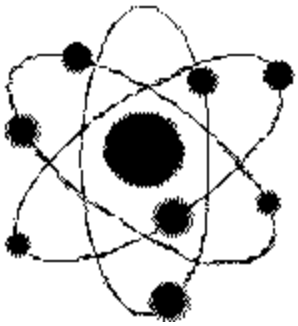
Amnesty Irrational

How the Nuclear Regulatory Commission Fails to Hold Nuclear Reactors Accountable for Violations of its Own Safety Regulations



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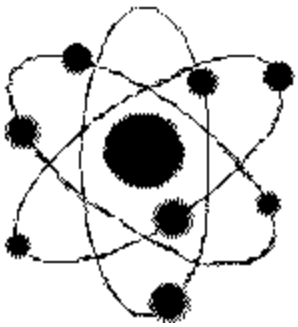

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This report is dedicated to the individuals and families of the National Nuclear Safety Network:
An association of whistleblowers and citizens that have risked both their lives and livelihoods to address significant safety issues at nuclear reactors across the U.S.

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Public Citizen is a nonprofit membership organization in Washington, D.C., dedicated to advancing consumer rights through lobbying, litigation, research, publications and information services. Since its founding by Ralph Nader in 1971, Public Citizen has fought for consumer rights in the marketplace, for safe and secure health, for fair trade, for clean and safe energy sources, and for corporate and government accountability. Critical Mass Energy Project is its energy policy group.

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Abuse of Discretion: NRC's Non-Enforcement Policy

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The design basis of a nuclear reactor is the starting point of all regulation. It is the safety and operational blue print for the nuclear reactor. If a reactor is operating "outside design basis" it is impossible for the Nuclear Regulatory Commission (NRC) or the utility to determine whether the reactor is "safe" or whether its operation poses an undue risk to public health and safety. Operating a reactor "outside design basis" constitutes a violation of NRC regulations.

If a utility has operated the reactor outside of the safety parameters established in its operating license, i.e. "outside design basis," it is required to document it in a daily event report filed with the NRC. The more event reports filed by a nuclear reactor, the less certain that the reactor and its safety systems will operate as designed.

Nuclear reactors across the United States have reported to the NRC that they have been splitting atoms while "outside design basis" and in violation of the terms and conditions of their operating licenses. Public Citizen has documented which reactors have most often reported operating while "outside design basis." From October 1996 through May 1999, 102 of 111 nuclear reactors have reported over 500 instances where they have been splitting atoms while "outside design basis."

Event reports filed with the NRC indicate that reactors operating "outside design basis" have undermined the NRC's regulatory philosophy of defense-in-depth. Rather than having multiple, redundant barriers to the release of radiation, i.e. defense-in-depth, reactors have failed to maintain their design basis for such safety significant systems as the emergency core cooling system and the electrical cables that control the nuclear reactor. Additionally, failure to maintain the design basis has led to instances where defense-in-depth has been so thoroughly undermined that a single event or condition could have prevented the functioning of safety systems needed to: shutdown the reactor, cool the radioactive fuel in the reactor core, prevent the release of any radiation into the environment or otherwise mitigate the consequences of an accident.

Many design basis problems have existed for years, if not decades. Some design basis problems date back to when the reactors were first licensed. Design basis deficiencies have reduced safety margins at nuclear reactors across the United States; in some cases safety margins were significantly reduced if not eliminated. However, every time the NRC has moved to address the problem, the nuclear industry lobby has intervened to block any meaningful attempt to correct inadequacies in the design basis of nuclear reactors.

Even before the NRC had documented the extent of the design basis problems in the nuclear industry, the regulator decided that nuclear reactor licensees would not be held accountable for violating NRC regulations. The NRC has re-written its enforcement policy to create an amnesty program that will last until March 30, 2001.

The NRC's amnesty program has severely circumscribed its ability to take enforcement action (issuing a fine and or violation) against nuclear utilities that have failed to maintain the design basis of their nuclear reactors. This amnesty means that the NRC will only hold utilities accountable for the most egregious violations of NRC regulations.

The U.S. Nuclear Regulatory Commission has long been aware that nuclear utilities have failed to adequately maintain their design basis and as a consequence, have operated their reactors "outside design basis" and in violation of the terms of their licenses. Over a span of decades, the NRC was repeatedly put on notice that design basis problems were under-mining the safety of the nuclear reactors they were supposed to regulate. However, due to the potential financial impact on the nuclear industry, the NRC has obfuscated the issue and delayed taking action.

Design basis issues have already contributed to the closure of three nuclear reactors: Haddam Neck, Maine Yankee and Millstone Unit 1. Public Citizen has found that several of the design basis issues that contributed to the closure of Haddam Neck, Maine Yankee and Millstone Unit 1 exist at other nuclear reactors.

The design basis issues that eventually resulted in these shutdowns were not identified by the utility. These problems only came to light when driven by events, whistleblower allegations or subsequent NRC inspections. The NRC design inspections turned up significant safety problems; however, the efficacy of these inspections must be questioned. NRC did not inspect the "as found" conditions of the nuclear reactors. The NRC warned the utilities which systems would be inspected and the utilities worked the systems prior to NRC inspection.

The NRC can not reasonably expect the utility to identify design basis problems that would jeopardize future operation of the reactor. The NRC's amnesty program is an irrational move by an ineffective regulator and will not address the significant design basis issues that still exist at nuclear reactors across the United States.

INTRODUCTION

Nuclear utilities across the United States have been reporting to the Nuclear Regulatory Commission that their reactors have been splitting atoms while "outside design basis" and in violation of the terms and conditions of their operating licenses. Rather than hold these utilities accountable, the NRC instituted an amnesty program in October 1996. This amnesty program means that utilities will only be held accountable for the most egregious violations of NRC regulations

Since that time, Public Citizen has been documenting which reactors have most often operated while "outside design basis." From October 1996 through May 1999, 102 of 111 nuclear reactors have reported over 500 instances where they have been operating "outside design basis." However, if a nuclear reactor is splitting atoms while "outside design basis" neither the NRC nor the utility can determine whether that operation is safe or poses an undue risk to public health and safety.

Public Citizen's report identifies those reactors that have most often operated outside of their design basis and documents how the nuclear industry and the NRC have ignored this important safety issue for decades.

I. FINDINGS

The U.S. Nuclear Regulatory Commission (NRC) is charged with assuring that the public health and safety are protected from the consequences of a nuclear reactor accident. The NRC contends that if a nuclear reactor is designed, constructed and operated in compliance with its approved design, then the redundant safety systems built into the plant will provide an adequate level of safety even if one of the safety systems should fail and an accident were to occur. According to the NRC, the redundant safety systems built into the reactor will prevent the release of radiation into the environment and surrounding communities.

The design basis of a nuclear reactor is the starting point of all NRC regulation. It is the safety and operational blue print for the nuclear reactor. If a reactor is operating "outside design basis" it is impossible for the NRC or the utility to determine whether the reactor is "safe" or whether its operation poses an undue risk to public health and safety. Operating a reactor "outside design basis" constitutes a violation of NRC regulations.
If a utility has operated the reactor outside of the safety parameters established in its operating license, i.e. "outside design basis," it is required to document it in a daily event report filed with the NRC. The more event reports filed by a nuclear reactor, the less certain that the reactor and its safety systems will operate as designed.

Operating nuclear reactors outside their design basis has reduced, if not eliminated safety margins at many reactors across the United States. However, the NRC has failed to hold nuclear reactors accountable for these violations. Rather than holding nuclear utilities responsible for failing to comply with their design basis and violating NRC regulations, the NRC issued an amnesty program in October 1996 that will last until March 30, 2001.

Public Citizen has scoured the daily event reports filed over the past three years of NRC amnesty program documenting those reactors that have reported operating "outside design basis." Over the past three years 102 of 111 nuclear reactors have reported over 500 times that they have been splitting atoms while "outside design basis." The NRC has attempted to down play the significance of this problem that they and the nuclear industry have ignored for decades. This amnesty program means that the NRC will only hold utilities accountable for the most egregious violations of NRC regulations. The NRC policy is not sound regulatory practice, its Amnesty Irrational!

TABLE I
REACTORS REPORTING "OUTSIDE DESIGN BASIS" 1996 -1999

Reactor	Unit	Owner	State	Reports
VERMONT YANKEE	1	VT Yankee Nuclear Power Corp.	VT	42
PILGRIM	1	Boston Edison Co.	MA	27
THREE MILE ISLAND	1	GPU Nuclear Corp.	PA	26
COOK	2	Indiana/Michigan Power Co.	MI	22
COOK	1	Indiana/Michigan Power Co.	MI	18
POINT BEACH	1	Wisconsin Electric Power Co.	WI	18
POINT BEACH	2	Wisconsin Electric Power Co.	WI	18
MILLSTONE	1	Northeast Nuclear Energy Co.	CT	16
OYSTER CREEK	1	GPU Nuclear Corp.	NJ	16
MILLSTONE	3	Northeast Nuclear Energy Co.	CT	16
PRAIRIE ISLAND	1	Northern States Power Co.	MN	14
CATAWBA	2	Duke Power Co.	SC	14
DIABLO CANYON	2	Pacific Gas & Electric Co.	CA	14
NINE MILE POINT	2	Niagara Mohawk Power Corp.	NY	14
HADDAM NECK	1	Northeast Nuclear Energy Co.	CT	13
PRAIRIE ISLAND	2	Northern States Power Co.	MN	13
OCONEE	3	Duke Power Co.	SC	12
DIABLO CANYON	1	Pacific Gas & Electric Co.	CA	11
OCONEE	2	Duke Power Co.	SC	11
CATAWBA	1	Duke Power Co.	SC	10
DAVIS-BESSE	1	Toledo Edison Co.	OH	10
NINE MILE POINT	1	Niagara Mohawk Power Corp.	NY	10
OCONEE	1	Duke Power Co.	SC	10
PALISADES	1	Consumers Power Co.	MI	10
INDIAN POINT	3	New York Power Authority	NY	10
INDIAN POINT	2	Consolidated Edison Co.	NY	9

(NOTE: the entire list is contained in Appendix A. The entire text for each report may be view on the Critical Mass Web site @ http://www.citizen.org/cmep/AI/Default.htm)

Since NRC began its amnesty program, the nuclear reactors listed in Table I have filed the greatest number of event reports with the Commission indicating that they operated "outside design basis." The more event reports filed by a reactor the less certain that the nuclear plant and its safety systems will function as designed.

Table II indicates those nuclear plants that have most often operated their reactors "outside design basis" and in violation of NRC regulations. Nuclear plants have between one and three reactors or units located at the same site. For instance, the Cook nuclear plant consists of two reactors, Unit 1 and 2.

While the number of "outside design basis" event reports indicate the extent of the problem, they do not tell the entire story. Even a single instance of a nuclear reactor operating outside of its design basis can thoroughly undermine the "safety" of the reactor.

TABLE II
"OUTSIDE DESIGN BASIS" BY NUCLEAR PLANT 1996-1999

Reactor	Owner	State	Event Report
VERMONT YANKEE	VT Yankee Nuclear Power	VT	42
MILLSTONE	Northeast Nuclear Energy Co.	CT	35
PILGRIM	Boston Edison Co.	MA	27
THREE MILE ISLAND	GPU Nuclear Corp.	PA	26
NINE MILE POINT	Niagara Mohawk Power Corp.	NY	24
COOK	Indiana/Michigan Power Co.	MI	23
POINT BEACH	Wisconsin Electric Power Co.	WI	20
INDIAN POINT	Con-Edison Co./ NYPA	NY	19
OYSTER CREEK	GPU Nuclear Corp.	NJ	16
PRAIRIE ISLAND	Northern States Power Co.	MN	16
DIABLO CANYON	Pacific Gas & Electric Co.	CA	14
CATAWBA	Duke Power Co.	SC	14
OCONEE	Duke Power Co.	SC	13
HADDAM NECK	Northeast Nuclear Energy Co.	CT	13
PALISADES	Consumers Power Co.	MI	10
DAVIS-BESSE	Toledo Edison Co.	OH	10

(NOTE: The entire listing arranged by nuclear plant is contained in Appendix B. Appendix C contains an accounting of all "outside design basis" event reports.)

The more than 500 event reports documented by Public Citizen all concern design basis issues. More than 70 additional reports of reactors operating "outside design basis" were filed with NRC and later retracted by the utility. However, retracted does not mean there wasn't a problem. Event reports have been retracted because utilities have either made "quick fixes," removed the documentation from the final safety analysis reports, or have amended the terms of their license. Other reports were retracted because the utilities originally mischaracterized the nature or extent of the problem that they thought placed the reactor "outside design basis."

Table III lists those few nuclear reactors that have not reported splitting atoms while "outside design basis." However, the NRC has identified that Fermi Unit 2 and both of the LaSalle reactors have failed to update their final safety analysis reports (FSAR). While failure to update the FSAR does not necessarily result in the reactor operating outside of its design basis, it does mean that these reactors have been making safety decisions based upon incomplete or inaccurate information.

TABLE III
REACTORS NOT REPORTING "OUTSIDE DESIGN BASIS"

Reactor	Unit	Owner	State
ARKANSAS	1	Entergy Operations, Inc.	AR
FERMI	2	Detriot Edison Co.	MI
HATCH	2	Southern Nuclear Operating Co.	GA
LA SALLE	1	Commonwealth Edison Co.	IL
LA SALLE	2	Commonwealth Edison Co.	IL
PALO VERDE	3	Arizona Public Service Co.	AZ
RIVER BEND	1	Entergy Operations, Inc	LA
WASHINGTON	2	Washington Public Power System	WA
WATTS BAR	1	Tennessee Valley Authority	TN

"Outside design basis" event reports filed by utilities indicate that serious problems with safety systems have existed for years, if not decades. These reports indicate that reactors operating "outside design basis" have undermined the NRC's regulatory philosophy of "defense-in-depth." Rather than having multiple, redundant barriers to the release of radiation, i.e. defense-in-depth, reactors have failed to maintain their design basis for significant safety systems such as the emergency core cooling system and the electrical cables that control the nuclear reactor.

Additionally, failure to maintain the design basis has led to instances where defense-in-depth has been so thoroughly undermined that a single event or condition could have prevented the functioning of safety systems needed to: shutdown the reactor, cool the radioactive fuel in the reactor core, prevent the release of any radiation into the environment or otherwise mitigate the consequences of an accident.

Although not every design basis issue is of high safety significance, a preliminary review by the NRC's now defunct Office of Analysis and Evaluation of Operational Data (AEOD) conducted in June 1997 found that:

- 34% of all event reports contained design basis issues.
- 42% of these events involved four risk significant systems: emergency core cooling, primary reactor systems, emergency ac/dc power and containment isolation.
- 29% of event reports were judged by AEOD to be significant.[1]

Design basis issues have already contributed to the closure of three nuclear reactors: Haddam Neck, Maine Yankee and Millstone Unit 1. The design basis issues that eventually resulted in these shut downs were not identified by the utility. These problems only came to light when driven by events, whistleblower allegations or subsequent NRC inspections. Public Citizen has found that several of the design basis deficiencies that contributed to these shut downs exist at other reactors. Specifically, design basis deficiencies concerning the ECCS,

inadequate separation of control cables and "single failure vulnerabilities" which are all discussed below.

EMERGENCY CORE COOLING SYSTEM PROBLEMS

There are two purposes of the Emergency Core Cooling Systems (ECCS). The first is to provide cooling to the reactor core to prevent a meltdown following a loss of coolant accident or LOCA. This is accomplished by the injection of large amounts of borated water into the reactor coolant system. The borated water helps to quell the chain reaction in the reactor's core. The second purpose of the ECCS is to ensure the reactor remains shut down. This is accomplished by the use of the same borated water source. [2]

Haddam Neck was permanently shut down due in large part to the fact that its ECCS would not have performed its function. If, during the 28 years of its operation, Haddam Neck had experienced a loss of coolant accident, the ECCS would not have functioned as designed and the reactor would likely have had a meltdown. As explained in a later section, (See: **Was Haddam Neck Ever Safe?** at p.25.) Northeast Utilities which owned and operated the Haddam Neck never realized that the ECCS was outside of its design basis.

The D.C. Cook nuclear power plant in Michigan also had design basis problems with the ECCS. As at Haddam Neck, these design basis deficiencies with the ECCS were not self identified. The NRC only identified the ECCS issue at Cook after the Commission was forced to institute design basis inspections. The NRC report on the Cook plant states that "some of the issues indicate that the ECCS system may not have performed its safety function under all design basis accident scenarios." [3] Table IV identifies the reactors where the ECCS would not have performed its function.

TABLE IV
NUCLEAR REACTORS REPORTING "OUTSIDE DESIGN BASIS" DUE TO EMERGENCY CORE COOLING SYSTEM PROBLEMS

Event	Reactor	UNIT	ST	Date	Details
33378	OCONEE	3	SC	12/10/97	DISCOVERY OF A POSSIBILITY OF THE ECCS BECOMING INOPERABLE DURING THE SUMP RECIRCULATING
33762	OCONEE	1, 2, 3	SC	2/20/98	EMERGENCY OPERATING PROCEDURE (EOP) REVIEW HAS IDENTIFIED A STEP IN THE
33843	PALISADES	1	MI	3/5/98	MANUAL ACTIONS TO SUPPORT EMERGENCY CORE COOLING SYSTEM (ECCS) RESPONSE TO A

32551	ROBINSON	2	SC	6/27/97	NRC A/E INSPECTION IDENTIFIED POTENTIALLY INADEQUATE NPSH FOR SIPUMPS. ENGINEERING
31497	THREE MILE ISLAND	1	PA	12/21/96	UNIT OUTSIDE DESIGN BASIS DUE TO CONCERNS WITH BWST SWITCHOVER ANALYSIS THE

INADEQUATE CABLE SEPARATION

Although Maine Yankee had problems with the ECCS, it was cable separation problems that eventually forced it to shutdown. The proper separation of cables is important in nuclear power plants to ensure that if one or more sets of cables are damaged, other control cables will be available to shut down the reactor.

Cable separation became an issue after a fire at the Browns Ferry nuclear plant in Alabama. On March 22, 1975, the Browns Ferry nuclear plant experienced one of the worst accidents prior to the meltdown at Three Mile Island. Workers were looking for air leaks using a candle when the flame was sucked into an opening and ignited the polyurethane foam insulation in the trays that carried the electrical cables which controlled the reactor. The fire burned for seven and a half-hours. It damaged over 1600 electrical cables, more than a third of which were safety related. Unit 2 was immediately shut down but Unit 1 was perilously out of control for several hours. Whistleblowers, who at the time spoke with the Union of Concerned Scientists, said that a major release of radiation was only avoided "by sheer luck.." [4]

In 1978, NRC Inspector Peter Atherton identified numerous inadequately separated safety-related electrical cables at Maine Yankee dating back to plant construction. Maine Yankee declined to reroute the cables due to "physical limitations." [5] Because of his efforts to address this significant safety issue, the NRC Inspector was subjected to psychological testing, forced out of the NRC and "blackballed" in the nuclear industry. However, Maine Yankee acknowledged that at least two and probably three recently identified cable separation issues date back to plant construction.

Although the NRC considered Maine Yankee's performance to be adequate, a number of significant weaknesses and design deficiencies were identified through NRC inspection efforts. An independent assessment concluded that "these weaknesses and deficiencies appeared to be related to two root causes: economic pressures to contain costs and poor problem identification as a result of complacency and the lack of a questioning attitude." [6]

Table V lists other reactors that have reported inadequate cable separation that have placed these reactors outside of their design basis.

TABLE V
NUCLEAR REACTORS REPORTING“OUTSIDE DESIGN BASIS” DUE TO INADEQUATE CABLE SEPARATION

Event	Reactor	Unit	State	Date	Details
31213	MAINE YANKEE	1	ME	10/25/96	CABLES FOR BOTH CHANNELS OF CONTAIN-MENT HYDROGEN MONITORING SYSTEM ARE ROUTED
31291	MILLSTONE	3	CT	11/7/96	NUMEROUS EXCEPTIONS TO THE SEPARA-TION CRITERIA IN REG GUIDE 1.75HAVE NOT BEEN INCLUDED IN THE
31442	MILLSTONE	3	CT	12/12/96	DISCOVERY OF INADEQUATE CABLE SEPARA-TION FOR THE CONTAINMENT LEAK MONITORING AND STEAM
33669	NINE MILE POINT	2	NY	2/6/98	VIOLATION OF CABLE SEPARATION CRITERIA. DURING A PLANT WALKDOWN, THE RESIDENT
35541	OYSTER CREEK	1	NJ	04/02/99	THREE CABLE TRAYS FOUND IN REACTOR BUILDING DO NOT MEET SEPARATION CRITERIA.
33314	PILGRIM	1	MA	11/26/97	TEMP POWER CABLES & EXTENSION CORDS IN VIOLATION OF SEPARATION CRITERIA -
32369	ROBINSON	1	SC	5/21/97	- 'C' SI PUMP INOP DUE TO CONTROL CABLES RUN IN 'A' SI PUMP CABLE TRAYS -
33070	VERMONT YANKEE	1	VT	10/10/97	- INADEQUATE CABLE SEPARATION IN SAFETY-RELATED ALTERNATECOOLING SYSTEM -
33779	VERMONT YANKEE	1	VT	2/24/98	LICENSEE IDENTIFIED AN ELECTRICAL CABLE WHICH DID NOT MEET CABLE SEPARATION CRITERIA.
33870	VERMONT YANKEE	1	VT	3/10/98	NON-SAFETY-RELATED CABLES ROUTED IN BOTH SAFETY-RELATED DIVISION RACEWAYS
32035	VERMONT YANKEE	1	VT	3/27/97	FIRE PROTECTION LIGHTING CABLE RUN IN BOTH DIVISION I & II CABLETRAYS -
32146	VERMONT YANKEE	1	VT	4/14/97	THE LICENSEE REPORTED A CABLE SEPARATION CONDITION WHICH DOES NOTMEET THE DIVISION 1 AND
32163	VERMONT YANKEE	1	VT	4/16/97	CERTAIN NONNUCLEAR SAFETY CABLES MAY NOT MEET CABLE

SINGLE FAILURE VULNERABILITIES.

A number of reactors have identified what are known as "single failure" vulnerabilities. Failure to maintain the design basis of the nuclear reactor has led to instances where a single event or condition could have prevented the functioning of the nuclear reactor's safety systems. These safety systems are needed to: shutdown the reactor, cool the radioactive fuel in the reactor core, contain the release of any radiation into the environment or otherwise mitigate the consequences of an accident.

Single failures are significant because they represent instances where the NRC's "defense-in-depth" approach to reactor safety has been undermined. Rather than having multiple, redundant layers of protection from the release of radiation into the environment, single failure vulnerabilities reveal holes in the NRC's nuclear safety net.

Single failures are defined by the NRC as:

> Any event or conditions that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to:
>
> 1. Shut down the reactor and maintain it in a safe shutdown condition,
> 2. Remove residual heat,
> 3. Control the release of radioactive material, or
> 4. Mitigate the consequences of an accident. [7]

Table VI lists those reactors have identified single failure vulnerabilities.

TABLE VI
NUCLEAR REACTORS REPORTING"OUTSIDE DESIGN BASIS"
DUE TO SINGLE FAILURE VULNERABILITIES

Event	Reactor	Unit	State	Date	Details
32917	BRUNSWICK	1, 2	NC	9/12/97	A SINGLE FAILURE CAN PREVENT THE FUNCTION OF THE PRESSURE SUPPRESSION FUNCTION OF
33120	LIMERICK	1, 2	PA	10/20/97	POTENTIAL FOR SUPPRESSION POOL TO BE BYPASSED DURING A LOCA.
34222	LIMERICK	1, 2	PA	5/13/98	PRIMARY CONTAINMENT ELECTRICAL PENETRA-TION OVER CURRENT ROTECTION CIRCUITS
34186	LIMERICK	1, 2	PA	5/6/98	THE LICENSEE IDENTIFIED A CONDITION WHERE THE ELECTRICAL PENETRATION
31731	MILLSTONE	1	CT	2/5/97	FAILURE TO ASSUME THAT A SINGLE FAILURE OF THE AUTOMATIC PRESSURE RELIEF
33121	PEACH BOTTOM	1, 2	PA	10/20/97	POTENTIAL FOR THE SUPPRESSION POOL TO BE BYPASSED DURING A LOCA
33608	PILGRIM	1	MA	1/27/98	SINGLE FAILURE COULD PREVENT OPERATION OF EDG FOR SEVEN DAYS
35048	PRAIRIE ISLAND	1, 2	MN	11/17/98	POTENTIAL FOR SINGLE FAILURE DURINGTESTING
33131	SUSQUEHANNA	1, 2	PA	10/22/97	POTENTIAL FOR SUPPRESSION POOL TO BE BYPASSED DURING A LOCA

II. NUCLEAR "SAFETY," THE DESIGN BASIS & THE FINAL SAFETY ANALYSIS REPORT

WHAT IS NUCLEAR "SAFETY"?

The U.S. Nuclear Regulatory Commission (NRC) is the agency charged with assuring that public health and safety are protected from the consequences of a nuclear reactor accident. While the NRC does not precisely define nuclear "safety", the Commission assumes nuclear reactors are safe if:

1. they are built and operated within their approved designs and;
2. comply with all applicable NRC regulations.[8]

Before a utility can receive a license to split atoms, the NRC must approve the design of a nuclear reactor, monitor its construction and review the final safety analysis report (FSAR). Once a nuclear reactor is licensed, the NRC is responsible for inspecting the reactor to assure that it continues to operate within its approved design, i.e. its design basis. Since the design basis of a reactor can change over time due to amendments to its operating license and changes in NRC regulations, utilities that own nuclear reactors are required to periodically update their final safety analysis reports.[9]

When utilities fail to maintain their design basis or update their safety analyses, the NRC may cite them with a violation and a fine. If the violation is serious enough, the NRC can force the reactor to shut down. However, this has only happened once, when reactor operators were found sleeping at the Peach bottom reactor in Pennsylvania. Usually, the utility will shutdown the reactor on its own accord and the NRC will then prevent the reactor from restarting until the problem has been addressed.

The NRC contends that if a nuclear reactor is designed, constructed and operated in compliance with its approved design then the redundant safety systems built into the plant will provide an adequate level of safety even if one of the safety systems should fail and an accident were to occur. This concept is known as "defense-in-depth." Redundant safety systems are supposed to provide multiple layers of protection to help assure that radiation is not released into the environment and the surrounding communities.[10]

While redundant safety systems are necessary, the 1979 meltdown of the Three Mile Island reactor in Harrisburg, Pennsylvania has shown that these safety systems do not guarantee that an accident will not occur or that radiation will not be released into the environment. Additionally, over reliance on the concept of defense-in-depth can lull the NRC and the nuclear industry into a false sense of security. As noted by MIT professor of nuclear engineering Theos J. Thompson:

> Most dangerous of all is the operating philosophy that there are several independent sequential barriers to prevent a given accident and that therefore, the failure of any given barrier is not serious and that repair to that barrier can be postponed indefinitely. Each true safety barrier to an accident should be treated as if it were the last one for indeed it may be.[11]

WHAT IS THE DESIGN BASIS OF A NUCLEAR REACTOR?

The design basis is the starting point of all NRC regulation; it is the safety and operational blue print for the nuclear reactor. The design basis for every nuclear reactor is unique. The design basis for each reactor differs based upon the specific type of nuclear reactor, and the different regulations that were in place at the time it was licensed. The NRC has licensed two types of nuclear reactors for commercial operation, pressurized water reactors (PWRs) and boiling water reactors (BWRs).

These two basic types of reactors, PWR and BWRs, have four different manufacturers. General Electric has manufactured the nuclear systems in the boiling water reactors while Westinghouse, Combustion Engineering and Babcock & Wilcox have manufactured the nuclear systems in the pressurized water reactors. Each of these manufacturers have several different designs. General Electric has six, Westinghouse has three and Combustion Engineering and Babcock & Wilcox each have two different reactor designs that are operating in the United States.[12] Each of these different types and styles of reactor have different design basis.

If a nuclear reactor is operating "outside design basis," it is impossible for the NRC or the utility to determine whether the reactor is "safe" or if its operation poses an undue risk to public health and safety. The design basis of a nuclear reactor is defined in the U.S. Code of Federal Regulations:

- Design bases means that information which identifies the specific functions to be performed by a structure, system, or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design.

- These values may be (1) restraints derived from generally accepted "state of the art" practices for achieving functional goals, or (2) requirements derived from analysis of the effects of a postulated accident for which a structure, system, or component must meet its functional goals.[13]

Every safety decision made by the regulator is premised upon the supposition that the nuclear reactor has been constructed and maintained in accordance with its design basis. This

supposition forms the foundation upon which the NRC builds its argument that nuclear reactors do not pose an unwarranted risk to the public health and safety.

WHAT IS THE FINAL SAFETY ANALYSIS REPORT (FSAR)?

Every nuclear utility is required to provide the NRC with a Final Safety Analysis Report (FSAR) for each of its reactors. The final safety analysis report is the document that the NRC relies upon to issue a nuclear reactor a license to split atoms. The FSAR is defined in 10 CFR Part 50.34(b) of the Commission's regulations:

> Final safety analysis report. Each application for a license to operate a facility shall include a final safety analysis report. The final safety analysis report shall include information that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components and of the facility as a whole…[14]

The FSAR requires a description of the plant, a presentation of the plant's design bases and the limits on its operation, and a safety analysis of the structures, systems, and components as well as the whole facility. The FSAR becomes part of the basis for granting an operating license. [15]

Nuclear utilities are required to periodically update their FSAR. These requirements are supposed to assure that the information included in the FSAR contains the latest material. The Code of Federal Regulations state that the updated FSAR:

- shall be revised to include the effects of all changes made in the facility or procedures;
- all safety evaluations performed by the licensee either in support of requested license amendments or in support of conclusions that changes did not involve an unreviewed safety question; and
- all analyses of new safety issues performed by or on behalf of the licensee at Commission request. The updated information shall be appropriately located within the FSAR.[16]

In 1996, as a result of the problems experienced at the Millstone nuclear power plant, the NRC was forced to acknowledge that many reactors were failing to update these safety analysis reports and that the FSAR at many reactors did not contain the types of information the NRC expected. The NRC would have Congress and the public believe that they just discovered these problems with design basis documentation. However, the NRC has long been aware of design basis problems at the nuclear reactors it purports to regulate. In fact, the Nuclear Regulatory Commission has been in denial of these design basis problems for decades.

III. NRC'S DECADES OF DENIAL

The U.S. Nuclear Regulatory Commission has long been aware of the fact that that nuclear utilities have failed to adequately maintain the design basis documentation in their final safety analysis reports and, as a consequence, have operated their reactors "outside design basis" and in violation of the terms of their licenses. Over a span of decades, the NRC was repeatedly put on notice that design basis problems were under-mining the safety of the nuclear reactors they were supposed to regulate. However, due to the potential financial impact on the nuclear industry, the NRC has obfuscated the issue and delayed taking action.

THREE MILE ISLAND MELTDOWN & ITS AFTERMATH

On March 28, 1978, the number two reactor at the Three Mile Island nuclear power plant experienced a meltdown; the worst nuclear accident to date in the United States. Suddenly, the entire country became aware of the fact that safety levels at nuclear reactors across the U.S. were not adequate to protect the public from the consequences of an accident. In November 1979, in the aftermath of the meltdown at Three Mile Island, Congress required the NRC to:

1. Identify which of NRC's current safety requirements were met by each operating plant;
2. Identify those generic unresolved issues for which technical solutions have been developed;
3. Identify those licensed plants that had implemented those solutions.[17]

By identifying those reactors that met safety requirements, the NRC was supposed to provide the Congress with some confidence that the level of safety at the nation's nuclear plants was adequate. However, identifying which reactors met safety requirement and which did not was a lot easier said than done.

THE DENTON MEMOS

Throughout the summer of the following year, a series of memos from the NRC Director of the Office of Nuclear Reactor Regulation, Harold Denton, to the Commission detailed the difficulty the NRC would have complying with the congressional requirement. Denton concluded that:

> The problem of <u>documentation</u> of conformance with the Commission's regulations is a vexing, manpower intensive effort to which the staff, due to time and manpower limitations, has been forced to give inadequate attention. By good management effort, I hope to improve this situation and to gradually eliminate it. **But to do so by an intense effort will be costly.** This was the

> thrust of my June 13, 1980 memorandum. However, the defects in documentation should not be misconstrued as evidence of defects in the review process. Using a audit process, **it is simply not possible for the NRC to state, based upon its own knowledge, that every rule and regulation has been met for every applicable action by the applicant**.[18]

THE SYSTEMATIC EVALUATION PLAN (SEP)

The NRC attempted to address this "vexing" problem noted in the Denton memos and answer Congress by using the Systematic Evaluation Plan (SEP). The NRC had initiated the systematic evaluation program several years earlier to review the designs of older, operating nuclear power plants. The SEP was divided into 2 phases:

- First, the staff identified 137 safety issues where regulations had so changed enough over time that they warranted a re-evaluation.

- Then the staff compared the design of 10 of the 51 older plants to the current requirements.[19]

Through the SEP, the NRC supposedly addressed Congress' concern as to whether nuclear reactors met safety requirements. However, the public must question the efficacy of the NRC's Systematic Evaluation Plan. Both Millstone 1 and Haddam Neck were part of this review and both have been permanently shut down due to design basis deficiencies that dated back to construction of the reactors. If the SEP had been effective, the NRC should have identified and corrected the problems at Haddam Neck and Millstone Unit 1 decades ago.

Congress also questioned the efficacy of the SEP. According to Representative Morris Udall, the NRC had taken a congressional request to ascertain the safety of operating reactors and turned it into, "a multi-million dollar bureaucratic exercise that will not give answers about the safety of today's operating plants until sometime in the 1990's." [20] Congress did eventually get its answer in the 1990's. However, that answer came in the form of a shutdown of every nuclear reactor in the state of Connecticut.

DEFICIENCIES IN DESIGN BASIS DOCUMENTATION

In 1984, the NRC again acknowledged problems with the design basis but failed to require any action by the utilities. On July 5, 1984, the NRC issued an information notice which stated that, "A common finding in (inspections) conducted by the (NRC's) Office of Inspection and Enforcement has been deficiencies in design base documentation and calculations for nuclear power plant structures, systems, and components." [21] Despite the fact that NRC regulations require accurate and complete design basis documentation, the NRC information notice failed to require any action by the nuclear utilities. The notice stated that,

"suggestions contained in this information notice do not constitute NRC requirements and, therefore, no specific action or written response is required." [22]

1985 DAVIS BESSE ACCIDENT

In 1985, design basis issues were again brought to the forefront when Davis Besse experienced a loss of feed water accident. According to then- NRC Executive Director for Operations James Taylor:

> We really began looking at existing utilities in the aftermath of the Davis-Besse event of 1985 when there were clear indications that portions of the design -- that was a complete loss of feed and then failure of auxiliary feedwater event. **It was a very significant event**. But one of the things that triggered our intense interest to go back and look at the designs grew out of that event…. **that was a clear-cut case due to some design issues that hadn't been carefully checked out where we actually lost a safety system completely.** [23]

DESIGN BASIS RECONSTITUTION PROGRAMS

As a result of the Davis Besse accident, the NRC began what became known as safety system functional inspections. As these inspections turned up problems, the nuclear industry adopted programs to address deficiencies in the design basis of their nuclear reactors. However, not all reactors participated in this voluntary industry initiative. According to NRC's Director of the Division of Reactor Inspection and Safeguards:

> The current industry status is that a majority of utilities are embarking on a design document reconstitution program. We are aware of a few that will forego this, Big Rock Point for example, because of economic factors. Others have stretched out their evaluations and reconstitution program because of budget reasons.[24]

However, the NRC acknowledged that they really didn't have a clear idea of what the nuclear industry was actually doing to address the situation:

> We haven't done a rigorous inquiry to determine who is doing what. We do have the results of industry surveys and our own knowledge as we go out in the field and we can say some people are deferring, but we don't have exactly who is doing what at this point. [25]

LICENSE RENEWAL

In the early 1990's design basis issues were again the topic of discussion as the NRC attempted to formulate a rule to renew nuclear reactor licenses for an additional 20 years. The Commission's original rule was premised on the assumption that a nuclear reactors design basis and final safety analysis report would be sufficient to protect the public health and safety so long as it was modified to account for the effecting of aging.

Rather than reviewing the design basis documentation in order to prove that reactors were in compliance with the design, the final safety analysis report and the terms of its operating license, the NRC merely deemed that it was so. Under the license renewal rule, members of the public could not challenge the sufficiency of or question the compliance with a reactor's design basis.

When a reactor applies to renew its license, the NRC is neither going to review these documents nor confirm that the reactor is in compliance with the regulations imposed under the current license. Yet, the NRC acknowledges that the current licensing basis for the nation's nuclear power plants is "outdated and oftentimes poorly recorded.'[26]

In 1991, NRC Chairman Ivan Selin illustrated this point stating that:

> Many of these documents have gotten lost over the years. In some cases the licensees never had them. In other cases they had them but didn't keep them up to date. So, this is a very, very important part of what we do. Obviously, you have to understand what the design basis and the safety margins of a plant are before one can look at plant modifications.[27]

Chairman Selin acknowledged that the Congress had expressed considerable interest in requiring that design basis be available as part of a license renewal. Selin stated that:

> The Commission's position was very strong. On the one hand, we felt and do feel strongly that whatever our views are on having the design basis in hand, they are independent of whether the licensee is coming in for plant life extension or not, but we did agree to take a look at the possibility of requiring that the design basis be available up to a certain standard.[28]

If the Commission's position was strong, the Commission's actions failed to live up to it. Even after acknowledging the necessity of having the "design basis in hand," Selin's Commission waffled on the issue. Rather than "requiring that the design basis be available up to a certain standard," the Commission merely wrote an unenforceable policy statement.

1992 NRC POLICY STATEMENT

In order to address the design basis issues that were raised during the development of the license renewal rule, the NRC issued a policy statement entitled, "Availability and Adequacy of Design Bases Information at Nuclear Power Plants."

The policy statement stressed the importance of nuclear utilities maintaining current and accessible design basis documentation. It also recommended that all reactor licensees assess the accessibility and adequacy of their design bases information. Nuclear utilities were supposed to be able to show that there was sufficient documentation to conclude that the nuclear reactor, as constructed, is consistent with the design bases.[29]

However, since the NRC only issued a policy statement rather than a regulation, it's dictates failed to have the desired impact upon the nuclear industry.

NRC GENERIC LETTER ON DESIGN BASIS IS NEVER ISSUED

In March 1993, the NRC issued a draft generic letter for public comment. The letter requested that nuclear reactor licensees, on a voluntary basis, submit information and schedules for any design bases programs completed, planned, or being conducted, or a rationale for not implementing such a program. This generic letter would have at least given some additional regulatory weight to the NRC's unenforceable policy statement issued the previous year.

However, the nuclear industry lobby argued that the generic letter was "unnecessary and unwarranted." Seven months later, NRC acquiesced to industry pressure and decided not to issue a generic letter.[30]

DESIGN ERRORS IN NUCLEAR POWER PLANTS 1985-1995

In 1997, a report from the NRC's Office for Analysis and Evaluation of Operational Data (AEOD), reviewed design errors that had been reported by nuclear reactors from 1985 – 1995. The AEOD identified three design basis event reports where the probability of an accident that damaged the reactor core was unacceptably high.

The AEOD reported two events where the probability of damaging the core was 1 in 1000 and one event with a core damage probability of 1 in 100. All three of these event reports are exponentially more dangerous than NRC standards allow. However, the AEOD failed to identify which nuclear reactors had reported those events. [31]

The AEOD report found that the number of reported design errors "steadily decreased by 1995, presumably due in part to diminishing licensing resources allocated to this effort and the lessening number of undiscovered latent design errors." [32] Furthermore the AEOD concluded that "the number of design errors discovered at any given time was dependent on the extent of initiatives taken by the NRC and the industry." [33]

These findings indicate that the more effort nuclear utilities put into discovering deficiencies in their design basis the more they found. Unfortunately, the AEOD can not do a similar analysis of the post-Millstone event reports. After the reports produced by AEOD were used to prove that NRC senior managers were not doing their jobs, NRC broke up the office scattering its personnel throughout the agency.

MAINE YANKEE'S DESIGN PROBLEMS LEAD TO SHUTDOWN

In December 1995, in response to whistleblower allegations regarding the adequacy of safety analyses to support license amendments at Maine Yankee, the NRC staff audited the design basis analyses used to demonstrate the adequacy of the Maine Yankee emergency core cooling system. The staff concluded Maine Yankee's analysis was unreliable.[34]

In December of the following year, based upon further investigations into design basis deficiencies, Maine Yankee identified cable separation problems that could have resulted in the inability of the reactor operators to manually shut down the reactor. The reactor was taken offline to address these issues. Once the reactor shut down, the NRC prohibited its restart until the cable separation problems had been addressed. The NRC noted that "the proper separation of cables is important in nuclear power plants to ensure that if one or more set of cables is damaged, the plant will be able to achieve a safe shutdown."[35]

After the utility's attempts to sell the reactor, either whole or in parts, failed to find a buyer Maine Yankee moved to decommission the nuclear reactor.

TIME COVER STORY BLOWS THE WHISTLE ON THE NRC

On March 4, 1996 George Galatis and the Millstone nuclear reactor graced the cover of Time magazine. In a special investigation, Time detailed how "two gutsy engineers in Connecticut have caught the Nuclear Regulatory Commission at a dangerous game it has played for years: routinely waiving safety rules to let plant keep costs down and stay on line." [36]

Suddenly, the issue that the NRC had been sweeping under the proverbial rug for decades was receiving national attention. Within two weeks of the Time cover story the NRC issued Information Notice 96-17: Reactor Operation Inconsistent with the Updated Final Safety Analysis Report detailing the design basis problems at Millstone. [37]

However, the NRC would have the public believe that it has been unaware of the design basis problem in the nuclear industry until the Millstone debacle. This is not true. The NRC has long been aware of deficiencies in the design basis of the nuclear reactors it purports to regulate. Once the design basis problems landed the Millstone reactor on the cover of Time magazine, NRC was forced to take action. Unfortunately, that action took the form of an amnesty program rather than holding nuclear reactor owners to the terms of their license.

IV. THE MILLSTONE DEBACLE & ITS FALLOUT

In 1992, a senior engineer named George Galatis raised the issue of the improper refueling of the Millstone Unit 1 nuclear reactor in Connecticut. When Millstone Unit 1 had to replace its radioactive fuel rods, it would take the entire core of the nuclear reactor and place it in the reactors spent fuel pool. However, this practice of fully off loading the core of the reactor was not approved by Millstone's license and neither the utility nor the NRC had ever done an analysis to see if it was safe. Galatis notified his management at Northeast Utilities (NU) that the refueling practices at Millstone Unit 1 were outside the design basis assumptions in the Millstone final safety analysis report (FSAR) and a violation of the reactor's operating license. [38]

After NU failed to take any action to address his safety concerns, Galatis filed a petition with the NRC claiming that Northeast Utilities had "knowingly, willingly and flagrantly operated Millstone Unit 1 in violation of its operating license for approximately 20 years."[39] Galatis knew that absent compliance with the reactor's design basis, it was impossible for the NRC or Northeast Utilities to determine whether a reactor was operated "safely". What Galatis didn't know was that he had uncovered one of the nuclear industry's dirtiest secrets**. Not only was the Millstone 1 nuclear reactor operating outside of its design basis, so was most, if not all of the nuclear industry!**

In May 1996, the NRC reported on the extent to which problems encountered at Millstone Unit 1 existed at other nuclear power plants. The NRC staff determined that fifteen nuclear reactors at nine sites needed to either modify their license or their plant practices to ensure that their refueling practices were in compliance with their design basis. Similar to Millstone Unit 1, a number of other reactors had previously performed full core offloads in violation of their design basis, as shown in Table VII [40]

TABLE VII
PAST OFFLOADS IN VIOLATION OF THE DESIGN BASIS

REACTOR	OWNER	STATE
Cooper	Nebraska Public Power	NE
McGuire 1 & 2	Duke Power Company	NC
Millstone 1	Northeast Nuclear Energy Co.	CT
North Anna 1 & 2	Virginia Electric & Power Co.	VA
Oconee 1,2 & 3	Duke Power Company	SC
South Texas 1 & 2	Houston Lighting & Power	TX
Summer	South Carolina Electric & Gas Co.	SC
Turkey Point 3 & 4	Florida Power & Light Co.	FL
Vogtle 1	Southern Nuclear Operating Co.	GA

In addition, the NRC found that eighteen reactors had failed to update their final safety analysis reports, as shown in Table VIII. The utilities that owned these reactors were therfore making safety decisions based upon incomplete and incorrect information about the design of the nuclear reactor.[41]

TABLE VIII
REACTORS THAT FAILED TO UPDATE THEIR FSAR

REACTOR	OWNER	STATE
Browns Ferry 1, 2 & 3	Tennessee Valley Authority	AL
Crystal River	Florida Power Corp.	FL
Fermi 2	Detroit Edison Co.	MI
Kewaunee	Wisconsin Public Service	WI
LaSalle 1 & 2	Commonwealth Edison Co.	IL
Millstone 1, 2 & 3	Northeast Nuclear Energy Co.	CT
Salem 1 & 2	Public Service Electric & Gas	NJ
Sequoyah 1 & 2	Tennessee Valley Authority	TN
Vermont Yankee	VT Yankee Nuclear Power Corp.	VT
Zion 1 & 2	Commonwealth Edison Co.	IL

NRC SENDS LETTERS TO EVERY NUCLEAR CEO

In October 1996, the NRC sent letters to every utility requiring that they provide information to the NRC concerning the adequacy and availability of design bases information. The Commission not only required that the utility chief executive officers provide this information, but that they swear to it. Under oath or affirmation, the utility CEO's were to provide:

> Information documenting current practices for concluding that the plant is consistent with its design and processes for identification of problems and implementation of corrective actions.[42]

The CEOs were to inform the NRC as to whether they had undertaken any programs to review the accuracy and completeness of their reactors'design basis. If so, they had to describe how these programs would ensure that their reactors had accurate information, were using it and that this information was being kept up-to-date. If the CEOs had not instituted a design basis program they had to provide the NRC with some rationale.[43]

The NRC's demand for information was almost unprecedented, raising the hopes of whistleblowers and other safety advocates that the NRC was finally going to take action to rectify design basis problems that had festered for decades. However, rather than holding

nuclear utilities accountable for failing to adequately maintain their design basis the NRC decided to exercise its discretion not to enforce its own regulations.

AMNESTY IRRATIONAL

Even before NRC had documented the full extent of the design basis problems at nuclear reactors throughout the country, the Commission decided that the nuclear industry would not be held accountable. On October 18, 1996, NRC revised its enforcement policy to establish an amnesty program for those nuclear reactors that were not in compliance with their design and as a result had operated their reactors in violation of NRC safety regulations.

This amnesty program states that the NRC may refrain from imposing a fine upon the utility so long as the violation is documented, the utility has described what action it will take to correct the situation and that it meets all of the following criteria:

- The violation was identified by the licensee as a result of its voluntary initiative;
- It was or will be corrected within a reasonable time following identification and;
- The violation was not likely to be identified by routine licensee efforts such as normal surveillance or quality assurance (QA) activities.[44]

Additionally, the NRC may choose not to issue a violation if the staff believes that the issue is not linked to the present performance of the nuclear reactor. For instance, NRC will not take enforcement action for violations that are over 3 years old or violations that occurred during plant construction unless the nuclear utility should have identified the violation earlier.

The NRC's amnesty program applies not only to violations of a reactors design basis but also to the underlying root cause: the licensee's failure to adequately maintain and up-date its final safety analysis report. NRC's amnesty program runs until March 30, 2000 for items having high safety-significance and until March 30, 2001 for other equipment.[45]

The NRC has severely circumscribed its ability to take enforcement action against nuclear reactor licensees that have design basis violations. However, the extent to which even the NRC will ignore violations of its own regulations has a limit and its amnesty program does not mean total immunity. The NRC has indicated that it will not employ this amnesty program and may issue violations and fines if:

- The NRC identifies the violation, unless it was likely in the staff's view that the licensee would have identified the violation in light of the defined scope, thoroughness, and schedule of the licensee's initiative;

- The licensee identifies the violation as a result of an event or surveillance or other required testing where required corrective action identifies the FSAR issue;

- The licensee identifies the violation but had prior opportunities to do so and failed to correct it earlier;

- There is willfulness associated with the violation;

- The licensee fails to make a report required by the identification of the departure from the FSAR; or

- The licensee either fails to take comprehensive corrective action or fails to appropriately expand the corrective action program. [46]

The NRC claims that, "this exercise of discretion is to place a premium on licensees initiating efforts to identify and correct subtle violations that are not likely to be identified by routine efforts before degraded safety systems are called upon to work."[47] However, the NRC has no reason to expect that the current voluntary nuclear industry effort will be any more successful at addressing significant design basis issues than any of the other myriad programs, notices, and ineffectual policies NRC has already employed.

Additionally, the NRC cannot reasonably expect nuclear reactor licensees to self-identify design basis issues that would threaten the continued operation of the nuclear reactor. The design basis issues that resulted in the permanent shutdowns at Haddam Neck, Maine Yankee and Millstone Unit 1 were not identified by the nuclear reactor owner but by an accident and whistleblowers who were paid for their honesty by being driven from the nuclear industry.

The NRC's amnesty program might make more sense if the regulator could make the case that it was unaware of the design basis problems. It can not. Both the NRC and the nuclear industry have been aware of the fact that design basis problems have undermined safety at nuclear reactors for years, if not for decades.

Despite the breadth of NRC's amnesty program, the NRC has taken escalated enforcement (a violation and fine) action against a few nuclear power plants including: Cook, Palo Verde, Perry, River Bend, Robinson, Three Mile Island and Vermont Yankee.[48]

WAS HADDAM NECK EVER SAFE?

After being forced to acknowledge the problems at Millstone 1, the NRC expanded its investigations to see whether similar problems existed at other reactors operated by Northeast Utilities. The subsequent investigations found that Haddam Neck's emergency core cooling system (ECCS) would have been unable to perform its function of cooling the reactor core in the event of an accident. In other words, if Haddam Neck had experienced a loss of coolant accident, the reactor's safety systems would not have been up to the task and the nuclear reactor would likely have had a meltdown. What is equally disturbing is the fact that this problem existed since the plant was licensed. For 28 years, Northeast Utilities operated a nuclear reactor with an ECCS that would not have cooled the reactor core in the event of an accident. Subsequent NRC inspections revealed that:

> Inspectors also found that safety margins were reduced, and in some cases technical specifications were violated a result of poor engineering. For example, too small pipes leading from the containment sump system to the residual heat removal pump left insufficient suction to support pump operation without relying on containment building backpressure. **This violation is significant because it could have caused a failure of the system needed to keep the reactor core cool in the event of an accident.**[49]

On July 22, 1996, operators had to shut down the reactor due to questions regarding the operability of safety systems. On December 4, 1996, NU announced its decision to permanently shut down Haddam Neck. The NRC finally got around to writing a violation against NU for the ECCS problems at Haddam Neck six months after the reactor had permanently shut down. On May 12, 1997, The Nuclear Regulatory Commission staff proposed a $650,000 fine against Northeast Utilities for more than 70 alleged violations at Haddam Neck. Yet even after the reactor had permanently shut down, NRC attempted to down play the severity of the issues revealed at Haddam Neck and continued to play the role of nuclear industry apologist. NRC's press release announcing the proposed fine of NU stated that:

> While none of these matters immediately threatened public safety, NRC Region I Administrator Hubert J. Miller wrote in a letter to Northeast Utilities that the violations and underlying causes demonstrated "significant departures from the defense-in-depth principles upon which nuclear power plants are designed, built and operated, and upon which the NRC relies to ensure nuclear power plant operation does not jeopardize public health and safety."[50]

The only reason the NRC can claim that the problems at Haddam Neck did not "immediately threaten public safety" was because the reactor had not operated in over nine months.

MILLSTONE & MAINE YANKEE LESSONS LEARNED?

As a result of problems that came to light at the Millstone and Maine Yankee nuclear power plants in 1996, NRC became concerned that other nuclear reactors may have had design basis issues that compromised safety. The agency formed three NRC-led teams of contract engineers to perform design basis inspections of risk-significant safety systems. These inspections were supposed to determine three things:

- Would the selected safety systems have performed their function?
- Had the licensees adhered to their design and licensing bases? and
- Did the "as-built" safety system operate as described the final safety analysis report?[51]

As of May 1998, 16 inspections have been completed at the following nuclear plants:

Arkansas Nuclear 1	Palisades
Cook 1 & 2	Perry 1
Cooper	Robinson 2
Davis-Besse	St. Lucie 1 & 2
Diablo Canyon	Three Mile Island
Farley 1 & 2	Vermont Yankee
Ginna	Washington Nuclear 2
Indian Point 2	Wolf Creek

[52]

These inspections revealed that like Millstone, other nuclear plants had:

(1) failed to appropriately maintain or adhere to plant design bases,
(2) failed to appropriately maintain or adhere to the plant licensing basis,
(3) failed to comply with the terms and conditions of licenses and NRC regulations, and
(4) failed to assure that Updated Final Safety Analysis Reports (UFSAR) reflect the actual condition of facilities. [53]

Although these inspections turned up significant problems, the efficacy of NRC's inspections must be questioned. NRC did not inspect the "as found" conditions of the nuclear reactors. The NRC warned the utilities which systems would be inspected and the utilities worked the systems prior to NRC inspection. The NRC acknowledged that:

> We tell the plant which system we're looking at. And what happened is -- give you an example --at St. Lucie we have two contractors: Stone & Webster, Sargent Lundy. We were going in with Sargent Lundy. They went and hired Stone & Webster at St. Lucie to look at the systems we had picked to look at before we got there. And we're seeing extensive efforts on the part

> of the Utilities looking at the systems before we show up, because they want credit to have it self-identified and self-fixed.[54]

In light of the fact that NRC told the utilities which reactor systems they would inspect and that the utilities preconditioned these system prior to NRC's inspection, it's a wonder that the NRC found anything at all. Despite NRC's attempts to limit their findings and to put these design basis inspections in a positive light, the NRC was forced to admit that:

> the industry's voluntary efforts to improve and maintain design bases information for their plants . . . have not been effective in all cases. The extent of the licensees' failures is of concern because of the potential impact on public health and safety if safety-related systems do not perform properly.[55]

To her credit, Chairman Jackson asked the pertinent follow up question during the NRC briefing on the Millstone and Maine Yankee Lessons Learned:

> Let me ask you this kind of a bomb question. You know, given that, in a certain sense, we got to where we are because we thought there were voluntary things that were being done by the industry relative to design basis, one could argue this is a deja vu kind of a set of statements. What comfort do we take that this would be any different from what got us to where we are in the first place, you know, always keeping the focus on what is most risk-significant? But if you don't have the basis here in the first place, you can't parse it to talk about what has a risk or safety feature.[56]

The Chairman's question is instructive. Why should we believe that the current voluntary nuclear industry initiative to improve the design basis of nuclear reactors will be any more successful than the previous voluntary nuclear industry attempts to address this problem? Time after time, the NRC has been forced to acknowledge that nuclear reactors have operated "outside design basis" and that safety margins were compromised if not eliminated. Yet the Commission has continually acquiesced to industry pressure and for decades has failed to adequately address the design basis problem at nuclear reactors throughout the United States.

NRC FINALLY ADDRESSES GALATIS' 1995 PETITION

On July 27, 1999, the NRC finally completed its review of George Galatis' petition to hold Millstone unit 1 to terms of its operating license. Four years after the petition was filed, three years after every nuclear reactor in the state of Connecticut was shut down, two years after Galatis was harassed and intimidated into leaving the nuclear industry and one year after Millstone Unit 1 permanently ceased splitting atoms, the NRC finally answered the petition that brought the entire Millstone debacle into the light of day.

While the NRC addressed the issue of full core offloads in December of 1996, "the NRC indicated that it was still considering the petitioners' assertions that Unit 1 was operated in violation of its license and that (Northeast Utilities) had given material false statements to the NRC in a license amendment submittal." [57]

When the NRC finally completed its investigation of the Galatis petition, the agency issued a violation and concluded that Millstone had:

> **knowingly, willingly, and flagrantly operated Millstone Unit 1 in violation of its license**, **and that (Northeast Utilities) had provided the NRC with a material false statement**. The NRC staff determined that a fine was not necessary because (Northeast Utilities) had previously addressed the basic cause of this issue in response to the NRC's enforcement action in December 1997 when (Northeast Utilities) was assessed a $2.1 million fine. With the May 25, 1999, violation, the NRC staff concluded that, in effect, the petitioners' request for enforcement action was granted. [58]

After the permanent shutdowns of Haddam Neck, Maine Yankee and Millstone Unit 1, the NRC finally got around to acknowledging what everyone in the nuclear industry and the concerned public already knew: that Northeast Utilities had knowingly, willingly, and flagrantly operated Millstone Unit 1 in violation of its license.

V. CONCLUSION

The U.S. Nuclear Regulatory Commission has long been aware of the fact that nuclear utilities have failed to maintain the design basis documentation in their final safety analysis reports and as a consequence have operated their reactors in violation of the terms of their licenses. Absent compliance with the design bases, neither the NRC nor the utility can determine whether operation of the reactor poses an undue risk to the public health and safety. However, due to the potential financial impact on the nuclear industry, the NRC has obfuscated and delayed taking action for decades.

Even before NRC had documented the extent of the design basis problems in the nuclear industry, the regulator decided that the nuclear reactor licensees would not be held accountable for violating NRC regulations. The NRC has re-written its enforcement policy to create an amnesty program that will last until March 30, 2001.

The NRC's amnesty program has severely circumscribed its ability to take enforcement action against nuclear utilities that have design basis violations. This amnesty means that the NRC will only hold utilities accountable for the most egregious violations of NRC regulations.

Design basis issues have already contributed to the closure of three nuclear reactors: Haddam Neck, Maine Yankee and Millstone Unit 1. However, in each case, the NRC was forced to regulate only due to the actions of whistleblowers and citizens petitions.

The design basis issues that resulted in the shutdown of Haddam Neck and Maine Yankee were not identified by the utility. These problems only came to light when driven by events or NRC inspections. The NRC can not reasonably expect the utility to identify design basis problems that would jeopardize future operation of the reactor.

The NRC design inspections turned up significant safety problems, however, the efficacy of these inspections must be questioned. NRC did not inspect the "as found" conditions of the nuclear reactors. The NRC warned the utilities which systems would be inspected and the utilities worked the systems prior to NRC inspection.

Design basis problems have reduced safety margins at nuclear reactors across the United States; in some cases safety margins have been significantly reduced if not eliminated. However, every time the NRC has moved to address the problem the nuclear industry lobby has intervened to block any meaningful attempt to address inadequacies in the design basis of nuclear reactors.

The NRC's amnesty program is an irrational move by an ineffective regulator and will not address the significant design basis issues that still exist at nuclear reactors across the United States.

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