have no analysis whether any significant cooling will result.

It is by no means clear that the pressure-suppression containments are, overall, significantly cheaper than dry containments when all costs are included. Information on this point would be useful in evaluating costs and benefits, and should be obtained.

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+ Appendix B: AEC's Attempt to Ban Pressure Supression Containment Designs

September 25, 1972

Note to John F. O'Leary

With regard to the attached, Steve's idea to [redacted] Dry containments have the notable advantage of brute simplicity in dealing with a primary blowdown, and are thereby free of the perils of bypass leakage.

However, the acceptance of pressure suppression containment concepts by all elements of the nuclear field, including Regulatory and the ACRS, is firmly imbedded in the conventional wisdom. [redacted]

Joseph M. Hendrie

+ Appendix B: AEC's Attempt to Ban Pressure Supression Containment Designs

Appendix B Z-21

Z-20

September 25, 1972

Note to John F. O'Leary

With regard to the attached, Steve's idea to ban pressure suppression containment schemes is an attractive one in some ways. Dry containments have the notable advantage of brute simplicity in dealing with a primary blowdown, and are thereby free of the perils of bypass leakage. Z-20

However, the acceptance of pressure suppression containment concepts by all elements of the nuclear field, including Regulatory and the ACRS, is firmly imbedded in the conventional wisdom. Reversal of this hallowed policy, particularly at this time, could well be the end of nuclear power. It would throw into question the continued operation of licensed plants, would make unlicensable the GE and Westinghouse ice condensor plants now in review, and would generally create more turmoil than I can stand thinking about.

Joseph M. Hendrie

✢ Appendix C: NRC's Information Notice on Chernobyl

LIS ORIGINAL

SSINS No.: 6835
IN 86-33

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

May 6, 1986

IE INFORMATION NOTICE NO. 86-33: INFORMATION FOR LICENSEE REGARDING THE CHERNOBYL NUCLEAR PLANT ACCIDENT

Addressees:

Fuel cycle licensees and Priority 1 material licensees.

Purpose:

The purpose of this notice is to provide background information only and requires no action on the part of recipients. The reference background information relates to the Chernobyl nuclear plant accident and is contained in the enclosed copy of Information Notice No. 86-32 sent to NRC nuclear power plant licensees on May 2, 1986.

Discussion:

As indicated by the enclosed information, radioactive material from the Chernobyl accident is expected to be detected in the continental United States through EPA environmental surveillance, perhaps as assisted by Department of Energy facilities and NRC-licensed nuclear power reactor sites. The level of activity in the United States is expected to be low and should have little, if any, impact on licensee monitoring programs. As stated in the enclosed notice, any anomalous detection of radioactive material should be evaluated in accordance with your license to assure that any detected materials are properly identified as to source (i.e., licensed activities or the Chernobyl Event).

If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC regional office, or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: L. Rouse, NMSS
427-4205

Attachments:
1. Information Notice 86-32
2. List of Recently Issued IE Information Notices

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PDR I&E Notice 86-0

+ Appendix C: NRC's Information Notice on Chernobyl

PRIORITY ATTENTION REQUESTED

SSINS No.: 6835
IN 86-32

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

Attachment 1
IN 86-33
May 6, 1986
Page 1 of 9

May 2, 1986

IE INFORMATION NOTICE NO. 86-32: REQUEST FOR COLLECTION OF LICENSEE RADIOACTIVITY MEASUREMENTS ATTRIBUTED TO THE CHERNOBYL NUCLEAR PLANT ACCIDENT

Addressees:

All nuclear power reactor facility licensees holding an operating license (OL) or construction permit (CP).

Purpose:

The purpose of this information notice is to update licensees of the recent Chernobyl nuclear power plant accident and to request voluntary reporting of any licensee environmental radioactivity measurement data probably caused by that event.

In order to enhance the Federal and state monitoring programs, all nuclear power reactor facilities with on-going environmental monitoring programs are requested to consider the NRC request to report confirmed anomalous environmental radioactivity measurements probably caused by radioactive material released in the accident at the Chernobyl nuclear power plant in the U.S.S.R. It is requested that recipients review the attached information and provide the environmental data discussed herein.

Description of Circumstances:

Information issued by the Environmental Protection Agency (EPA) concerning the recent reactor accident in Chernobyl, USSR is contained in Attachments 1, 2 and 3.

In the week following the accident at Chernobyl, elevated levels of radioactivity have been detected in air, rainwater, soil and food in many European countries. The radionuclides that have been detected in air in these countries include: I-131, Cs-137, Cs-134, Te-132, Ru-103, Mo-99, Np-239, and Nb-95. Although estimates of plume arrival time and location of entry into the continental United States are highly uncertain at this time, the plume may arrive in the Pacific Northwest United States during May 7-10, 1986.

Discussion:

It appears likely that radioactive material from the Chernobyl accident may arrive within the continental U.S. in concentrations that are readily detectable. In order to enhance nationwide environmental surveillance, the EPA (and some states) have increased the airborne monitoring sampling frequencies to be better able to detect any traces of the plume. In order to supplement and reinforce this state and federal nationwide surveillance program, the NRC licensees [as

~~[illegible]~~ 11pp.

+ Appendix C: NRC's Information Notice on Chernobyl

IN 86-32
May 2, 1986
Page 2 of 2

part of their routine Environmental Monitoring Program (EMP)] are requested to voluntarily provide the following information:

1. Report to the NRC any anomalous environmental radiation or radioactivity measurement that can be reasonably assumed to have resulted from the Chernobyl accident. These confirmed measurement results from the licensee's routine EMP should be telephonically reported to the NRC Operations Center (301-951-0550) within 24 hours of determining that material from the accident has been measured. (Environment air sampling probably is the most sensitive and thus most likely means of detecting the airborne materials. Some other less-sensitive potential means of detection may include personnel whole body counting equipment).

The reporting format should provide for:

1. Sample date(s) and approximate locations(s).
2. Medium or pathway (e.g., air particulate, air charcoal, milk).
3. Type of analysis (e.g., gross beta, iodine-131, other gamma emitter).
4. Statistical data (mean, range, number of samples).

Any data provided by NRC licensees will be shared with appropriate federal agencies. The NRC as part a combined Interagency Task Force is providing daily technical information reports to the Institute for Nuclear Power Operations (INPO). This updated technical information is available to member utilities through INPO's Nuclear Network system. Because the sensitivity and broad scope of existing licensee programs, augmentation of the NRC licensee EMPs is not necessary.

Any anomalous detection of radioactive material should be evaluated in accordance with facility license, technical specifications and applicable regulations to assure that the detected materials are properly identified as to source (e.g., either plant operations or the Chernobyl Event).

We appreciate your cooperation with us on this matter. If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC regional office, or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contacts: James E. Wigginton, IE
(301) 492-4967

Roger L. Pedersen, IE
(301) 492-9425

Attachments:
1. EPA Task Force Report (May 1, 1986)
2. Talking Points (April 30, 1986)
3. Fact Sheet (May 2, 1986)
4. List of Recently Issued IE Information Notices

✛ Appendix C: NRC's Information Notice on Chernobyl

EPA

Soviet Nuclear Accident

IN 86-32
May 2, 1986
Page 3 of

FOR RELEASE: 2:00 P.M., THURSDAY, MAY 1, 1986

A Task Force Report

CONTACT: DAVE COHEN
(202) 382-4355

On Tuesday, the Environmental Protection Agency, which maintains the nation's radiation monitoring network, increased its sampling frequency for airborne radioactivity to daily. Results obtained thus far show no increase in radioactivity above normal background levels. The Canadian air monitoring network has also increased its sampling frequency to daily. Results there show no increase in radioactivity.

The air mass containing the radioactivity from the initial Chernobyl nuclear event is now widely dispersed throughout northern Europe and Polar regions. Portions of radioactivity off the northwest Norwegian coast yesterday morning should continue to disperse with possible movement toward the east in the next several days. Other portions of the radioactive air mass may move eastward through the Soviet Union and through the Polar regions over the coming week.

The Soviets have reported they have smothered the fire. From our information it is not clear whether the fire is out or not. We also cannot confirm news reports of damage at a second reactor, but the second hot spot seen in the LANDSAT photos is not a reactor.

The U.S. Government has offered to provide technical assistance to the Soviet Government to deal with the accident. On Wednesday afternoon, a senior Soviet official from their Embassy in Washington delivered a note to the Department of State expressing appreciation for our offer of assistance and stating that for the time being, assistance is not needed.

At the present time, the U.S. Government has no data on radiation levels or contamination levels at any location within the Soviet Union. We also have no firm information concerning the number of casualties from the accident.

(more)

+ Appendix C: NRC's Information Notice on Chernobyl

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The Department of State is not advising against travel to the Soviet Union, Scandinavia and Eastern Europe. As a result of the nuclear accident, the State Department has issued a travel advisory recommending against travel to Kiev and adjacent areas. We are largely dependent on the Soviets for information on conditions within the USSR and we are doing everything possible to obtain relevant information from Soviet authorities. Americans planning travel to the Soviet Union and adjacent countries should carefully monitor press reports on this rapidly changing situation to make as fully informed a decision as possible with respect to their travel plans. They should bear in mind that many of these countries have reported increased levels of radiation in the environment.

The State Department Office of Legislative Affairs has commented that customary international law requires the Soviet Union to notify other States/Countries of the possibility of transboundary effects of the incident and to furnish them with the information necessary to address those effects.

The White House has established an Interagency Task Force to coordinate the Government's response to the nuclear reactor accident in Chernobyl. The Task Force is under the direction of Lee M. Thomas, Administrator of the Environmental Protection Agency, with representatives from the White House, Department of State, EPA, Department of Energy, Nuclear Regulatory Commission, National Oceanic and Atmospheric Administration, U.S. Air Force, Department of Agriculture, Food and Drug Administration, Federal Emergency Management Agency, Department of Interior, Federal Aviation Administration, the U.S. Public Health Service, and other agencies.

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✛ Appendix C: NRC's Information Notice on Chernobyl

IN 86-32
May 2, 1986

TALKING POINTS
CHERNOBYL NUCLEAR ACCIDENT
April 30, 1986

Page 5

o Late Friday, April 25, or early Saturday, April 26, a serious accident occurred at the Chernobyl nuclear facility near Kiev in the Soviet Union. As a result of an apparent loss of reactor coolant, the facility experienced a core meltdown, explosion, and fire. Causes of the accident are not known.

o The explosion and resulting fire released a plume of radioactive materials to the atmosphere. So long as the reactor core fire continues, radioactive gases will be given off.

o The facility involved is a graphite-moderated, boiling-water-cooled, pressure-tube unit. It is one of four such units at Chernobyl. To our knowledge, only this one unit, known as Unit #4, is involved in the accident.

o The initial plume traveled in a northwest direction toward Scandanavia. Predictions now suggest it will move in an eastward direction. Radiation levels above normal background have been detected in Scandanavian countries. However, these levels pose no significant risk to human health or the environment.

o The U.S. government has made an offer of technical assistance to the Soviets. This good faith offer was made out of genuine concern for the health and safety of the Soviet people. The Soviet government responded April 30 that no foreign assistance is needed.

o We have also requested specific information on the accident. To date, we have not received a full response to that request. This is also a matter of great concern to the United States.

o The radiation plume emitted as a result of the Chernobyl accident will disperse over time throughout the Northern Hemisphere. Eventually, some radioactive contamination will reach the United States. However, based on the limited information we now have, there is no reason to believe that levels reaching this country will pose any significant risk to human health or the environment. Please see the accompanying fact sheet on radiation health effects for basic information on exposure.

+ Appendix C: NRC's Information Notice on Chernobyl

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o It is very unlikely that any significant amounts of radiation from the accident will reach the U.S. during the next few days. The Environmental Protection Agency's Environmental Radiation Ambient Monitoring System -- ERAMS -- is conducting daily sampling throughout the nation. In addition to ambient air, the system also monitors radiation levels in drinking water, surface water, and milk.

o The White House has established an interagency task force to monitor the health, safety and environmental consequences of the Chernobyl accident. The task force is chaired by Lee Thomas, Administrator of the U.S. Environmental Protection Agency. Members represent the following federal agencies: EPA, DOE, NRC, NOAA, HHS, USDA, DOD, DOT and others. On a daily basis, the task force compiles, evaluates, and widely distributes current technical information on the Chernobyl accident and its environmental and health consequences.

✛ Appendix C: NRC's Information Notice on Chernobyl

Attachment 3
IN 86-33
May 2, 1986

Fact Sheet-Chernobyl
SOVIET NUCLEAR
ACCIDENT

FOR RELEASE: 2:00 P.M., FRIDAY, MAY 2, 1986

CONTACT: DAVE COHEN (202) 382-4355

Radiation monitoring networks in the United States and Canada are continuing to analyze for airborne radioactivity daily. No increases in radioactivity above normal background levels have been detected in either country. Canadian officials intend to increase the sampling frequency of their milk monitoring network, which consists of 16 stations near population centers in southern Canada, to weekly beginning next week.

It is believed that air containing radioactivity now covers much of Europe and a large part of the Soviet Union. The distribution of radioactivity is likely to be patchy. Air containing radioactivity detected by aircraft at 5000 feet about 400 miles west of northern Norway is believed to have moved westward and now appears to be heading south or southeastward perhaps to return to western Europe. There is no independent confirmation of the radioactivity in the air moving eastward across Asia.

(A weather map should be attached to today's Task Force Report. If you do not have a copy, it can be picked up in the EPA press office, room 311, West Tower, 401 M St., S.W. (202) 382-4355.)

Environmental monitoring data have been provided by the Swedish government for the Stockholm area for April 28-30. Extrapolations of those data suggest that radiation exposure levels at the Chernobyl site would have been in a range from 20 rem to hundreds of rem whole-body for the two-day period over which most of the radiation release probably took place. Radiation doses for the thyroid gland have been estimated to be in a range from 200 rem to thousands of rem for the same period. These doses are sufficient to produce severe physical trauma including death. It should be emphasized that these are estimates subject to considerable uncertainty. The U.S. has as yet no information from the Soviet Union as to actual radiation levels experienced at the accident site.

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