FUTILITY AT THE UTILITY

How use of the wrong answer key for safety tests went undetected for 20 years at Fermi Unit 2

It was only fortuitous that no safety problems resulted from the operation of Fermi with inaccurate technical specifications.
NRC Senior Manager, February 1990

Fermi would operate for at least sixteen more years with inaccurate technical specifications.

Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

DAVID LOCHBAUM
DIRECTOR, NUCLEAR SAFETY PROJECT
FEBRUARY 2007

FUTILITY AT THE UTILITY

INTRODUCTION

For over two decades, workers at Detroit Edison's Fermi Unit 2 nuclear power reactor dutifully tested a key safety system—the one that reacts to interruptions in electricity and signals the onsite emergency diesel generators to start and power components that protect the reactor core from damage. The proper functioning of the emergency diesel generators is extremely important. As a measure of that importance, when the emergency diesel generators become disabled, Fermi Unit 2 must be shut down within 12 hours to avoid causing a breakdown at the plant that would expose the public to undue risk.

But over those two decades, workers tested this crucial safety system using the wrong answer key. As a result, although the safety system was repeatedly given a passing grade, the test did not, in actuality, gauge whether the system would have worked properly in case of emergency. Twenty years of testing resulted in a safety system that may never have been adequate.

Hard to believe? Certainly. More unbelievable is the fact that Detroit Edison and the Nuclear Regulatory Commission (NRC) had hundreds, perhaps thousands, of opportunities to discover this problem during those decades. Lots of people had lots of chances to notice the discrepancy. It wasn't that one person made many mistakes or many people made the same mistake. Many people made many mistakes for many years.

How could this happen? The failure to ask and answer this simple question just once is the primary reason the problem was missed by so many for so long. When other problems were uncovered – as frequently happened over the years – no one asked how the problems had gone unnoticed. Consequently, the process flaws that initially created the problem and then allowed them to remain undetected were not identified and fixed. Instead, individual problems were remedied only when they surfaced, while the uncorrected process flaws continued to create new problems and sustain old ones.

This report documents our inquiry into the 20-year period during which Detroit Edison tested the emergency diesel generator protection safety system using the wrong answer key. The first section explains how the emergency diesel generator protection system functions and how the discrepancy was introduced in August 1986. The next section, along with the timeline provided in the appendix, chronicles the numerous opportunities Detroit Edison and the NRC had to uncover the discrepancy prior to its finally being revealed in August 2006. The final section describes steps the NRC must take to rectify the mistakes made in incorrectly testing emergency equipment, as well as strategies for detecting and correcting such glaring errors in the future. This report offers an invaluable, long-overdue lesson for safe operation of Fermi Unit 2 and more than 100 other nuclear power reactors in the United States.

ELECTRICAL BUS VOLTAGE PROTECTION

Nuclear power plants have a single purpose – to generate electricity for sale to residential and commercial consumers. Nuclear power plants themselves consume large amounts of electricity to run the many pumps, fans, hoists, compressors, valves, lights, heaters and other plant components. Most of these components support day-to-day operation of the nuclear plant, but some of the components are the emergency elements needed either to prevent or mitigate reactor accidents. All of the components are normally powered by the electricity generated by the nuclear plant or by electricity drawn from the electrical grid. When a nuclear plant is shut down and the electrical grid becomes unavailable, most components at the plant are rendered useless due to lack of power. Emergency backup power is required by federal regulations at all nuclear power plants so safety equipment can function independent of the grid and plant.

The emergency backup power system for Fermi Unit 2 features four emergency diesel generators (EDGs) configured such that two (EDG-11 and EDG-12) supply power to one division of safety equipment and two (EDG-13 and EDG-14) supply power to a fully redundant second division of safety equipment.

Figure 1 provides a schematic diagram for one of the two safety-related divisions at Fermi Unit 2. The top portion of the diagram shows the plant's switchyard with the transmission lines connecting the plant to the electrical grid (i.e., the Luzon and Custer lines) along with some of the electrical distribution system for non-essential plant equipment (e.g., Transformer S566 provides electricity to the circulating water (CW) system pumps and equipment). Emergency diesel generators (EDGs) 11 and 12 are shown at the bottom of the diagram providing power to safety-related 4.16 kilovolt electrical buses 11EA and 12EB which in turn supply power to safety-related 480 volt electrical buses 72EA, 72EB, and motor-control centers (MCCs). MCCs are the nuclear plant equivalent to fuse panels in homes: they contain electrical breakers that control power supply to electrical circuits throughout the plant. Non-safety-related 4.16 kilovolt electrical buses 64B and 64C in the middle of the diagram show how the safety-related buses are normally powered from the electrical grid.

Except during periodic tests, the emergency diesel generators are normally not running. They remain in standby mode. Two conditions that signal an emergency diesel generator to start automatically are (1) loss of voltage on its associated electrical bus and (2) undervoltage on that bus. "Loss of voltage" and "undervoltage" sound alike, but they describe two different situations. Figure 2 illustrates the difference. Safety-related electrical buses 11EA and 12EB normally operate at 4.16 kilovolts or 4160 volts. The condition that signals "loss of voltage" for these two electrical buses is voltage falling to or below 3033 volts for more than 2 seconds (this voltage level is called the "setpoint"). "Undervoltage" refers to the voltage falling to or below a setpoint of 3952 volts for more than 44 seconds. The following cases explain how the electrical bus voltage protection is supposed to work.

> Case 1 – Electrical transient with no EDG response: The electrical bus voltage drops below the degraded voltage setpoint of 3952 volts, starting the 44-second timer. But because the voltage returns to over 3952 volts in less than 44 seconds, no signal to start the emergency diesel generator occurs.
>
> Case 2 – Electrical transient with EDG response on degraded voltage: The electrical bus voltage drops below the degraded voltage setpoint of 3952 volts, starting the 44-second time. With voltage still below 3952 seconds after 44 seconds, the emergency diesel generator is signaled to start. Power from the running emergency diesel generator restores the electrical bus voltage to its normal value.
>
> Case 3 – Electrical transient with EDG response on loss of voltage: The electrical bus voltage drops below the loss of voltage setpoint of 3033 volts, starting the 2-second timer. With voltage still below 3033 volts after 2 seconds, the emergency diesel generator is signaled to start. Power from the running emergency diesel generator restores the electrical bus voltage to its normal value.

The time delays and staggered setpoints prevent unnecessary demands on the emergency diesel generators. The 2-second delay for loss of voltage allows momentary "glitches" to be accommodated as power supplies for electrical buses are switched from primary to secondary feeds. Likewise, the 44-second delay for undervoltage allows voltage "droop" as large motors supplied from electrical buses are started. Engineering calculations and analyses support the setpoints and time delays to provide reasonable assurance that the components powered from the electrical buses will function when needed to prevent damage to the reactor core.

On July 2, 1986, Detroit Edison applied to the NRC for an amendment to the Fermi Unit 2 technical specifications that would increase the degraded voltage setpoint for the Division 1 4160-volt electrical bus from 3702 volts to 3952 volts. This increase represented a more stringent safety requirement than in the past. The company justified the change based on the need to correct an original design deficiency and to

protect against component damage. The degraded voltage setpoint is established by determining the minimum voltage required for each component supplied by an electrical bus. That minimum voltage varies from component to component. For analogy, consider battery-powered devices. Old batteries may still retain enough juice to illuminate a flashlight or power a portable CD player, but lack enough power to operate a cordless drill. If all these devices were deemed vital, the equivalent of the degraded voltage setpoint for batteries would replace them before their capability dropped below the level needed to operate the cordless drill even though they could still work in a flashlight.

On August 22, 1986, the NRC issued Amendment 4 to the Fermi Unit 2 technical specifications, revising the degraded voltage setpoint for the Division 1 electrical bus to 3952 volts. The NRC granted this change, which Detroit Edison had requested six weeks earlier, since Detroit Edison determined that a degraded voltage setpoint of 3702 volts did not adequately protect components that were powered from the Division 1 electrical bus from damage. But Detroit Edison failed to revise the test procedure for the system—it continued to test for a degraded voltage setpoint of 3702 volts. In other words, if workers determined the setpoint to be greater than or equal to 3702 volts, the test passed. But if the setpoint was less than 3952 volts, the technical specification requirement would not have been met.

So Detroit Edison raised the voltage standards at Fermi, arguing it was important in order to ensure safety. But workers continued to test against the old, lower standard.

On August 25, 2006 – 7,308 days after Amendment 4 was issued – an NRC inspector questioned Detroit Edison on why the degraded voltage test acceptance criterion did not match the requirement in the technical specifications.

For the intervening 20 years, the answer key would have accepted a degraded voltage setpoint of 3702 to 3951 volts – a value Detroit Edison and NRC deemed insufficient to protect safety equipment from damage.

FUTILITY AT THE UTILITY

"Futility at the Utility" is more than a catchy title. It explains how so many people at Detroit Edison and the NRC could have overlooked a simple fact: the technical specifications for one of the most safety-significant components in the plant specified that the Division 1 degraded voltage setpoint was 3952 volts while the actual testing procedures instead checked for a value of only 3702 volts.

For two decades, workers conducted and the NRC-monitored tests for the Division 1 degraded voltage protection that used the wrong answer key. These tests were performed at least once every 18 months,[1] so there were at least a dozen opportunities for someone to notice that passing the test did not equate to satisfying the technical specification requirements. Yet the futility is far deeper. There were literally hundreds, perhaps thousands, of opportunities for the glaring error to be identified. For example, Detroit Edison had to shut down Fermi Unit 2 in February 1988 after discovering it had not been testing the degraded voltage protection system for the emergency diesel generators as required by the technical specifications. The remedies for that problem did not identify other degraded voltage testing problems – although they clearly should have done so. For all that looking, there was no seeing. The timeline provided in the appendix to this report chronicles many missed opportunities to have identified the erroneous testing criterion.

It is truly hard to explain how so many opportunities in a two-decade span could have been missed. If it had been a snake, it would have died of old age. Every time the testing procedure was revised, several people reviewed it. Every time a new system engineer took over responsibility for the emergency diesel generators, his or her turnover process required a review of applicable technical specifications and testing procedures. Every time a training class of new operator candidates reviewed technical specifications and

associated testing procedures, they covered the function of the undervoltage protection system. Every time quality assurance auditors verified that testing procedures satisfied regulatory requirements, they had chances to notice the discrepancy. But these people all failed to detect a glaring mistake despite countless opportunities to do so during the two decades.

It wasn't the case of one person making the same mistake over and over or many people making the same mistake. Many people made many different mistakes for many years.

HOW?

The repeated failure of Detroit Edison and NRC to ask and answer this question allowed nonsense like performing tests with the wrong answer key to go unnoticed for two decades. The appendix contains dozens of accounts of Detroit Edison committing egregious errors. Each time, Detroit Edison promised various steps to prevent recurrence. Each time, NRC gave its blessing after varying degrees of scolding..

If nothing else, this latest episode clearly reveals the futility of promising and accepting reforms without first identifying the root cause of a problem. Having failed again and again to pinpoint the cause of its problems, Detroit Edison merely treated the symptoms. And the NRC mistook flailing for fixing.

Picture for a moment an assembly line for automobiles, maybe even one of those in Detroit. An NRC inspector at the end of the line spot checks an automobile selected at random and discovers that its doors open inward instead of outward. The NRC inspector brings it to the attention of the foreman and patiently watches as workers correct the problem. Then there are handshakes and backslaps all around as everyone celebrates finding and fixing the problem. But more than likely, the assembly line will continue to turn out automobiles with improperly installed doors because the NRC inspector, foreman, and workers merely dealt with the consequences at the end of the line rather than addressing the problem at its root.

The assembly line at Fermi Unit 2 keeps turning out surveillance tests that fail to adequately verify compliance with technical specification requirements. The appendix is replete with examples of such failures, yet it is an abridged listing which demonstrates that instead of determining what's wrong with the assembly line and correcting that process flaw, Detroit Edison merely fixes the occasional errant test when someone stumbles across it.

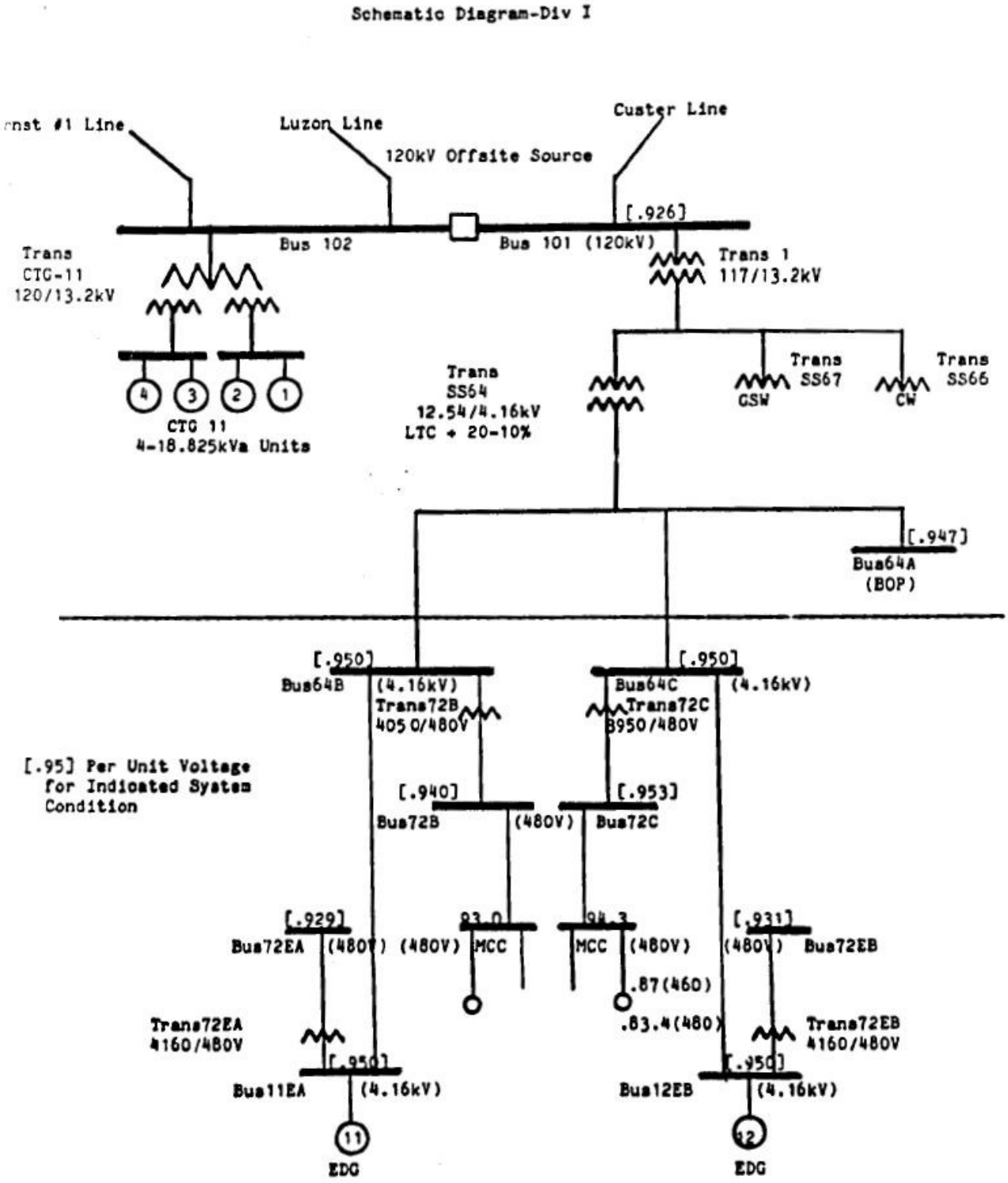
The NRC must compel Detroit Edison to investigate its flawed assembly line. Then and only then can Detroit Edison implement the fixes needed to not only correct yesterday's mistakes but also avoid tomorrow's mistakes. For example, the company claimed that it completed a "*100% verification of the Technical Specification requirements*"[2] in August 1986. It would be extremely useful to understand how a 100% verification failed to notice the multiple non-compliances with technical specification requirements identified after August 1986. Likewise, Detroit Edison shut down Fermi Unit 2 in February 1988 because it had not been testing the degraded voltage protection for the emergency diesel generators as required by technical specifications, allegedly fixed the problem, and restarted the reactor. It would be equally useful to understand how that exercise failed to reveal it was testing the degraded voltage protection for the emergency diesel generators using long outdated technical specification values. In October 1994, Detroit Edison informed the NRC that the failure it had identified earlier that year in not testing the permissive interlocks for the undervoltage protection system as required by technical specifications was widespread, and the company committed to reviewing all other applicable testing procedures. It would be useful to understand how that effort was for naught.

What did the NRC do when the 20-year old testing problem was finally discovered? It "sanctioned" Detroit Edison with a GREEN finding – the lowest severity level in NRC's four-level, color-coded sanction system – for the violation of federal safety regulations spanning two decades. That's all.

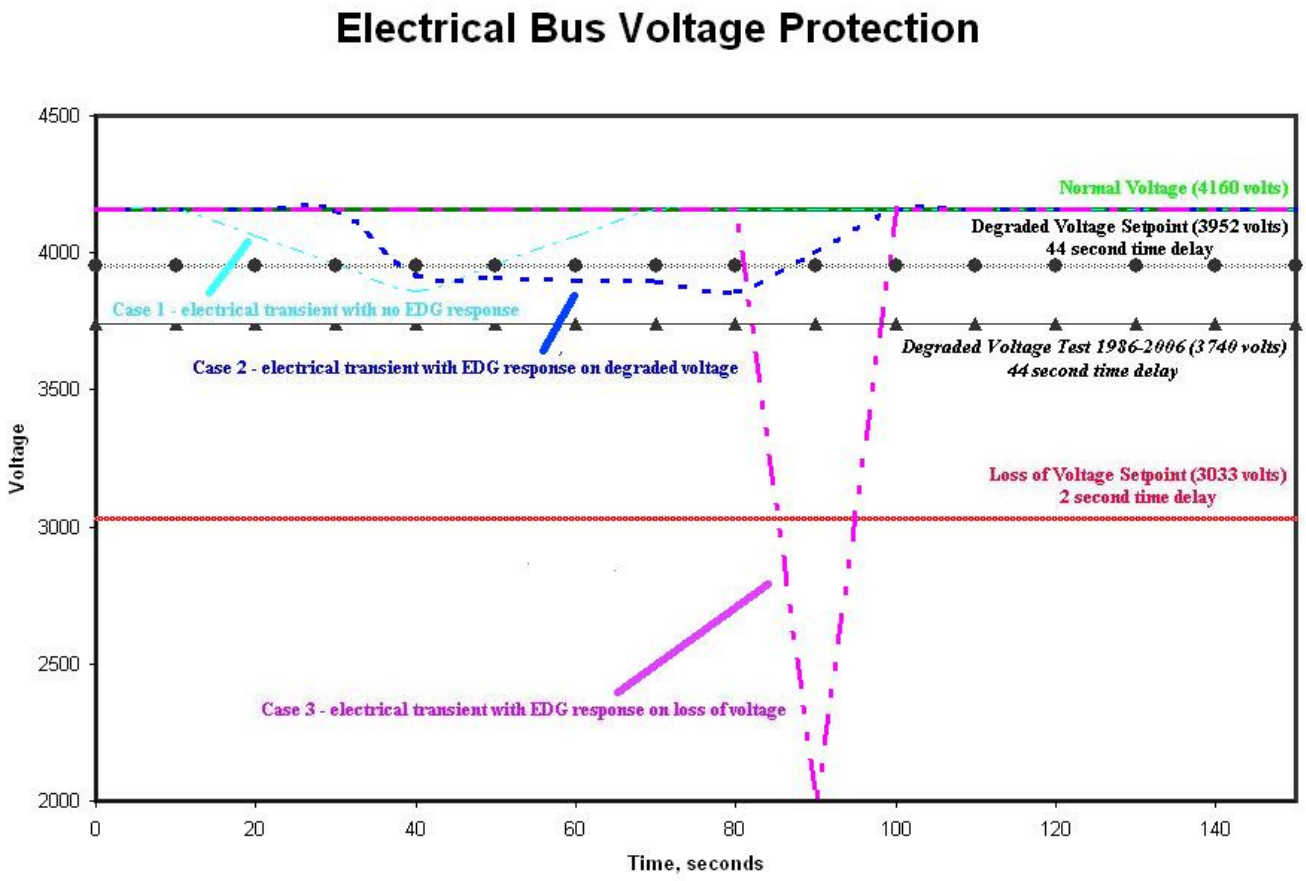
Detroit Edison doesn't have to explain how it missed this glaring mistake many times for many years. Detroit Edison doesn't have to fix the many flawed processes that allowed so many of its workers to perform tests with the wrong answer key. This may not be the most useless sanction in nuclear history, but it's likely in the top five.

What should the NRC do? By letter dated February 7, 1997, Detroit Edison formally responded to the NRC's query about availability and adequacy of design basis information. Detroit Edison listed many activities conducted over the years at Fermi Unit 2 that provided the company assurance the reactor complied with requirements. All of those activities failed to note that Detroit Edison was testing the Division 1 degraded voltage protection system using the wrong answer key. The NRC should require that Detroit Edison revisit its February 1997 submittal activity-by-activity and explicitly state how each activity failed to catch this problem. The NRC should then require that Detroit Edison state what it had done to remedy the deficiencies identified in each activity. Following some appropriate time span (say, 60 days), the NRC should conduct an audit at Fermi Unit 2 to determine if Detroit Edison has actually completed the remedial actions it identified.

Will the NRC take these steps? Probably not. But an effective regulator would.



Degraded Grid Setpoint-Maximum Bus Loads-Post Start of Two RHR and Two CS Pumps


Electrical Bus Voltage Protection
Normal Voltage (4160 volts)
Degraded Voltage Setpoint (3952 volts)
44 second time delay
Case 1 - electrical transient with no EDG response
Case 2 - electrical transient with EDG response on degraded voltage
Degraded Voltage Test 1986-2006 (3740 volts)
44 second time delay
Loss of Voltage Setpoint (3033 volts)
2 second time delay
Case 3 - electrical transient with EDG response on loss of voltage
Voltage
Time, seconds
4500
4000
3500
3000
2500
2000
0
20
40
60
80
100
120
140

APPENDIX 1: TIMELINE

Date	Event
August 4, 1984	Workers modified the sight glass used to indicate the oil level for one of the bearings on Emergency Diesel Generator 14. Due to an error, the sight glass was unintentionally and unknowingly installed nearly one inch below its original level.[3] This error went undetected and uncorrected for nearly 17 years and caused catastrophic failure of the bearing on March 21, 1991.
November 26, 1984	The Detroit Edison Company's Vice President for Nuclear Operations certified to the NRC in writing that the Technical Specifications for Fermi Unit 2 were adequate and consistent with the Final Safety Analysis Report and as-built plant design.[4] The NRC relied upon this certification in granting Detroit Edison an Operating License for Fermi Unit 2.
July 1, 1985	According to the NRC: *… a reactor operator (the Nuclear Supervising Operator at the control panel), about an hour into his shift, while withdrawing control rods to achieve criticality on his first attempt ever to bring a commercial power reactor critical, pulled 11 rods in Group 3 to the fully withdrawn position (position 48), rather than position 04 required by the rod pull sheet. This resulted in the reactor prematurely reaching criticality although this was not fully recognized by the licensee until several days later. While pulling the 11th control rod in Group 3, the Short Period Alarm annunciated five times and the pen for the Channel A Source Range Monitor failed to ink for about three minutes. When the pen began inking again the count rate was increasing. At about the same time, the rod pull error was recognized and the reactor operator began reinserting the 11 rods. The Nuclear Shift Supervisor (NSS), was called and came out of his office to consult with the reactor operator. The NSS, who was also responsible for directing his first startup of a commercial power reactor, reviewed the event with the reactor operator and the Shift Technical Advisor in training and determined that the reactor had not gone critical. … A Shift Reactor Engineer made the determination on July 4, 1985, that the reactor had been critical on July 1, 1985, with a 114 second period, and informed his management*.[5]
July 15, 1985	The NRC issued Detroit Edison an Operating License for Fermi Unit 2: *The Nuclear Regulatory Commission (the Commission) has found that:* *…. There is reasonable assurance (i) that the activities authorized by this operating license can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations."*[6]
December 17, 1985	Emergency Diesel Generator 13 failed to start during a surveillance test, the second start failure of EDG 13 since the operating license was issued.[7]

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Date	Event
June 1986	The Independent Safety Engineering Group [an internal audit organization mandated by the NRC as one of the many lessons learned from the Three Mile Island Unit 2 accident] initiated a review of the Technical Specification Surveillance Program. In parallel, the Nuclear Quality Assurance organization audited the Technical Specification Surveillance Testing Program.[8]
July 2, 1986	Detroit Edison submitted a request to the NRC seeking to amend the Fermi Unit 2 operating license to revise the Technical Specification values for degraded grid undervoltage relay setpoints on the Division 1 electrical system. The requested change sought to increase the undervoltage setpoint, from 89 percent to 95 percent of nominal voltage to account for design deficiencies and to allow for Division 1 operability.[9]
July 3, 1986	The NRC imposed a $300,000 fine on Detroit Edison for violations stemming from the July 1, 1985, inadvertent, unrecognized reactor criticality at Fermi.[10] **UCS View:** ***This fine represented little more than regulatory sabre-rattling by the NRC. The NRC issued Detroit Edison an operating license for Fermi Unit 2 on July 15, 1986 – two weeks AFTER the inadvertent, unrecognized reactor criticality event. Had NRC truly been concerned by the event or Detroit Edison's behavior, it would not have given the company the keys so soon after the event. But a six-figure fine provides the public with the allusion of an aggressive regulator.***
July 8, 1986	Emergency Diesel Generator 14 failed to start during a surveillance test. It was the first start failure of EDG 14 since the issuance of the operating license.[11]
July 9, 1986	Emergency Diesel Generator 14 failed to start during a surveillance test. It was the second start failure of EDG 14 since the issuance of the operating license.[12]
August 1986	The review of the Technical Specification Surveillance Program by the Independent Safety Engineering Group (ISEG) and the audit of the Technical Specification Surveillance Testing Program by the Nuclear Quality Assurance organization concluded. Five items where inadequate surveillance procedures had resulted in equipment or services being rendered technically inoperable were identified.[13] In February 1997, Detroit Edison would emphasize the value of the ISEG review in writing to the NRC: *This activity occurred during the initial operating period of the Fermi 2 plant. Because it represented a 100% verification of the Technical Surveillance Requirements at that time, and because deficiencies were resolved, it was extremely important in establishing a baseline for the procedural control of Technical Specification surveillances.*[14]

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Date	Event
	UCS View: Detroit Edison claimed to have conducted a "100% verification of the Technical Surveillance Requirements" in summer 1986, yet subsequent testing inadequacies were reported in May 1987, October 1987, February 1988, July 1994, and October 1994. The purported "100% verification" had very little value.
August 6, 1986	In a licensee event report (LER) submitted to the NRC by Detroit Edison about its failures to meet the surveillance testing requirements contained in the Fermi 2 technical specifications, the company stated: *Part of Detroit Edison's corrective action to a violation involving not meeting Technical Specification Limiting Conditions for Operation was to review the Fermi 2 Surveillance Program. The review consists of verifying that Technical Specification surveillance requirements are included in appropriate procedures, that they are adequately scheduled, and for selected surveillance procedures to verify that the surveillance requirements are adequately implemented. While performing this review, five cases have been found where a surveillance requirement was not specifically addressed in a procedure, or that documentation of performing a surveillance is not available because it was not specifically required by procedure.*[15]
August 8, 1986	In issuing Detroit Edison an operating license for Fermi Unit 2 on July 15, 1985, the NRC made the license conditional on the company implementing a testing regime for the lubricating oil used in the emergency diesel generators. [16] On this date, workers identified that lube oil filter checks for the emergency diesel generators had not been performed during the previous three months as required.[17]
August 22, 1986	The NRC issued amendment 4 to the Fermi 2 operating license and approved revisions to the technical specifications that increased the Division 1 degraded grid undervoltage relay setpoints to correct a design deficiency.[18]
September 16, 1986	In another in a series of licensee event reports (LERs) submitted to the NRC by Detroit Edison about its failures to meet the surveillance testing requirements contained in the Fermi 2 technical specifications, the company stated *The cause of these events was an inadequate review of surveillance procedures which resulted from personnel error. Review of procedures is an activity which is controlled by an approved procedure. As a corrective action, the Technical Review process was improved. Among the improvements was the addition of a Technical Review Checklist. The Technical Review Checklist was approved on September 16, 1986.*[19] **UCS View: Detroit Edison proffered the Technical Review Checklist as a "fix" for past sins. Yet this purported "fix" failed dozens of times when revisions to the degraded voltage protection system test**

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	procedure were approved despite having the wrong acceptance criterion.
May 14, 1987	The NRC fined Detroit Edison $100,000 for seven violations involving failure to satisfy surveillance testing requirements in the technical specifications. The NRC stated: *The base value of a civil penalty for a Severity Level III violation or problem is $50,000. … The base civil penalty amount has been increased by 100 percent because: (1) your prior performance in the surveillance testing area since issuance of your operating license in April 1985 has been poor in that Severity Level IV violations have been issued and an Enforcement Conference was held in May 1986 concerning this area and (2) your corrective actions to prevent recurrence of the violations described in the February 1987 Enforcement Conference were incomplete in that you had not initiated an appropriate and comprehensive program to reexamine the technical adequacy of the surveillance and preoperational test procedures.*[20]
May 23, 1987	Reinforcing the $100,000 fine issued by the NRC just nine days earlier for seven violations of surveillance test requirements, Detroit Edison notified the NRC that it had not been performing the surveillance test of the carbon dioxide fire protection function for the standby gas treatment system. The company promised, yet again, to undertake actions to identify and correct the surveillance program deficiencies.[21]
June 26, 1987	Reminiscent of the inadvertent, unrecognized reactor criticality event that occurred on July 3, 1985, there was an unmonitored, uncontrolled reactor mode change event at Fermi Unit 2.[22]
July 27, 1987 to August 7, 1987	In response to the unmonitored, uncontrolled reactor mode change event that occurred one month ago, an NRC inspection team spent 12 days at Fermi Unit 2 and reported: *Six significant events occurred during the inspection period which provided an opportunity for team members to observe operator actions. In general, the team found examples of operator inattentiveness, instances of unfamiliarity with equipment and system operating characteristics, and the absence of a questioning, problem-oriented attitude that asked "what if" questions in an effort to identify and prevent problems*.[23]
July 31, 1987	Detroit Edison voluntarily shut down Fermi Unit 2 for a maintenance outage.[24]
August 3, 1987	An NRC inspector following up on the surveillance testing violations reported: *In response to LER 87-019 mentioned above, the licensee committed to*

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	verify: 1) that procedures were available and responsive to each TS surveillance requirement line item by July 31, 1987; 2) that the TS procedure index would be verified accurate by August 31, 1987; and 3) that an independent sample verification of these activities would be conducted during September 1987. … As of August 3, 1987, the TS Procedure verification required to be completed by July 31, 1987 was less than 50 percent complete. Of 417 review packages, 20 had been completed, about 50 were awaiting supervisor review, and about 200 had been rejected by supervisory review and were under correction or resubmittal for review. … The inspector was unable to obtain a firm completion date.[25]
September 8, 1987	Another NRC inspector began a follow-up examination of Detroit Edison's efforts to correct deficiencies in its surveillance testing program.[26]
October 9, 1987	The NRC Regional Administrator authorized Detroit Edison to restart Fermi Unit 2 following a maintenance outage, but limited the reactor's output to 50 percent of its licensed power level.[27]
October 23, 1987	The NRC inspector completed the examination of the surveillance testing program initiated on September 8, 1987, and reported: ❑ Prior to October 23, 1987, Detroit Edison had not been testing all portions of the RCIC and HPCI systems because the testing had not provided the level of overlap such that the entire system was tested. ❑ Prior to October 23, 1987, Detroit Edison had not been response time tested all portions of the HPCI system because the testing had not provided the level of overlap such that the entire system response time was measured. ❑ Prior to October 23, 1987, Detroit Edison's surveillance testing of the RCIC remote shutdown initiation switch and RCIC valves E51-F045 and F059 switch failed to verify the components to be OPERABLE.[28]
October 23, 1987	The NRC informed Detroit Edison about the results from its Operational Safety Team Inspection at Fermi Unit 2. The NRC stated: *The NRC team effort focused on: the effectiveness of management oversight of plant operations and in communicating the goals and objectives of programs designed to correct operational problems to plant operating staff; the control and effectiveness of plant operating procedures and practices; a review of surveillance test programs and related procedures in conformance with Plant Technical Specification requirements; the effectiveness of administrative procedures and controls; organizational interfaces and coordination in support of plant operation; the adequacy of safety reviews and the process for proposing and implementing plant modifications and corrective actions; training program effectiveness; and a review of programs for assuring quality in*

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	these areas.[29] *The inspection findings affirmed prior staff assessments that the problems at your station encompass a broad range of plant activities, including operating practices, administrative controls, surveillances, training, and the corrective action process. … In the Regional Administrator's letter to you dated October 9, 1987 authorizing plant restart, … you were also directed to submit detailed plans for improvement in the plant's Technical Specifications and their interpretation and implementation, and to prepare a comprehensive report of your various improvement programs and commitments to the NRC*.[30] *The team's findings disclosed no new, significant programmatic or managerial deficiencies which, if remedied, would dramatically improve the licensee's ability to safely operate the facility*.[31] *Operators did not appear to understand the use of the Technical Specifications (TS) as a "working" document by being intimately familiar with requirements for operability of systems and time limitations*.[32] *Operators had a production orientation that regularly resulted in the licensee taking the path of least resistance in resolving administrative and material problems which had the potential to delay progress toward commercial operation*.[33] *Based on an examination given to operators by the licensee as a result of the mode change incident and on interviews and observations, the team concluded that operators were not fully knowledgeable in the duties and responsibilities of their individual positions. Operators, instrument technicians, and maintenance personnel did not seem to grasp the significance of how their actions had the potential to place the plant at risk*.[34] *The licensee continued to encounter difficulty with the surveillance program. The licensee's plans to minimize missed surveillances remained unfulfilled after several attempts*.[35] *The team considered the site QA program as a strength, although QA at times failed to grasp the fundamental causes of problems*.[36] *The inspector noted that recent attrition from the [QA] group had caused a rolling backlog of about 15-18 overdue surveillances out of the 24 scheduled as of August 9, 1987*.[37] **UCS View: The NRC assumed the role of "pot" to Detroit Edison's "kettle." NRC asserted that Detroit Edison had a "production orientation," yet the NRC Regional Administrator duplicated this**

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	characteristic on October 9, 1987, when he allowed Fermi Unit 2 to be restarted but operated at no more than 50 percent power until all identified problems were corrected. A proper "safety orientation" would have resulted in BOTH Detroit Edison and the NRC giving these longstanding problems more than mere lip service.
December 9, 1987	The NRC informed Detroit Edison about the results from its inspection into the efforts by the company to resolve recurring surveillance testing program problems: *At the time of this inspection, the licensee was in the process of improving their surveillance program. This included rewriting and changing the format of over 500 procedures. Technical Specifications were being reviewed (as the result of DER-87-286 and corrective actions as stated in LER 87-019) to ensure the following: each requirement was covered by an approved procedure; … and the procedures contained steps which implemented the required Technical Specification.*[38] **UCS View: It is highly implausible that a serious effort to verify "each requirement was covered by an approved procedure … and the procedures contained steps which implemented the required Technical Specification" would fail to discern that the Division 1 degraded voltage protection setpoint in the technical specification did not match the setpoint in the test procedure. What is far more likely is that the scope and depth of this "band-aid" was overblown by Detroit Edison and not checked by NRC.**
February 26, 1988	Detroit Edison began shutting down Fermi Unit 2 after the engineering department determined that all four emergency diesel generators had not been adequately tested. Specifically, the degraded voltage mod for both the Division 1 and Division 2 emergency diesel generators had never been tested, even though required in the Technical Specifications. All four emergency diesel generators were declared inoperable due to the lack of degraded voltage mode testing, requiring the reactor to be shut down within 12 hours. Shortly after midnight (early on February 27th), operators manually scrammed the reactor from 10 percent power.[39] **UCS View: This event marks the greatest single opportunity for Detroit Edison and the NRC to have noticed that the Division 1 degraded voltage protection setpoint in the technical specifications did not match that in the associated test procedure. After all, Detroit Edison had to shut down Fermi Unit 2 after finding that degraded voltage testing had not been performed as required by technical specifications. There's no explanation for how both Detroit Edision and the NRC allowed Fermi Unit 2 to restart without having found and fixed the discrepancy.**
1989	Detroit Edison committed to the NRC that it would complete a self-initiated Design Bases Document (DBD) Program. The scope of the DBD program covered

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	the Fermi 2 safety related systems, including the emergency diesel generators. Detroit Edison told the NRC that the validation process for each DBD would identify and correct additional discrepancies between information in the DBDs, as-built documents, procedures, Updated Final Safety Analysis Report, and the Operating License.[40] **UCS View: Detroit Edison developed and issued a Design Basis Document for the emergency diesel generators, yet somehow failed to identify the discrepancy between the degraded voltage setpoint in the technical specifications and the associated test procedure. One of the primary purposes of the DBD effort was not met.**
April 27, 1989	The NRC conducted an enforcement conference with Detroit Edison on violations stemming from numerous NRC inspections conducted between 1984 and 1986 at Fermi Unit 2. The violations ranged from certifying that the technical specifications were accurate to having deliberately provided false information to the NRC about access controls for security information.[41]
February 12, 1990	The NRC sanctioned Detroit Edison for numerous violations identified between 1984 and 1986 and discussed at the enforcement conference about a year earlier. The NRC did not fine the company, but scolded it severely: *It was only fortuitous that no safety problems resulted from the operation of Fermi with inaccurate technical specifications.* [42] *We realize that most of the individuals involved in the violations described in the Notice are no longer employed in the Fermi nuclear program.*[43] *The inadequate certification of your Technical Specifications, and the management systems that allowed them to occur are intolerable in the nuclear power industry.*[44] The NRC noted that the manager who had deliberately lied to the NRC about security information access controls still worked for Detroit Edison, but in a part of the organization outside nuclear power. The NRC ordered Detroit Edison to let the agency know before it returned that individual to its nuclear program. **UCS View: The NRC would tolerate the "intolerable" for 16 more years. NRC's strong words were backed by weak (in)action.**
March 4, 1991	The NRC notified Detroit Edison and other nuclear plant owners about testing problems for emergency diesel generators. The NRC expressly informed Detroit Edison: *… some EDG testing has not adequately verified the capability of the EDG to carry its maximum expected loads and other tests have failed to properly verify the operation of the load shedding logic for the EDG.*

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	These testing deficiencies indicate that other licensees may have similar deficiencies that have not yet been detected. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems.[45]
April 28, 1991	Less than eight weeks after being warned about inadequate testing of the emergency diesel generators, Detroit Edison inadequately tested all four of its emergency diesel generators. A technician calibrated the four degraded grid undervoltage and four loss of voltage relays, but left the loss of voltage relays outside the tolerance band specified in the calibration procedure. Worse, the degraded grid undervoltage relays were left outside of the allowable values in the Technical Specifications. During the review of the completed calibration procedure, the shift technical advisor and the nuclear shift supervisor signed the calibration package without noticing the failed results. The system engineer later caught the failure and had all the relays properly recalibrated.[46]
July 29, 1991 to August 30, 1991	The NRC conducted an electrical distribution system functional inspection at Fermi Unit 2. According to the NRC: *The team reviewed the electrical and mechanical support systems of the EDS, examined installed EDS equipment, reviewed EDS testing and procedures, and interviewed selected corporate and site personnel.* [47] *The team verified conformance with General Design Criteria (GDC) 17 and 18 and the applicable 10 CFR 50, Appendix B criteria. The team also reviewed plant technical specifications (TS), the updated safety analysis report (USAR), and appropriate safety evaluation reports (SERs) to verify that TS requirements and licensee commitments were met.* [48] Years later, Detroit Edison provided this recollection of the NRC effort: *An Electrical Distribution System Functional Inspection (EDSFI) was conducted by the NRC in August 1991. The inspection team assessed the performance capability of the Fermi 2 Electrical Distribution System (EDS), including all emergency sources of power to systems required to remain functional during and following design basis events.* [49] **UCS View: The NRC conducted a lengthy, focused inspection of the electrical distribution system but somehow failed to identify that the test procedure for the degraded voltage protection system used the wrong acceptance criterion. That this focused NRC effort failed to detect the glaring discrepancy between technical specifications and testing procedures suggests only one thing to UCS – that NRC inspectors are checking to see if licensees are doing what they say they'll do (i.e., following their procedures) rather than doing what they're required to do (i.e., comply with technical specifications). It's Millstone all over again, only this time the NRC inspectors are**

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	neglecting technical specifications rather than Updated Final Safety Analysis Reports.
July 15, 1994	Detroit Edison discovered yet another failure to conduct adequate surveillance testing per Technical Specification requirements: *During a routine review of surveillance procedure 42.302.02, "Calibration and Logic System Functional Test of Division 1 4160 Volt Emergency Bus 64B and 11EA Undervoltage Circuits," it was determined that the permissive interlocks for the bus undervoltage relays have not been tested to the degree necessary to fully meet the requirements of Technical Specification section 3.3.3. Further testing deficiencies were identified on September 9, 1994 related to the starting and loading of the Emergency Diesel Generators. All Emergency Diesel Generators were declared inoperable.*[50] In response to this oversight, Detroit Edison told the NRC it had taken these corrective steps: *In 1994, during a periodic review of electrical surveillance testing procedures for logic system functional surveillance testing of safety related equipment, Detroit Edison identified problems associated with inadequate overlap of surveillance test procedures. For example, permissive interlocks for the bus undervoltage relays for the Division 1 4160 Volt Emergency Bus 64B and 11EA Undervoltage Circuits had not been tested to the degree necessary to fully meet the requirements of the Technical Specifications. … Corrective actions including revising the deficient procedures and performing the surveillances, and reviewing similar surveillances.*[51]
October 7, 1994	Detroit Edison informed the NRC that the company's initial evaluation of the surveillance testing deficiencies identified in July indicated the problem was not isolated, prompting the company to expand its efforts: *A comprehensive review of the LOP and the LOP/LOCA procedures, schematics, load diagrams, design calculations and overlaps is being performed to ensure that all of the loads and logics are being properly tested. Likewise, a review of all other Technical Specification section 4.8 surveillance requirements is being performed to ensure that the surveillance procedures are adequate to perform the required testing.*[52] **UCS View: This event, following many prior events of similar nature, reveals the futility of having Detroit Edison conduct reviews of surveillance tests without first having determined why previous reviews failed. This review failed to identify the incorrect degraded voltage protection system setpoint as had all prior reviews. While six half-hearted attempts are better than five, what is best is one whole-**

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	hearted attempt. The NRC must make Detroit Edison first figure out the errors of its ways and correct them for there to be any hope that the next attempt will be successful.
January 20, 1995	NRC warned Detroit Edison and all other plant owners about testing methods causing undervoltage protection relay settings being out of tolerance.[53]
November 1995	Detroit Edison began an effort to convert the Fermi Unit 2 Technical Specifications to the Improved Technical Specification format. Detroit Edison described the conversion process to the NRC: *Detroit Edison has undertaken an initiative to convert the Fermi 2 Technical Specifications to the Improved Technical Specifications (ITS). Major benefits sought by this conversion include improved operational safety, clearer understanding of Technical Specification requirements, and reduced administrative burden. … The development phase of the Fermi 2 ITS began in November of 1995 and continues until submittal of the proposed Fermi 2 ITS (expected in second quarter of 1997). … In addition to the benefits expected after implementation, the effort involved in developing the ITS Bases is providing additional confidence in the adequacy and accessibility of design bases information. Development of the Bases requires incorporation of Fermi 2 design information into the generic ITS Bases. This is providing an opportunity to clearly document the origin and intent of the requirements in the Technical Specifications. The level of review of these ITS drafts, including the Onsite Review Organization, provide further assurance that the design and licensing bases are accurately understood and adequately addressed in the ITS Bases*.[54]
February 5, 1996	During a test run, a pump providing cooling water to an emergency diesel generator malfunctioned when freezing weather conditions caused ice to form and build up in the piping. Despite the obvious potential for common-mode failure affecting the pumps for the other emergency diesel generators, workers "*did not immediately recognize the possibility that other cooling water systems for plant safety equipment might be affected by the weather*."[55]
February 6, 1996	During a test run of another emergency diesel generator, a pump providing it with cooling water operated erratically due to the buildup of ice.[56]
May 22, 1996	The NRC proposed a $50,000 fine on Detroit Edison for a violation stemming from the emergency diesel generator cooling pump problems encountered on February 5th and 6th. [57] **UCS View: "Regulatory Whimsy" is the only way to explain how the NRC could fine Detroit Edison $50,000 for a problem that impaired the emergency diesel generators for perhaps 20 hours yet impose no sanction for a problem that impaired the emergency diesel generators**

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	for over 20 years.
1996	In response to the configuration management problems identified at Millstone and reported by NRC to all other nuclear plant owners, Detroit Edison conducted a systematic review of the Fermi Unit 2 Updated Final Safety Analysis Report using subject matter experts such as system and design engineers. Detroit Edison informed the NRC: *While the UFSAR Overview was not a complete verification or validation, the subject matter experts were expected to identify any significant discrepancies between the UFSAR and plant configuration and operation.*[58]
1996	The NRC conducted an Operational Safety Inspection at Fermi Unit 2 to evaluate the effectiveness of the process for identifying, resolving, and preventing issues that degrade the quality of plant operations or safety. "*The inspection identified instances where corrective actions were not effective in preventing problem recurrence*." [59]
February 7, 1997	On October 9, 1996, the NRC required Detroit Edison to formally respond to questions about the available and adequacy of design bases information for Fermi Unit 2. This NRC action resulted from its discovery earlier in 1996 that the three reactors at the Millstone nuclear plant in Connecticut had operated for many years outside of its design and licensing bases. Detroit Edison responded, under oath, to the NRC with these statements: *Based on the information derived from these programs and activities, Detroit Edison concludes that there is reasonable assurance that Fermi 2 is configured, operated and maintained within the design bases.*[60] The assorted "programs and activities" cited by and relied upon by Detroit Edison included: *Detroit Edison has improved the accessibility of licensing bases information by creating electronically searchable files containing text and tabular information from a number of relevant documents, such as the UFSAR, plant Technical Specifications, and NRC Safety Evaluation Reports. Access to these files is available site-wide.*[61] *Surveillance Procedures provide the necessary steps to perform the required periodic testing of safety related structures, systems, and components in accordance with the Technical Specification requirements and/or the ASME Boiler and Pressure Vessel (B&PV) code Section XI. ASME and Technical Specification acceptance criteria are derived in part from design bases requirements contained in the UFSAR. Nuclear Shift Supervisor approval is required before performance of surveillance tests. After completion of surveillance tests, the Nuclear Shift Supervisor*

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	reviews tests to verify that they have been successfully performed and meet the acceptance criteria cited in the surveillance procedure.[62] *10 CFR §50 Appendix B and the Fermi 2 Quality Assurance Program require measures be established to ensure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected*.[63] *Procedures covering operation, maintenance, surveillance, and test activities have been in place since the issuance of the Fermi 2 Operating License. Ongoing internal, third party, and NRC assessment of these controls and their effectiveness provides opportunities to identify and correct nonconformances and their causes*.[64] *Fermi 2 conducted design reviews, plant procedure reviews, and licensing document reviews as part of the Design Basis Document (DBD) program. A DBD validation was performed, as part of the program, with an emphasis on consistency among DBDs, UFSAR, and Technical Specifications*.[65] *"The NRC Electrical Distribution System Functional Inspection (EDSFI) team reviewed most of the electrical design calculations at Fermi 2 and considered them a strength, as documented in the associated NRC Inspection Report*.[66] *The [NRC] team did not identify any operability concerns, and there were no violations of NRC requirements identified. The inspection concluded that emergency power sources were sized properly and adequate voltage was available to essential buses to accommodate EDS loads*.[67] *The objective of this functional evaluation was to assess the adequacy of the Technical Specification Surveillance Program. The elements of the assessment included verification that Tech Spec surveillance requirements were included in procedures.* [68] *Corrective actions included revising the deficient procedures and performing the surveillances, and reviewing similar surveillances. A dedicated team of approximately 40 people was established to conduct this review and correct identified deficiencies. When similar deficiencies were discovered in other logic functional test surveillances, the investigation was expanded. … This initial effort took place over approximately four months and involved review or revision of approximately 100 surveillance procedures*.[69] **UCS View: <u>None</u> of these many programs and activities prevented Detroit Edison from operating Fermi Unit 2 without testing the**

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	Division 1 degraded grid undervoltage relays as required by the Technical Specifications since August 1986. Since Detroit Edison expressly credited these many programs and activities, NRC should insist that the company explain how each one of these programs and activities failed.
June 2, 1998	The NRC approved an amendment to the Fermi Unit 2 operating license that extended the allowable out of service time for an emergency diesel generator from three days to seven days.[70]
September 15, 1998	Workers replaced the underfrequency relays on the emergency diesel generator. When NRC inspectors later reviewed the modification package, they noted mistakes in the review process required by federal regulation 10 CFR 50.59: *Technical Service Request (TSR)-30092, dated September 15, 1998, replaced Emergency Diesel Generator (EDG) underfrequency relay model GE P/N 12SFF21A1A with model 12SFF16A1A. The [NRC] team noted that the blocks in part 4 and part 5 of the 10 CFR 50.59 Preliminary Evaluation were incorrectly marked. The licensee determined this parts equivalency change to be an exempt change not requiring a full 10 CFR 50.59 evaluation, even though the relay model number was changed in UFSAR fig 8.3-4.*[71]
October 8, 1999	Linear reactor 2 on Emergency Diesel Generator 12 failed due to aging. Each emergency diesel generator features three linear reactors in its excitation circuit. The linear reactors provide base excitation voltage when the emergency diesel generator operates unloaded (disconnected from its electrical bus).[72]
March 3, 1999	During a plant-wide process of "green-banding" sight glasses to clearly identify acceptable bands of fluid levels for equipment, workers improperly translated the sight glass "green band" level indicators for the outboard bearing lubricating oil for Emergency Diesel Generator 14. As a result, the top of the clearly marked "green band" remained below the minimum oil level recommended by the vendor for the bearing.[73]
April 1, 1999	The NRC reported "*…an operator did not follow an emergency diesel generator test procedure sequence which caused the emergency diesel generator output breaker to trip open due to a reverse power condition*."[74]
May 1999 to July 1999	Workers replaced the safety-related electrical motor control center buckets for the emergency diesel generators with new buckets. Some of the replacement buckets had control power transformers that were insufficiently sized to ensure adequate voltage to the starter circuits for components under degraded voltage grid conditions. The safety problems introduced by these replacements would remain uncorrected until August 2006.[75]

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October 20, 1999	The NRC reported: *Inattention to detail, lack of self-checking and lack of an effective peer review resulted in an inadvertent trip of emergency diesel generator 14 during testing. An operator used the wrong switch to adjust voltage. The error resulted in the emergency diesel generator voltage regulator circuitry being damaged.*[76]
October 21, 1999	Linear reactor 2 on Emergency Diesel Generator 14 failed due to aging. Each emergency diesel generator features three linear reactors in its excitation circuit. The linear reactors provide base excitation voltage when the emergency diesel generator operates unloaded (disconnected from its electrical bus).[77]
March 23, 2000	The NRC reported its inspectors "observed all or portions of" the post maintenance test conducted following replacement of a bearing on Emergency Diesel Generator 11.[78]
April 12, 2000	Linear reactor 1 on Emergency Diesel Generator 12 failed due to aging. Each emergency diesel generator features three linear reactors in its excitation circuit. The linear reactors provide base excitation voltage when the emergency diesel generator operates unloaded (disconnected from its electrical bus).[79]
May 9, 2000	Linear reactor 1 on Emergency Diesel Generator 11 failed due to aging. Each emergency diesel generator features three linear reactors in its excitation circuit. The linear reactors provide base excitation voltage when the emergency diesel generator operates unloaded (disconnected from its electrical bus).[80]
June 16, 2000	Workers added the wrong lubricating oil to the alternator bearings on Emergency Diesel Generator 11, causing the EDG to be inoperable longer than the 7-days allowed by Technical Specification 3.8.1.1.[81]
September 7, 2000	NRC inspectors reviewed the results of the surveillance test performed for Emergency Diesel Generator 12 with no findings.[82]
October 16, 2000	Detroit Edison Company transmitted Revision 41 to the Fermi Unit 2 Technical Requirements Manual to the NRC. Revision 41 included a revision to the loss of power instrumentation Table TR3.3.8.1-1, but the Division I 4.16 kV emergency bus undervoltage (degraded voltage) trip setpoint remained at 3952 volts.[83] **UCS View: Detroit Edison repeatedly informed NRC, in writing, that the safety requirement for the degraded voltage setpoint was 3952 volts. Despite those repeated reminders, NRC inspectors failed to notice for more than two decades that Detroit Edison was not testing the degraded voltage setpoint to the proper value.**
November 4, 2000	Following a high temperature alarm on the generator bearing for Emergency Diesel Generator 11, NRC inspectors reviewed the requirements of Technical

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	Specification 3.8.1.[84]
January 11, 2001	The NRC reported its inspectors had reviewed Modification 30458 that revised the Bus 64C undervoltage load shed scheme with no findings.[85]
	UCS View: As indicated in Figure 1, Bus 64C is part of the Division 1 electrical distribution system which had the wrong undervoltage trip setpoint in its test procedure. So, there was a "finding" that NRC inspectors failed to make during review.
March 21, 2001	A few hours into the 23-hour endurance run of Emergency Diesel Generator 14, insufficient oil level in the reservoir caused the outboard bearing to overheat and catastrophically fail.[86]
April 18, 2002	The NRC reported its inspectors had reviewed Revision 47 to surveillance test procedure 24.307.15, "Emergency Diesel Generator 12 – Start and Load Test," with no findings.[87]
February 6, 2003	During a test run of Emergency Diesel Generator 11, workers noticed that the exhaust temperature from cylinder 2 was about 100°F below the normal value. The unexpectedly low temperature was attributed to the fuel injector nozzle allowing more fuel oil to flow into the cylinder. The nozzle was sent back to the vendor who found that the torque on the spring that controlled fuel flow rate was set at 20 ft-lbs instead of the required 55 ft-lbs. Workers at Fermi Unit 2 determined that procedure 34.307.001 did not contain sufficient information to ensure the proper torque setting on the injector nozzle spring.[88]
May 23, 2003	Workers initiated a corrective action report (CARD 03-11847) for an unanswered question from the NRC's safety system and design performance capability (SSDPC) inspection team regarding the adequacy of the time delay for the degraded grid undervoltage relay and the assumption made by Detroit Edison that the design basis did not require degraded grid protection to function concurrent with a loss of coolant accident." [89]
	UCS View: NRC inspectors questioned the degraded grid undervoltage design bases and Detroit Edison answered it – with no one noticing that the associated test procedure used the wrong value. Hardly a shining moment in regulatory history.
June 2, 2003	During maintenance, workers failed to properly reconnect a lubricating oil line for Emergency Diesel Generator 12 to the low lube oil pressure switch. Consequently, EDG 12 was unknowingly inoperable from June 2, 2003, until November 8, 2003.[90]
July 30, 2003	The NRC informed Detroit Edison of the results from its Safety System and Design Performance Inspection at Fermi Unit 2:

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	The inspectors reviewed the reliability and availability of electrical systems used for operation of the EECW and EESW Systems. The 4160V voltage system to assess vulnerabilities due to loss of the preferred offsite source and the standby onsite sources (diesel generators) was also reviewed. In particular, the team evaluated the adequacy of undervoltage protection and vulnerability to spurious separation from the offsite source. ... In addition, the undervoltage protection scheme for the safety related 4160V and 480V buses and control circuits were reviewed for proper operation as described in the licensing and design bases, and for proper isolation and separation to assure the independence of redundant circuits.[91] *NRC opened URI 05000341/2003007-02, Non-Conservative Acceptance Limit for the Time Delay Relay Did Not Assure the Availability of the Vital Buses.*[92]
August 13, 2003	A widespread electrical grid outage affected nine operating and one shut down nuclear power reactors in the US, including Fermi Unit 2. The NRC analyzed the risk implications of the grid outage on these nine reactors. Of the eight nuclear power reactors operating at the time, Fermi Unit 2 went the longest time without power – 6 hours and 19 minutes. The second longest power outage was experienced at the FitzPatrick nuclear plant in New York at 2 hours and 49 minutes – 3 ½ hours less outage time than Fermi Unit 2. The NRC reported that the recovery at Fermi Unit 2 was complicated by problems with the backup to the emergency diesel generators: *The combustion gas turbine generator (CTG) failed to start from the control room due to the failure of a battery-powered inverter. The CTG was manually started 3 hours into the event using a portable generator as an alternate source of starting power.*[93]
April 26, 2004	The NRC informed Detroit Edison of the results from routine inspections at Fermi Unit 2: *The inspectors reviewed applicable system health reports, associated CARDs, licensee maintenance rule conduct manual, various surveillance tests, applicable design basis documents, maintenance rule scoping determinations, expert panel meeting notes, monthly monitoring reports, and the control room unit logs for the following systems:* ❑ *Emergency Diesel Generator 11 (R3000)* [94]
July 27, 2004	The NRC closed URI 05000341/2003007-02 regarding potential inadequate undervoltage protection for the emergency diesel generators based on judgment that the corrective actions promised by Detroit Edison would resolve the issue. The corrective actions had not been implemented at the time the NRC issue was closed.[95]

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Date	Event
	UCS View: A year after **raising safety concerns about the undervoltage protection system, the NRC closed those concerns based on its perception of the adequacy of Detroit Edison's intentions to resolve the problem at some unspecified future date. Such regulatory antics give "nonchalance" a bad image.**
August 2, 2004	Workers replaced the output breaker on Emergency Diesel Generator 12 with a refurbished breaker as part of routine preventative maintenance. The post-maintenance test was performed successfully.[96]
August 6, 2004	During an operability test of Emergency Diesel Generator 12, operators could not open the output breaker using either the local or remote control switches. After actuating a test switch to simulate undervoltage, electricians were able to open the output breaker. The output breaker was replaced with the original breaker removed four days earlier.[97] During another operability test of EDG 12, operators heard an abnormal noise and shut down the EDG. Workers found damage to the scavenging blower that necessitated that it be shipped back to the factory. Faced with a pending deadline for restoring EDG 12 to service or shut down Fermi Unit 2, Detroit Edison asked NRC for seven more days.[98]
August 17, 2004	The NRC denied Detroit Edison's request for enforcement discretion that would have allowed Fermi Unit 2 to operate for seven more days beyond the existing seven day Limiting Condition for Operation for EDG 12 out of service. Among the myriad of reasons cited by NRC in its denial: (a) Detroit Edison did not know what caused the scavenging blower on EDG 12 to fail, (b) Detroit Edison did not know how long it might take to repair EDG 12, and (c) Detroit Edison did not know how the scavenging blower problem might impair the other three emergency diesel generators (i.e., perhaps they suffered from the same defect).[99]
March 31, 2005	Detroit Edison submitted its last monthly operating report to the NRC, having sought and obtained NRC's permission to discontinue the reports. Detroit Edison reported that Fermi Unit 2 had been online for a total of 113,619 hours. [100]
October 25, 2005	The NRC informed Detroit Edison of the results from its routine inspection at Fermi Unit 2. The NRC reported: *The inspectors reviewed the licensee's evaluation and management of plant risk for the maintenance and operational activities affecting safety-related equipment listed below. … The inspectors also reviewed Technical Specifications (TSs) requirements and walked down portions of redundant safety systems, when applicable, to verify risk analysis assumptions were valid and applicable requirements were met.* ❑ *Emergency diesel generator (EDG) 13 safety system outage* [101]

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Date	Event
November 2005	The NRC conducted a Safety System and Design Performance Capability (SSDPC) team inspection at Fermi Unit 2. The team focused on two safety systems – the reactor core isolation cooling and emergency diesel generator systems – and their support systems. According to the NRC: *The objective of the SSDPC inspection is to assess the adequacy of calculations, analyses, other engineering documents, and operational and testing practices that were used to support the performance of the selected systems during normal, abnormal, and accident conditions.*[102] *The inspectors reviewed information to verify that actual system condition and tested capability were consistent with the identified design basis.*[103] *The inspectors reviewed records of selected periodic testing and calibration procedures as well as surveillance procedures to verify that the design requirements of calculations, drawings, and procedures were incorporated in the system and were adequately demonstrated by test results. Test results were also reviewed to ensure that testing was consistent with design basis information.*[104] *The inspectors reviewed the 4160V voltage system to assess vulnerabilities due to a potential loss of the preferred offsite source and the stand by onsite sources (emergency diesel generators). The inspectors evaluated the adequacy of the licensee's undervoltage protection system.*[105] During the SSDPC inspection, the NRC questioned whether the control power transformers for the safety-related motor control centers were sized adequately to ensure sufficient voltage for component operability. Detroit Edison did not enter the unanswered question into its corrective action process.[106] During the SSDPC inspection, the NRC again questioned the adequacy of the undervoltage relay setpoints. Detroit Edison entered the unanswered question into its corrective action process (CARD 05-26685) as it had done during the 2003 SSDPC when the same unanswered question arose.[107] The NRC inspectors reviewed the resolution to the earlier corrective action attempt (CARD 03-11847), found it wanting, and re-opened the issue.[108] During the SSDPC inspection, the NRC determined that Detroit Edison's calculations failed to verify or check the adequacy of the emergency diesel generator loading against the limits in Technical Specification 3.8.1, which stated that the steady state frequency for the EDGs shall be between 58.59 Hz and 61.2 Hz.[109] **UCS View: The NRC assumed the role of "Charlie Brown" to Detroit Edison's "Lucy." In 2003, NRC inspectors raise concerns about undervoltage protection. Detroit Edison enters it into their corrective action process but never fixes it. In 2005, NRC inspectors again raise**

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	concerns about undervoltage protection. Detroit Edison counters by making the same useless promise. And NRC buys it. (Poor ol' NRC, never does kick that football.)
January 13, 2006	The NRC informed Detroit Edison of results from the SSDPC team inspection: *The inspectors identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to translate the design basis requirements for each of the Emergency Diesel Generator starting air systems into specifications, procedures, and instructions. As a result of this failure, no objective evidence existed that the required emergency diesel generator starting air system capacity was being maintained.*[110]
February 2, 2006	Workers replaced the output breaker on Emergency Diesel Generator 12 with a refurbished breaker as part of routine preventative maintenance. Following an earlier replacement attempt in August 2004, workers concluded that the refurbished breaker would work as long as its alignment was verified following installation. Proper alignment was verified. The post-maintenance test was performed successfully.[111]
February 3, 2006	During an operability test of Emergency Diesel Generator 12, operators could not open the output breaker from the local panel. After actuating a test switch to simulate undervoltage, electricians were able to open the output breaker. The output breaker was replaced with the original breaker removed the previous day. Due in part to the breaker failure, Detroit Edison determined that EDG 12 might not be restored to operable status prior to the expiration of the 7-day allowed outage time. A one-time technical specification amendment extending the allowed outage time an additional 7 days was requested by Detroit Edison and granted by the NRC.[112]
April 25, 2006	After a control power fuse for the Emergency Diesel Generator 13 engine room west supply fan blew, workers entered the problem into the corrective action program (CARD 06-22768). The cause of the blown fuse was not determined and was attributed to a random event.[113]
May 4, 2006	On May 4, 2006, the "Licensee determined that it had not been appropriately updating the design calculations associated with the MCC bucket replacements (CARD 06-23147)." [114]
August 15, 2006	"On April 25, 2005, a control power fuse associated with an EDG 13 ventilation fan failed. On August 15, 2006, during a review of the NRC CPT size question and the fuse failure event, the licensee questioned whether the EDG 13 fuse failure could have been a result of increased current or starter delay due to an undersized CPT." [115]

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	"The licensee later questioned whether the CPT size could have contributed to the blown fuse and entered the issue into their corrective action program on August 15, 2006, as CARD 06-25253. The concern was that size 3 motor starters should have had a nominal 250 Volt Amp CPT, whereas several buckets with size 3 starters had 150 Volt Amp transformers. With an under-sized CPT, the secondary voltage drops as the current draw increases due to the load demand of the starting coil. If the secondary voltage dropped below the pick-up voltage of the coil, the coil would draw the full inrush current until the control power fuse blew." [116]
August 25, 2006	"On August 25, 2006, the inspectors noted that surveillance test procedures associated with the Division 1 EDGs included a minimum required voltage of 3740 Volts and questioned the licensee about the appropriateness of the surveillance test acceptance criteria." [117]
	UCS View: Twenty-one years after the mistake was made, someone finally notices that the acceptance criterion in the test procedure is non-conservative to the technical specification requirement. It reveals an unrealized dividend of NRC's granting 20-year extensions to nuclear plant operating licenses – it gives NRC inspectors more time to find yesterday's mistakes.

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