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General Comment

Comments relate to Emergency Operations & on-site needs for nuclear power plants; comments relate to risks and cost-effective mitigation opportunities to reduce likelihood and duration of regional or national blackouts resulting from solar geomagnetic storms. Comments previously filed with FERC Commissioners. Submitted in advance of joint NRC-FERC joint commissioners mtg on June 15, 2012.

Attachments

Foundation_Comments_Commonsense_Appeal_NRC-2012-0031

Template=SECY-067

DS10

Commonsense Appeal to the FERC Commissioners for Action on a Regulatory Standard for Solar Storm Protection

Comments on Docket No. AD12-13-000
FERC Staff Technical Conference on Geomagnetic Disturbances
to the Bulk-Power System
held on April 30, 2012
Submitted to FERC on May 21, 2012 by

Foundation for Resilient Societies

www.resilientsocieties.org

Twenty-Three Years Is Long Enough

We urge the FERC Commissioners to order the North American Electric Reliability Corporation (NERC), the designated Electric Reliability Organization (ERO), to submit to the Commission a proposed reliability standard to protect the bulk power system against geomagnetic disturbance (GMD) caused by solar storms. Twenty-three years have passed since a solar storm hit the province of Quebec and amply demonstrated that solar storms can cause electric grid instability and widespread blackout. After twenty-three years, NERC has shown that it is unwilling, or unable, to take the initiative to set a reliability standard. Now the FERC Commissioners should exercise their authority within the legal framework of Section 215 of the Federal Power Act, as amended, and order that a standard be set.

Solar Storms Cause Electric Grid Blackouts

The real world experience of the 1989 Quebec Blackout demonstrated solar storms can cause widespread electric grid blackout; while further scientific study may be valuable, it should not be a precondition to action. There are multiple modes by which solar storms can cause blackout including reactive power consumption and associated voltage collapse; production of harmonics and associated tripping of relay protective devices; and transformer heating and premature failure.

These multiple failure modes make a widespread blackout in the United States an almost 100% certainty during a solar storm 4 to 10 times greater than the March 1989 storm that caused the Quebec Blackout. Within the past 200 years, there have been two solar storms of estimated intensity 4 to 10 times greater than the March 1989 Storm; the Carrington Event in 1859 and the 1921 Railroad Storm.

The February 2012 Report of the GMD Task Force of NERC concedes that a severe solar storm would cause likely cause collapse of the electric grid due to reactive power consumption.

Geographical Extent of Blackout Caused by Severe Solar Storm

The October 2010 report of the Oak Ridge National Laboratory, *Electromagnetic Pulse: Effects on The U.S. Power Grid,* sponsored by FERC and the U.S. Departments of Energy and Homeland Security rigorously examined a scenario of grid collapse caused by reactive power consumption. The study used a reference storm of intensity actually observed before--the 1921 Railroad Storm. The blackout area for such as storm would extend over much of the East Coast—including Washington D.C. and New York City—and into the American Midwest. The Pacific Northwest would also be affected. In total, approximately 130 million Americans would be without electric power.

Geographical Extent of Blackout during Severe Solar Storm

Probability of Blackout Caused by Solar Storms

The Oak Ridge National Laboratory report estimates a probability for a severe solar storm with the intensity of an 1859 Carrington Event or 1921 Railroad Storm at approximately 1% per year. A recent study published in the journal Space Weather confirmed this estimate using statistical techniques, with an estimated probability of a Carrington-sized event of 12% over the next decade. While sophisticated statistical techniques can be valuable, most laypeople would correctly surmise that the probability of an event that has occurred twice in 200 hundred years is about one-in-one hundred, or about 1% per year.

The odds of losing a round of Russian roulette are 16% and over 18 years, the odds of a widespread blackout caused by severe solar storm are approximately the same. No responsible parent would force their child to play a round of Russian roulette before their eighteenth birthday, but this is essentially the solar storm gamble being forced upon Americans by the electric power industry. For a short-term blackout of only hours or days, only the most vulnerable Americans might be affected—including those in hospitals and nursing homes, or dependent on respirators or kidney dialysis machines—but for a blackout persisting beyond a week, all children and adults would have a figurative gun pressed to their head.

Much of the attention of NERC and the electric utility industry has been on the reoccurrence of a severe solar storm that might occur every one hundred years. But this dramatic possibility diverts attention from the much higher probability of less severe, but more frequent solar storms. Solar Cycle 22 produced a province-wide blackout in Quebec, Canada. Solar Cycle 23 produced a large-scale blackout in Sweden. A small storm in Solar Cycle 23 caused early failure of 13 transformers in South Africa, with resulting long-term rolling blackouts and severe economic disruption.

Common sense would indicate that Solar Cycle 24, peaking in 2013, would have a high likelihood of producing another significant blackout, either in North America or elsewhere in the world. The peak and backside of Solar Cycle 24 will be within the terms of at least some of the current FERC Commissioners.

Power Restoration Time After Widespread Electric Grid Blackout

The experience of the 2003 Northeast Blackout, affecting large portions of the United States Northeast and Midwest, and also Canada, is instructive in terms of power restoration time. The 2003 Northeast Blackout affected a total population of 50 million people. Power was not restored for 4 days in some parts of the United States; parts of Ontario suffered rolling blackouts for more than a week before full power was restored.

The February 2012 of the GMD Task Force of NERC concedes that power restoration times could be "days" after a blackout caused by severe solar storm. Under some conditions, power restoration time could extend to months or even years. Inadequate blackstart procedures could be one cause of longer restoration times. Equipment damage could also lengthen restoration times.

Electric utility blackstart procedures are largely untested in real-world conditions. Moreover, according to NERC standards, utilities are required to practice blackstart procedures only 2 hours a year.

Because electric utilities do not make large profits on rarely used blackstart units, and because utilities can be fined for regulatory non-compliance on blackstart units, they can be reluctant to invest in blackstart equipment. All 104 nuclear power plants, representing 20% of U.S. generation capacity, cannot be used in blackstart. Nor can renewable resources—wind and solar—be used for blackstart. Coal-fired generation plants with several days of fuel stored on-site, a current blackstart resource, are being shut down for environmental reasons. Gas-fired generation plants do not have fuel stored on-site, but instead have interdependencies with pipelines that are increasingly actuated by electricity. All of these factors combine to make blackstart an uncertain process in areas without hydroelectric power, and a process that could easily extend beyond the rosy NERC restoration scenario of "days or hours."

Based on past real-world experience, equipment damage can occur during solar storms. During the 1989 Quebec Blackout, two transformers were damaged due to overvoltage conditions.

And during the same solar storm, a transformer failed at the Salem nuclear plant in New Jersey. Many more equipment failures may have occurred during smaller and more frequent solar storms, but since there is no coordinated or mandatory data reporting system, these failures have not been attributed to geomagnetic disturbance.

Large power transformers—the equipment most vulnerable to damage from solar storms—are not manufactured in significant quantity in the United States. Ordering lead times from foreign transformer manufacturers are typically 1-2 years. In contrast to the optimistic NERC scenario, official U.S. government reports predict restoration times after blackout due to solar storm to be months or years, not a "matter of hours or days."

Estimates of Economic Losses and Cost of Protection

Estimates of economic losses from the 2003 Northeast Blackout in the United States range between $4 billion and $10 billion. If one were to use the 2003 Northeast Blackout as a means to estimate losses for a blackout resulting from a severe solar storm involving 130 million people, comparable losses would be between $10 billion and $26 billion. With an annual severe solar storm probability of 1%, the probability of a storm would be just under 10% in a decade. Probability-adjusted losses for a decade-long period would be 10% of losses should a blackout actually occur, or between $1 billion and $2.6 billion.

Commercially-available equipment can protect the electric grid from solar storms. Multiple options are available, including time-tested series capacitors and newer "neutral current blocking devices." A range of estimates protect the U.S. electric grids from solar storms is $250 million to $1 billion.[1] Therefore, on a probabilistic basis, protective equipment would pay for

[1] The Foundation for Resilient Societies obtained year 2011 prices from a current producer of GIC neutral blocking devices, plus EMP type E1 surge protectors, plus GIC monitoring and recording devices, plus shipping , installation, and training costs. We estimate costs per EHV GSU transformer at $225,000 to $275,000 per hardware protective equipment set. To protect 1000 transformers, at $0.25 million per equipment set, would cost about $250 million. To protect 2000 EHV transformers at the National Academy of Sciences price of $0.5 million per transformer would cost about $1 billion. At both the low ($250M) and high ($1Billion) end of a program cost range, our Foundation estimates a rapid payback and positive net operating income for major U.S. investor owned electric utilities. See our May 7, 2012 filing in FERC AD12-13-000, and in NRC-2011-0299 on May 4, 2012, entitled Comments...Relating to the Prevention and Mitigation of Station Blackout.

itself in only 2.5 to 10 years. Since the lifetime of protective equipment would be far in excess of 10 years, the cost to protect the U.S. electric grid is far lower than even a modest estimate of economic losses. Thus with even with a modest estimate of blackout economic losses, and a high estimate of protective equipment cost, there should be no economic regrets in fully protecting the electric grid from solar storms.

Another way to look at the cost of protection from solar storms is on a per-ratepayer basis. There are approximately 150 million electric utility ratepayers in the United States. Therefore, the cost to protect individual ratepayers would be between $2 and $7 per ratepayer. If the cost were to be spread over 10 years, ratepayers would incur charges of only 7 cents to 28 cents per month. To revisit the previous Russian roulette analogy, no responsible parent would subject their child to a round of this deadly game to save 28 cents per month.

Second-Order Effects from Long-Term Electric Grid Blackout

A blackout affecting 130 million Americans could be an unprecedented economic and human catastrophe, especially should the rosy NERC scenario of restoration times of "hours to days" prove wrong. The electric grid is the keystone infrastructure upon which all other critical infrastructures depend—including food distribution, banking and financial services, petrochemical refining and distribution, and water and sanitation, to give only an incomplete list. And due to regional interdependencies, any blackout immediately affecting 130 Americans would affect all Americans in short order.

As the experience at the Fukushima Dai-ichi nuclear complex in Japan showed, extended loss of power to nuclear plants can cause large-scale radiation releases and land contamination lasting for hundreds of years. Only seven days of fuel for backup diesel generators is commonly stored on-site at nuclear plants; unless one were to assume perfectly reliable backup generators, and perfectly timed resupply of fuel at dozens of nuclear plants, radiation releases would occur if power restoration times were to exceed one to two weeks.

The Non-Solution of "Operating Procedures"

After 23 years of inaction on protection from solar storms, and with potentially catastrophic consequence of inaction, NERC and the electric utility industry propose "operating procedures" as their near-term solution. "Operating procedures" are little more than a technical smokescreen to provide a false sense of security to trusting citizens. When astronomers observe major solar eruptions, and the media appropriately recognizes a potential threat to the electric grid, representatives of the electric utility industry can be relied upon to assure that all is under control due to "operating procedures."

Electric utility "operating procedures" are dependent on solar storm forecasts that are about 50% accurate. In turn, "operating procedures" are dependent on a half-hour warning from a single satellite that could fail at any time and that is already past its planned operational life. While this is rarely disclosed, not all electric utilities have "operating procedures" for solar storms. Records of the Nuclear Regulatory Commission show some generation plants have reduced power up to 35% during moderate solar storms. The logical extreme of "operating procedures" during a severe solar storm is "load shedding" or outright grid shutdown. But it is unlikely the electric grid will be shut down based an uncertain solar weather forecast, because insurance company liability policies do not cover damages resulting from intentional acts. These legal and operational conundrums render "operating procedures" ineffective as a means of protecting the electric grid from severe solar storms.

We trust the FERC Commissioners will not be fooled by the non-solution of "operating procedures."

Additional "Study" as a Means to Avoid Regulation

When it comes to avoiding regulation on solar storms, NERC and the electric utility industry are masters of delay, technical obfuscation, and the illusion of progress without real action.

The recent report of the GMD Task Force proposes more lengthy study by individual utilities before any regulatory standard is even considered. Reports by the Congressional EMP Commission (2008); the National Academy of Sciences (2008); the Department of Energy and NERC itself (*2010 High-Impact, Low-Frequency Event Risk to the North American Bulk Power System*); the Federal Energy Regulatory Commission, Department of Energy, and Department of Homeland Security (2010), and most recently the Defence Committee of the British Parliament (2012) all conclude that a severe solar storm would result in a long-term blackout lasting months or years, and have catastrophic consequences for technologically-dependent societies. One must wonder whether another three—or even twenty-three—years of "study" will be required before NERC and the electric utility industry take action.

Notably, additional study would not necessarily increase public understanding of the risks of solar storms

Suppression of Data on Solar Storms and Transformer Failures

The electric utility industry, through its Electric Power Research Institute (EPRI) "Sunburst" project, has collected data on geomagnetically induced current during solar storms for two decades, but this data has been kept secret by means of agreements between EPRI and individual utilities. Not even NASA researchers on space weather effects have access to the EPRI Sunburst data . Nor was EPRI Sunburst data on geomagnetically induced currents made available to the GMD Task Force, except for one incomplete graph that did not specify the locations of readings.

The electric utility industry has likewise withheld data on transformers failing around the time of solar storms. When individual participants in the GMD Task Force requested data from PSEG, operator of a generation site susceptible to geomagnetically induced current, this request was declined. (For more information on the attempts of GMD Task Force participants to obtain data on solar storm impacts to transformers, and responses, see Appendix A of this comment.)

Drafts of the GMD Task Force Report contained pictures of transformers that have failed due to solar storms. These pictures were deleted from the final GMD Task Force report. We present one of the deleted pictures below.

Close-Up of Winding Damage in Eskom, South Africa Transformer

Through public testimony and its GMD Task Force Report, NERC and the electric utility industry seek to consume the FERC Commissioners in the technical debate over whether power transformers will overheat and prematurely fail during solar storms. Even if zero transformers were to overheat and fail, a blackout involving 130 million Americans would surely be catastrophic enough.

This debate about the extent of transformer damage during solar storms is still ongoing largely because of the refusal of the U.S. electric utility industry to release data on currents induced during solar storms. Nor have electric utilities released root-cause investigation reports for transformers that have failed around the time of solar storms. Every airliner crash is independently investigated using blackbox recorders. FERC and its Commissioners should demand no less for critical infrastructure such as high voltage transformers, upon which our entire society depends.

Perfunctory Review and Approval of GMD Task Force Report

Participants in the GMD Task Force asked the NERC Board of Trustees to carefully review the report of the GMD Task Force because of concerns that the GMD Task Force did not conduct a scientific investigation with collection and analysis of data, but instead relied on industry insiders who met in closed session to finalize report conclusions. The NERC Board of Trustees devoted less than one-half hour of its meeting time to reviewing and approving the GMD Task Force report. (A letter from GMD Task Force participants to the NERC Board of Trustees is included as Appendix B to these comments.)

The purportedly "independent" NERC Board of Trustees is elected by a NERC membership dominated by electric generation and transmission companies. Average per-member compensation for the NERC Board of Trustees in 2011 was $89,091, a 20% increase from 2010 and a 30% increase from 2008. Duties for the Board of Trustees include attending nine days of meetings per year and periodically meeting by telephone to review and approve NERC reports, as well as other incidental tasks. [2]

Advisories, Training, and Education to Avoid Action on Solar Storms

Standard practices of NERC are to issue "Industry Advisories", conduct training sessions, and provide "education and information exchanges," to avoid the action of imposing mandatory reliability standards on the electric utility industry. All of these tactics have been used, or are proposed, to preclude reliability standards for solar storms

In May 2010, NERC issued an industry advisory titled, "Preparing for Geo-Magnetic Disturbances," with the highlighted subtext "This Advisory provides industry with a set of

[2] As recently revealed in a Draft Performance Audit of NERC by FERC, NERC has hosted lavish dinners for NERC board members and their spouses, with food and beverage expenses ranging up to $146 per person. The draft audit report reads in part, "audit staff believes that entertainment expenses incurred on behalf of the BOT raise possible conflict of interest concerns."

operational and planning actions to prepare for the effects of severe Geo-Magnetic Disturbances on the bulk power system." Immediately after the subtext, the advisory reads: "**Status: Industry Advisory – No Action Necessary.**" The report of the GMD Task Force contains as a principal recommendation, "Develop education and information exchanges between researchers and industry." Notably, a full year of study by NERC has just been conducted, but no mandatory reliability standards are recommended—instead, the report only recommends to once again "review the need" for reliability standards.

Legal Liability of Electric Utilities

With the economic and human costs of a blackout caused by a severe solar storm so great, and the cost of hardware protection so minimal, one must wonder why NERC and the electric utility industry have so vigorously resisted a regulatory standard. One answer might be the potentially enormous legal liability of electric utilities should a blackout occur, and a mandatory regulatory standard be in place at the time of the blackout. Electric utilities could not argue that an "Act of God" had occurred, but would instead be held to account for non-compliance with a recognized standard. Additionally, were electric utilities to intentionally shut down major generation plants and transmission lines based upon solar storm warnings, they would risk loss of insurance coverage for equipment failures, for business interruption costs, and possibly for third party claims.

Ironically, if prudent equipment protection standards were in place, and electric utilities complied with these standards, utilities might avoid "blackout inducing" intentional acts and also be shielded from liability. If FERC ordered NERC to develop reliability standards, and if resulting standards facilitated the installation of hardware protection for critical grid infrastructure, then electric utilities could "operate through" solar geomagnetic storms.

The FERC Commissioners should note that even as this comment is being submitted, PJM Interconnection, L.L.C., a major Regional Transmission Organization, has a Petition for Declaratory Order pending before FERC that seeks FERC Tariff approvals designed to preempt

state laws on liability, so that gross negligence or reckless misconduct would be immunized by FERC.[3] To the contrary, with only limited enforcement powers, FERC should reinforce continuing liability under state laws. For an industry predisposed to avoid action, legal liability would provide incentive to actually protect the grid rather than merely "study" potential protections.

Hindsight Will Be 20-20

Should even a regional blackout occur due to a solar storm during this Solar Cycle or the next Solar Cycle, one could easily imagine the commonsense comments of a politician at the official inquest—"From the Carrington Event in 1859, we knew that severe solar storms can hit the earth. From the 1989 Quebec Blackout, we knew that solar storms can cause electric grid blackouts. From the 2003 Northeast Blackout, we knew that power restoration times can be days or even weeks. From the events at Fukushima in Japan, we knew that diesel generators at nuclear plants are not 100% reliable and that nuclear plants without power can lose cooling and release radiation. The federal government and the electric utility industry did not act and now we are burdened with the deaths of 5,000 Americans dependent on dialysis machines and respirators, 2,500 square miles of land contaminated by radiation, economic losses of $500 billion, job losses of 1 million, and a 2% reduction in GDP. All of this could have been prevented for an investment of only $500 million."

And one could equally imagine the defense of the NERC official at the inquest—"The solar storm was an Act of God. At the time of the storm, there was no scientific consensus on which areas would be most affected or the best protective measures. Individual utilities performed their own studies and some installed storm-resistant transformers, for which we should all be

[3] See PJM Interconnection, L.L.C., "Petition for Declaratory Order" in FERC Docket No. EL12-45-000 (pending). The initial request proposes immunity of a Regional Transmission Organization (RTO) from liability for injury to employees of Transmission owning (TO) utilities. If PJM Interconnection, L.L.C.is successful with its FERC Petition, which is supported by a group of transmission owning utilities (TOs), the electric industry will be in a position to seek FERC approval for revised tariffs. These federally approval tariffs could preempt state laws that presently establish liability for gross negligence or willful misconduct by electric utilities. If FERC allows these tariff-driven liability constrictions, the electric utility industry may further undermine market incentives to invest in bulk power protective equipment.

grateful. Electric utilities should not be held responsible for an Act of God, especially because there was no regulatory standard on solar storm protection. The Federal Energy Regulatory Commission had the authority to order a regulatory standard be developed on solar storms, but it declined to do so."

On this last point—ready excuse because of FERC inaction on ordering a regulatory standard—little imagination is required, because NERC has already used this excuse in testimony before the U.S. Congress. For example, NERC CEO Gerry Cauley testified during the May 5, 2011 hearing of the Senate Energy and Natural Resources Committee:

> FERC has the authority now under FPA Sec. 215(d)(5) to direct NERC to prepare a proposed standard to address a specific vulnerability or other matter, and to do so by a certain date. Thus, it is not clear to NERC that the vulnerability section [proposed new FPA Section 224(b)] is needed.

The FERC Commissioners have both the legal authority and obligation to order a regulatory standard on electric grid protection from solar storms and associated geomagnetic disturbance. We urge the FERC Commissioners to use this authority to protect the American public. The FERC Commissioners have an opportunity, based on the record of the recent Staff Technical Conference (AD12-13-000), to order NERC to expedite development of solar storm-protective reliability standards.

APPENDIX A: Correspondence on Event Investigation of GIC Impacts to Transformers

October 12, 2011 Email from Thomas Popik of Foundation for Resilient Societies

From: Thomas S Popik [mailto:thomasp@resilientsocieties.org]
Sent: Wednesday, October 12, 2011 6:31 PM
To: gmdtf-1
Cc: 'Watkins,Donald S - TO-DITT2'; kozaf@pjm.com; Eric.Rollison@nerc.net
Subject: Comments on Need for Public Reporting of GIC Incidents

GMD Task Force Members:

As members of the task force, we have been operating at an information deficit. Namely, there have been incidents that are strongly suggestive of equipment failure caused by Geomagnetic Induced Current (GIC) that have not been publicly reported by utility management. The example of Hope Creek is explained below.

Somewhere in the task force whitepaper, we should have a section stating the need for public reporting of GIC incidents. The NRC has public reporting of reactor trips; the consequences of widespread electric grid failure would be far greater than radiation releases from nuclear power plants.

Thomas Popik
Foundation for Resilient Societies
(603) 321-1090

Transformer Failures at Hope Creek Nuclear Power Plant

Hope Creek nuclear plant is co-located with the Salem 1 & 2 nuclear plants on Artificial Island, New Jersey. Salem 1 & 2 is the site of multiple transformer failures due to GIC impact, as described in the NERC Hydro Quebec GMD Event Report (1989) and NRC Information Notice No. 90-42: FAILURE OF ELECTRICAL POWER EQUIPMENT DUE TO SOLAR MAGNETIC DISTURBANCES (June 19, 1990).

There are several site characteristics that make Hope Creek particularly susceptible to GIC impact on power transformers. First, the site is at the terminus of a long east-west transmission line that is an excellent conductor of GIC. Second, the site is in a region of igneous rock formations. Third, the site is on the Atlantic coast, which produces an "end of antenna" effect for GIC. Lastly, Artificial Island is built on steel pilings that driven deep into the ocean bottom; the network of these pilings are interconnected to the neutral for site transformers and provide a ground of unusually low resistivity.

The vulnerability of transformers at Hope Creek to GIC is well known to plant management and the NRC. An "Official Transcript of Proceedings, Nuclear Regulatory Commission" dated September 25, 2003 (ADAMS Accession Number ML061460330) contains an interview of a Hope Creek staff member by Special Agent Eileen Neff.

Special Agent Neff: can you think of any examples?

Staff Member: I'll think of an example here. Yes. One example would be the decision to move the replacement of one of our main transformers out one refueling cycle. And we have three main transformers. One is a very good one that we replaced just a couple years ago, and the other two are very old, and they're susceptible to electromagnetic disturbances and are not very good transformers. It's not really a safety issue. We had originally planned on replacing one of the two remaining transformers last outage and we reviewed that decisions and the original game plan was to replace one that outage and replace the third one the following outage. And we determined that if we replaced them both in the upcoming refueling outage that would save the company about $2.5 million because we wouldn't have to pay the contractor twice to come in to set up, to change transformers and all that.

Special Agent Neff: Makes sense.

Staff Member: And so we did that. We deferred the transformer replacement from the outage that we just had back in the spring and moved out to the next outage so we're going to be replacing two transformers in the next outage instead of one. A lot of people have a problem with that, because they're concerned about the operational risk that we assume by continuing to run with the transformer that could've been changed out and wasn't.

Special Agent Neff: Okay.

Staff Member: And people question that. And that's fine. We explained the decision to them but that doesn't mean they always agree with the decision.

Special Agent Neff: Okay. In this case, with this particular transformer, had it been causing problems from a nuclear safety perspective?

Staff Member: No. It doesn't -- they don't cause problems from a nuclear safety aspect but what they can do is since they are sensitive to solar magnetic disturbances, there are conditions that occur a couple of times a year that will require us to reduce power on the unit in order to maintain the temperatures on those transformers within acceptable band to prevent damage.

Special Agent Neff: So it's not that they will affect the unit, the unit will affect them so you have to monitor the unit so as not to negatively affect the transformers?

Staff Member: No, not quite. You monitor the transformers and we have instrumentation that will detect the onset of the ground-induced currents, that's what they're called. When the ground-induced currents occur, they cause overheating of the transformer, so when that -- and

that condition is not controlled, we can't control that. It's actually caused by solar flares from the sun.

Special Agent Neff: Okay.

Staff Member: So we actually watched the solar forecasts. But there are conditions that occur, if a large solar flare occurs, those ground-induced currents, and they will exceed the threshold values in our operating procedures that will require us to reduce the power and the unit to prevent damage to the transformers.

Special Agent Neff: Okay.

Staff Member: And so that -- it's an operational risk that we assume by having those transformers in place. We know there may be times where the solar conditions are such that we'll have to back the units down, and if it gets real bad, we'll have to shut the units down altogether. And so there are some people that feel that the operational risk is too much and therefore we should've replaced the transformer last outage when we had the opportunity and not have made the decision to replace it the following outage when we do both.

Special Agent Neff: Now when you say that operational risk, just so I'm following you on that, is that operational risk to the flare ups in the heat generated or is that operational risk in that you have to back the unit down so you're not generating full power?

Staff Member: Yes. It's operational -- whenever you have to move the unit you incur operational risk.

In summary, management for the Hope Creek nuclear plant knew of GIC issues, and believed that transformer power reduction was the preferred method of dealing with these issues. As the interview indicates, GIC monitoring equipment was installed at the Hope Creek plant. In some cases, power might be reduced to 0%—total turn down—in order to protect the GSU transformers.

The Foundation for Resilient Societies examined NRC Reactor Power Status Reports for the Hope Creek and Salem plants for the month of July 2000. These status reports provide reactor power levels (specified in percent of rated power) for each calendar day, along with a "Reason or Comment" for the power level.

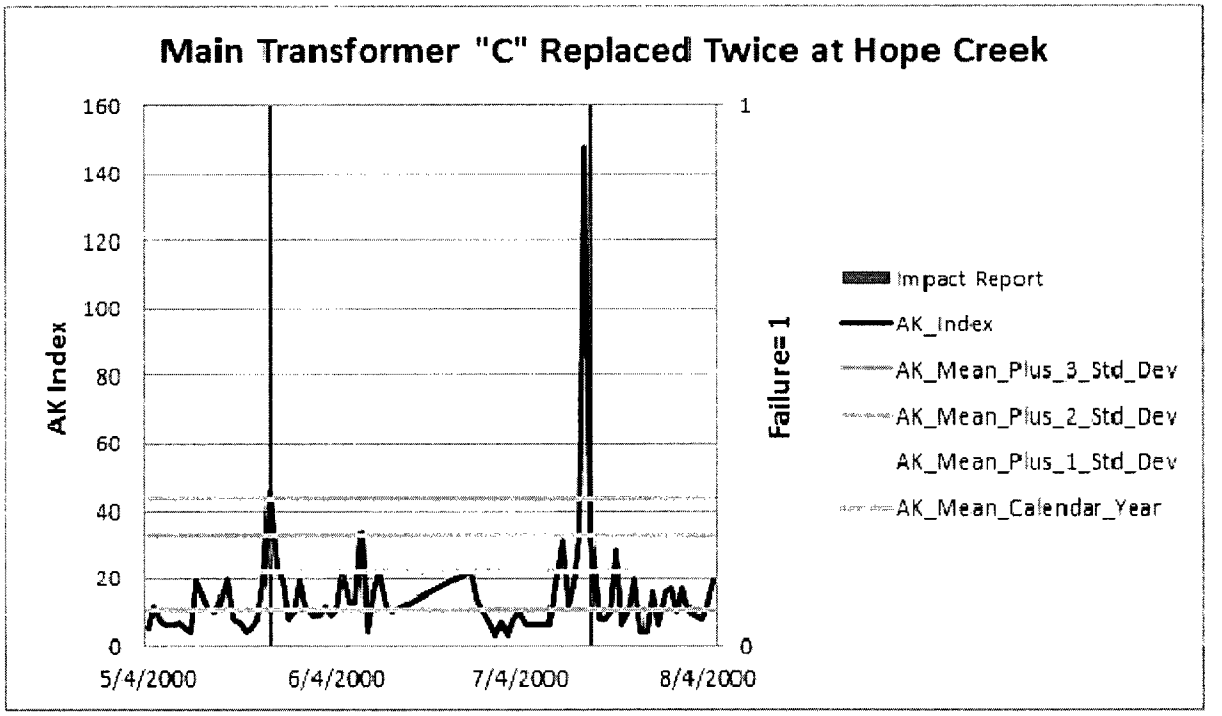
The Hope Creek status reports show that power was at a reduced 55% level on July 15, 2000 with the associated comment "REDUCED POWER FOR ROD PATTERN ADJUSTMENT." July 15 also represented the peak of the month's geomagnetic activity. On July 16, power was restored to 80% of rated load, with the comment "HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION." Eighty percent power was then maintained until July 24, when power was reduced to 15% with the comment "REACTOR OFF LINE TO REPAIR "C" MAIN POWER TRANSFORMER." Subsequent reports for the month of July show reduced power while "PERFORMING A TRANSFORMER EVALUATION."

The information provided in the Reactor Power Status Reports is supplemented by the Monthly Operating Status Reports filed by the plant operators with the NRC for June and July 2000, ADAMs Accession numbers ML003733040 and ML11200A221, respectively. The status reports show that Hope Creek entered the month of June 2000 with a failed Main "C" transformer, with this transformer being replaced and the plant back online as of June 22. Thus Hope Creek entered the month of July 2000 with a newly installed Main "C" transformer. The design vintage of this transformer is not known, although the Hope Creek plant was granted operating licensure in 1986.

The July 2000 Monthly Operating Report for Hope Creek filed with the NRC confirms the comments in the Power Reactor Status Reports:

- "Hope Creek entered the month of July at approximately 100% reactor power."
- "The unit at approximately 100% reactor power until July 14, when power was reduced for control valve testing and control rod adjustment. After the control valve testing and control rod adjustment, power was held at approximately 80% per load dispatcher recommendation due to solar magnetic disturbances."
- "On July 23, the plant was taken off-line for "C" main transformer work. The reactor remained critical. The unit was placed on-line on July 26 and operated for the rest of the month."

As described in the Monthly Operating Report, during the month of July 2000 the Hope Creek/Salem area experienced a geomagnetic disturbance of moderate intensity, with the peak of solar activity on July 15. Notably, the Monthly Operating Report describes the Hope Creek plant at 100% power "until July 14," the day before the peak of geomagnetic activity. The NRC Reactor Power Status Reports were also examined for the Salem 1 & 2 units. The reports show that both of these units had reduced power of 80% on July 16 with the comment "REDUCED POWER DUE TO GRID DISTURBANCE CAUSED BY SOLAR MAGNETIC DISTURBANCE."



A graph of solar activity represented by the AK Index juxtaposed with the "Main C" transformer failures clearly shows the coincidence of solar activity and transformer impact. Coincident degradation of a newly installed Main "C" transformer at Hope Creek with the onset of a geomagnetic disturbance strongly suggests that the transformer degradation was caused by GIC, especially given the failure history of other transformers due to GIC at the co-located Salem 1 & 2 nuclear plants. While Hope Creek reactor power was reduced to 55% of rated load during the second solar storm, per the status report, this apparently was not enough to prevent Main "C" transformer degradation and replacement.

October 13, 2011 Email from Ken Fleischer of FPL

From: Fleischer, Kenneth [mailto:Kenneth.Fleischer@fpl.com]
Sent: Thursday, October 13, 2011 9:46 AM
To: gmdtf-1
Cc: 'Watkins,Donald S - TO-DITT2'; 'kozaf@pjm.com'; 'Eric.Rollison@nerc.net'
Subject: RE: Comments on Need for Public Reporting of GIC Incidents

Tom:

To assist with some knowledge on this topic (if anyone from PSEG Salem/Hope Creek is on the GMDTF, they may be able to supplement additional detail).

I was an Engineering Supervisor at the Salem/Hope Creek complex from 1996 to 2005. The Hope Creek Generator Step Up (GSU) Transformer history is as follows:

1) Original Transformers when Hope Creek was commercially commissioned in 1986.

2) Spring 2000: Following a nuclear refueling outage (recollection: approximately 30 day duration - GSUs "cold"), Hope Creek was placed back on line.

3) Approximately 15 minutes following GSU transformer energization, "C" GSU transformer failed and caught fire.

4) Root cause was performed and concluded the "most likely cause" was fault of the "C" phase GSU transformer due to electrostatic discharge:

    a. Transformer was essentially ambient (approx 50F) for 30 days ("cold")

    b. Cooling Fans were running

    c. Transformer oil was very dry (this was determined based on a sample of the transformer oil that had been left over (i.e., not returned to the GSU). Part of layup during the outage was the oil was filtered and moisture content removed.

    d. SMD/GIC was considered, but ruled out as a "direct cause" of the "C" phase GSU fire.

5) Bridging Strategy: The replacement "C" phase GSU transformer was from a spare GSU (single phase) that had been neglected for many years (outdoors, unprotected, and not been properly taken care of). We were initially concerned when we had to clean out multiple vermin nests and restore much of what had been cannibalized (oil pumps, fans, instrumentation, etc.).

    a. Note: It should be noted that the replacement "C" phase transformer installed in 2000 was not a "new" transformer. This transformer was already known to be significantly degraded.

6) It was acknowledged that the this GSU transformer health was unknown and likely degraded as compared to the remaining two Hope Creek GSU transformers, so a "Nursing" unit was installed on "C" phase to monitor key parameters (early version of a multi-unit DGA).

7) This Nursing unit was intended to be a bridging strategy until the new VA-Tech ELIN transformers (designed for high levels of GIC withstand) were installed in a subsequent outage (2003 or 2004).

8) With "C" phase being a neglected, very old transformer, SMD/GIC vulnerability was of great concern until replaced. As a result, Hope Creek downpower threshold was at 10A of GIC. This resulted in many SMD maneuvers. I recall many of these SMD maneuvers (and delay to return to 100% when downpowered for another reason and SMD storm was a day away); however, I don't recall any of the transformer problems being directly associated with a specific SMD event, it just had problems due to neglect and age (Note: I was one of two Engineers that were involved with all Salem/Hope Creek SMD downpower events during Solar Cycle 23).

9) After 2003/2004, the replaced Hope Creek GSU Transformers were very SMD/GIC robust, currently better than the Salem GSU Transformers.

In addition to NRC Information Notice 90-42 "Failure of Electrical Power Equipment Due to SMD", the NRC commissioned a NUREG shortly thereafter entitled "Harmonic Effects of Solar GIC on Electrical Distribution System in Nuclear Power Plants". I don't know if the team has this or not, so I have attached it.

Ken Fleischer

October 13, 2011 Email from Justin Lane of PSEG

From: Lane, Justin [mailto:Justin.Lane@pseg.com]
Sent: Thursday, October 13, 2011 1:51 PM
To: gmdtf-1
Cc: 'Watkins,Donald S - TO-DITT2'; 'kozaf@pjm.com'; 'Eric.Rollison@nerc.net'; Lane, Justin
Subject: RE: Comments on Need for Public Reporting of GIC Incidents

GMD Task Force Members:

This e-mail is in response to the 10/12/2011 e-mail authored by Thomas Popik. While we all can appreciate a good story, it is important that we also report the facts.

I would like to thank Ken Fleischer for providing additional insight on the Hope Creek transformer failure (which pre-dates my time with the company). The information below supports Ken's reply and was taken from the root cause investigation and independently validated by an engineer here at the time of event.

Sequence of Events is as follows:

1.) 5-24-2000, HC C Phase GSU transformer fails 13 minutes after synchronization at 19% reactor power coming out of the station's 9th Refueling outage of 32 day duration. This failure was due to an insulation failure between the high voltage winding and ground. The root cause investigation identified static electrification discharges due to cooler design and excessive oil flow rates at low temperatures as the cause of the failure. During the outage the transformer underwent oil processing which caused the transformer to be more susceptible to static electrification damage. GIC induced damage was considered but ruled out in the investigation process.

2.) Upon failure, the transformer was replaced with a common spare onsite of vintage design which had been removed previously from Salem generating station when their transformers were upgraded following the 1989 event. This transformer was subjected to the GIC event and the only remaining transformer from the 1989 event which was deemed acceptable for use as an emergency spare. During this time, a new 'C" phase transformer was procured, specified with enhanced DC Neutral current capability.

3.) The subsequent load reductions after "replacement" were due to conservative operations taking into account the vulnerability of the vintage Salem transformer to GIC and the solar activity at the time. The July 23rd,2000 outage referenced was taken to install additional coolers and online gas analyzers for the C phase transformer to increase operational margin and monitoring parameters and not due to a GIC event. All referenced reductions were not due to additional failures or degradation of a GSU transformer of **modern design.**

4.) The "C" phase transformer was replaced once delivered on site and the "A" and "B" Phase transformers have also been replaced afterwards to support the Extended Power Uprate projects at Hope Creek Generating Station. All of these transformers now have enhanced DC Neutral Current withstand capability. The station also has a spare transformer of the same design for future replacements.

PSEG Nuclear has utilized conservative operations since the original Salem event including monitoring of DC Current and proactive load reductions based on the quantity of DC current present and observed transformer heating. To equate a reduction in power output to transformer degradation when the reduction was made using approved standard operating procedures is quite misleading. There was also a single "failure" associated C Phase Transformer and not "failures" as alluded to in the final paragraph of the original e-mail, and the failure was not attributed to GIC.

To summarize, PSEG Nuclear is aware that Artificial Island is a prime geographic location for GIC. This location has enhanced operational practices and procedures in place including monitoring of DC Neutral Current and load reductions to maintain operational margin during a SMD event. The transformers currently installed onsite are of modern designs and since the 1989 event Salem and Hope Creek Generating Stations have not experienced any additional failures or observed transformer degradation caused by a SMD.

Justin Lane, P.E.
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PSEG Nuclear - Hope Creek
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justin.lane@pseg.com

November 1, 2011 Email from Thomas Popik of Foundation for Resilient Societies

From: Thomas S Popik [mailto:thomasp@resilientsocieties.org]
Sent: Tuesday, November 01, 2011 3:38 PM
To: gmdtf-2
Subject: GMD Task Force Discussion about Salem/Hope Creek

Don, Frank, and Fellow GMD Task Force Members:

I ask that time be reserved during our upcoming GMD Task Force meeting in Atlanta to discuss Geomagnetic Disturbance (GMD) impacts at Salem 1 & 2 and Hope Creek nuclear power plants and the efficacy of "operating procedures" to mitigate Geomagnetically Induced Current (GIC) in power transformers.

The Artificial Island, New Jersey location of the Salem 1 & 2 and Hope Creek nuclear plants is an area susceptible to geomagnetic disturbance and GIC because of the latitude, the adjacent Atlantic Ocean, excellent site grounding, terminus of an east-west transmission line, and proximity to igneous rock formations. While the United States has experienced only moderate solar storms since the buildout of the modern electric grid, should we experience an extreme solar storm, past GIC impacts at the Salem and Hope Creek plants on Artificial Island would be indicative of impacts at other generation sites. I think that it is fair to say that Artificial Island is truly the "canary in the coal mine" as far as geomagnetic disturbance is concerned.

Because DC Currents and other transformer condition attributes are monitored at Salem 1 & 2 and Hope Creek plants, and because there is a record of mitigation actions for GIC at these plants, Artificial Island is essentially a laboratory for geomagnetic disturbance. For the GMD Task Force to come to valid conclusions and recommendations, it is critical that the task force have as much information as possible about events at this location.

The previous email perspectives on the power transformers at Hope Creek (included at the end of this email) are very helpful and I thank the task force members that provided them. Many would agree that it is difficult to unambiguously determine whether a particular transformer has been impacted due to GIC, because any failure or obvious degradation may occur days or even weeks after the GIC event; unrelated stress on a transformer may "push it over the edge" when previous GIC damage is present. In general, if we have more information about events leading up to transformer impacts, we will have better technical understanding.

I recognize that there may be legitimate semantic differences between how transformer impacts are described by plant operators and the common English meaning of words. For example, if a transformer shows signs of degradation by Dissolved Gas Analysis (DGA) and ultimately requires replacement, plant operators may not consider it a "failure." Likewise, if a transformer can operate in a degraded state, and the transformer can be repaired during a scheduled outage, it may not be a "failure." However, most all would consider a transformer explosion or fire a "failure."

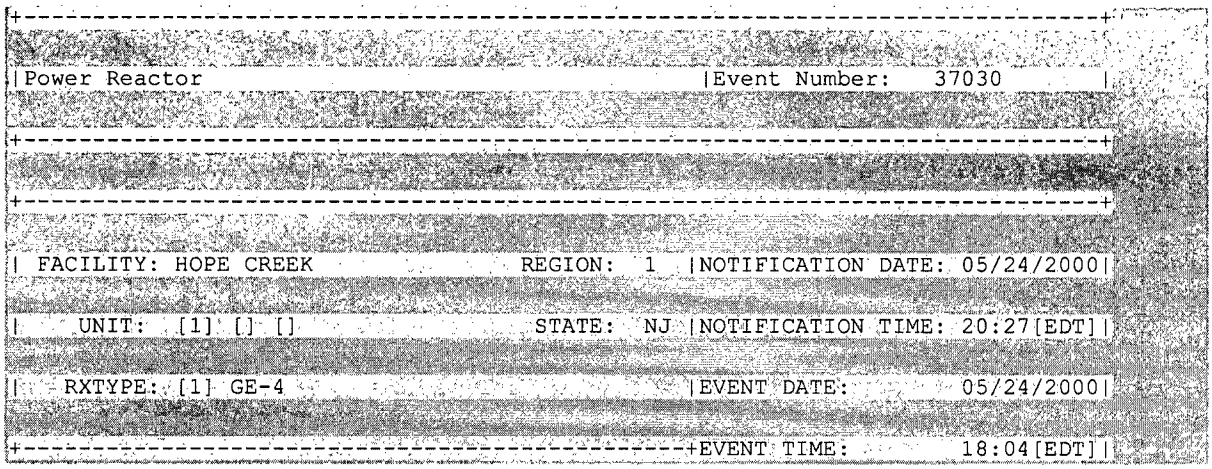
I have taken time to do additional research on Salem 1 & 2 and Hope Creek and present it now to the task force. First, I show status updates from the NRC Power Reactor Status Reports during conditions of geomagnetic disturbance and power reductions at nuclear plants. The vast majority of these power reductions during solar storms have taken place at Salem 1 & 2 and Hope Creek and the power reductions commenced the day after the July 15, 2000 solar storm. While the power reductions may have protected the plant transformers to some degree, undoubtedly they were also costly in terms of lost generation revenue. As a task force, we should understand the reasoning behind these costly power reductions and why the start of their use appears to be July 16, 2000:

Nuclear Plant Power Reductions Attributed to Solar Activity

Date of Report	Unit Name	Power	Reason
3/31/2001	HOPE CREEK	65%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCE'S
4/1/2001	HOPE CREEK	65%	HOLDING POWER DUE TO SOLAR MAGNETIC DISTURBANCE'S
4/2/2001	HOPE CREEK	80%	HOLDING POWER DUE TO SOLAR MAGNETIC DISTURBANCE'S
4/12/2001	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCE
4/13/2001	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCE
4/18/2001	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES ON "C" MAIN POWER TRANSFORMER
10/2/2001	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES AFFECTING THE MAIN TRANSFORMER
10/3/2001	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES AFFECTING THE MAIN TRANSFORMER
10/4/2001	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES AFFECTING THE MAIN TRANSFORMER
11/24/2001	HOPE CREEK	78%	SOLAR MAGNETIC DISTURBANCE
10/29/2003	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES
10/30/2003	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES
10/31/2003	HOPE CREEK	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES - WILL REASSESS HOLD AT 1100 EST AND, IF NO PROBLEMS, ESCALATE POWER
10/30/2003	POINT BEACH 1	83%	INCREASING POWER FOLLOWING A DECREASE IN POWER DUE TO GRID GEO-MAGNETIC DISTURBANCES
10/31/2003	POINT BEACH 1	84%	REDUCED POWER DUE TO GRID GEO-MAGNETIC

			DISTURBANCES
7/16/2000	SALEM 1	80%	REDUCED POWER DUE TO GRID DISTURBANCE CAUSED BY SOLAR MAGNETIC DISTURBANCE
11/6/2001	SALEM 1	75%	HOLDING POWER AT THIS LEVEL DUE TO SOLAR MAGNETIC DISTURBANCES
11/24/2001	SALEM 1	76%	SOLAR MAGNETIC DISTURBANCE
10/29/2003	SALEM 1	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES
10/30/2003	SALEM 1	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES
10/31/2003	SALEM 1	80%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCES - WILL REASSESS HOLD AT 1100 EST AND, IF NO PROBLEMS, ESCALATE POWER
11/8/2004	SALEM 1	77%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCE
7/16/2000	SALEM 2	80%	REDUCED POWER DUE TO GRID DISTURBANCE CAUSED BY SOLAR MAGNETIC DISTURBANCE
11/6/2001	SALEM 2	76%	HOLDING POWER AT THIS LEVEL DUE TO SOLAR MAGNETIC ACTIVITY
11/24/2001	SALEM 2	75%	SOLAR MAGNETIC DISTURBANCE
11/8/2004	SALEM 2	78%	REDUCED POWER DUE TO SOLAR MAGNETIC DISTURBANCE

Second, I have located the NRC Event Notification Report for the May 24, 2000 transformer explosion and fire at Hope Creek, shown below:



Power Reactor	Event Number: 37030
FACILITY: HOPE CREEK	REGION: 1 NOTIFICATION DATE: 05/24/2000
UNIT: [1] [] []	STATE: NJ NOTIFICATION TIME: 20:27[EDT]
RXTYPE: [1] GE-4	EVENT DATE: 05/24/2000
	EVENT TIME: 18:04[EDT]

NRC NOTIFIED BY: SERATA	LAST UPDATE DATE: 05/24/2000
HQ OPS OFFICER: CHAUNCEY GOULD	

	PERSON	ORGANIZATION
EMERGENCY CLASS: N/A	DAN HOLODY	R1
10 CFR SECTION:	JOSEPH GIITTER	IRO
NINF INFORMATION ONLY	JACK CRLENJAK	R1
	JOHN HANNON	NRR
	JOHN ZWOLINSKI	NRR
	ROY ZIMMERMAN	NRR

UNIT	SCRAM CODE	RX CRIT	INIT PWR	INIT RX MODE	CURR PWR	CURR RX MODE
1	N	Y	19	Power Operation	19	Power Operation

EVENT TEXT

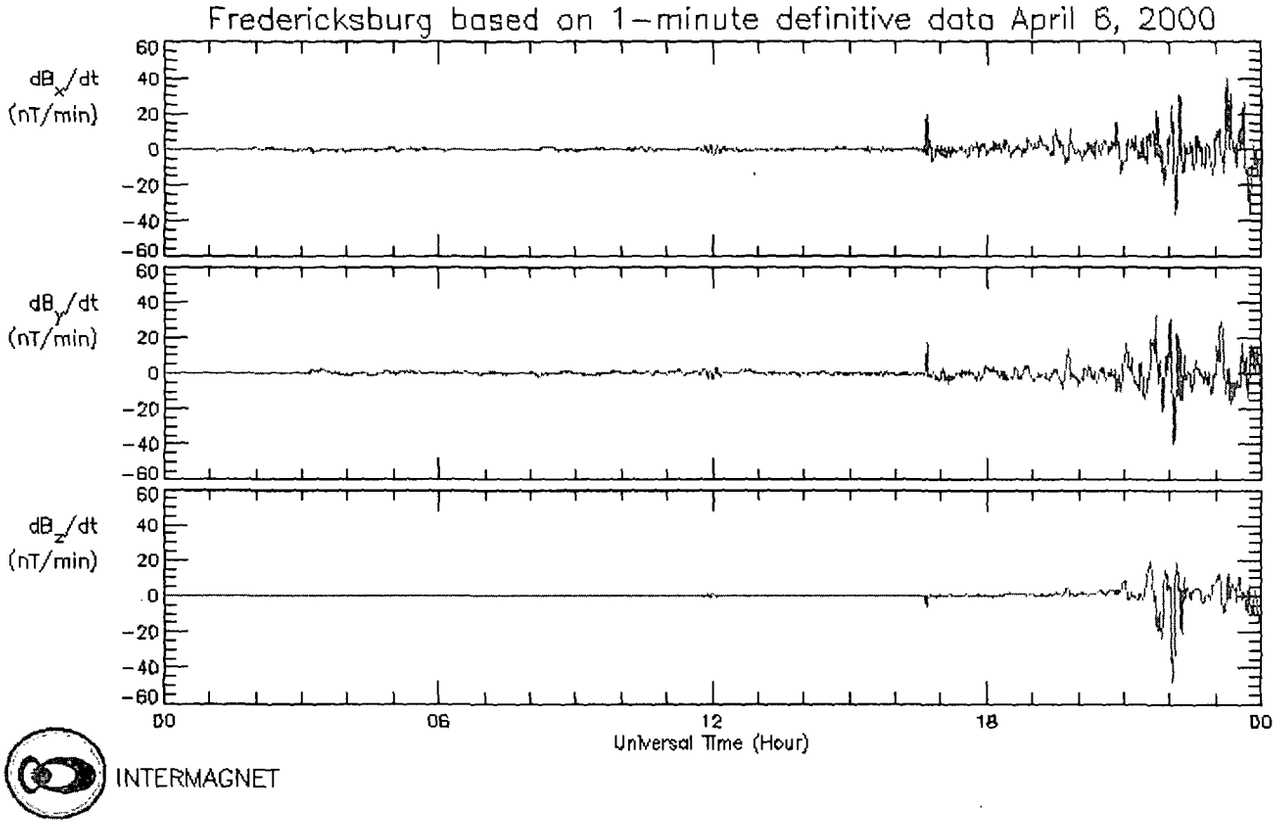
MAIN TRANSFORMER EXPLOSION AND FIRE WITHIN FIVE FEET OF THE TURBINE BUILDING.

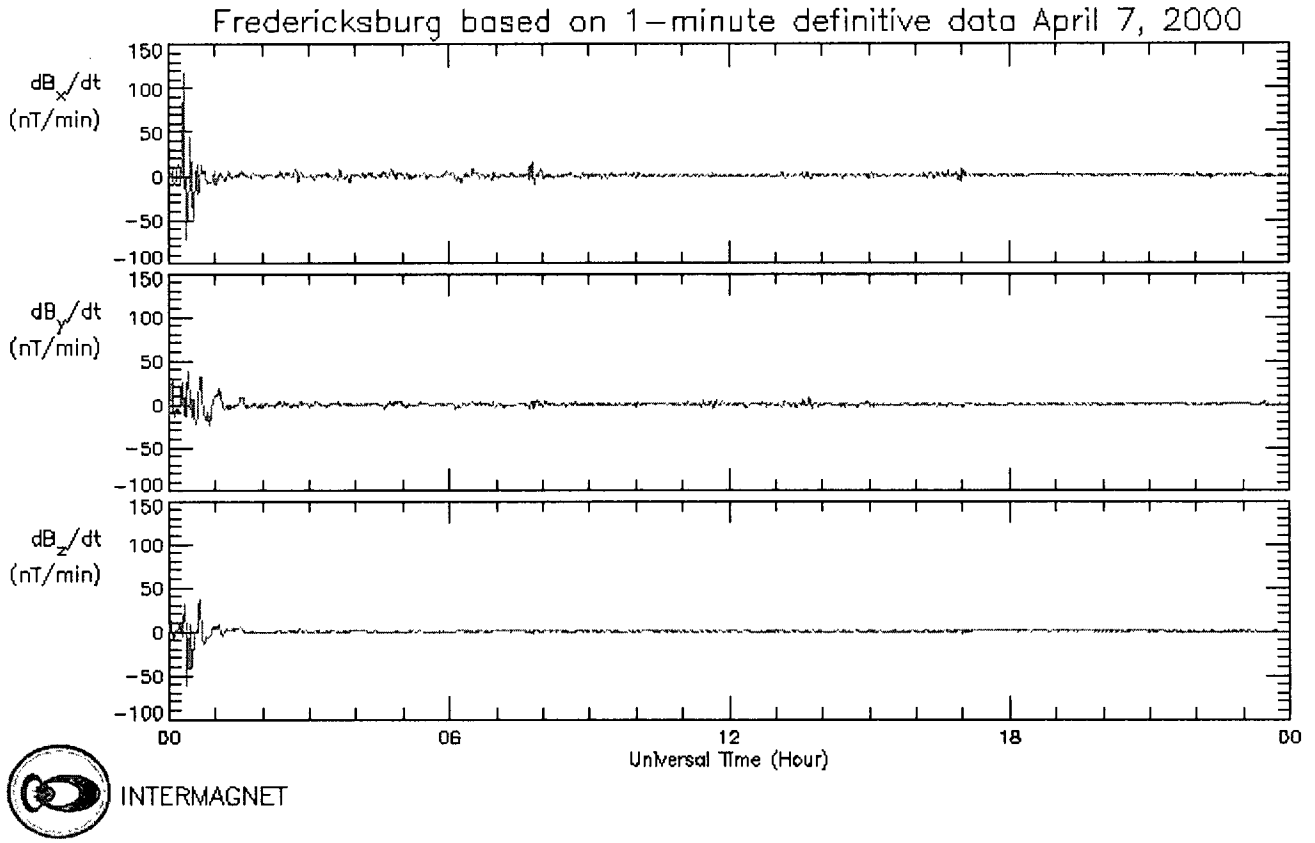
PRIOR TO THE EVENT, THEY HAD JUST CLOSED THE MAIN TURBINE AND GENERATOR OUTPUT BREAKERS SO THAT THE TURBINE WOULD SYNCHRONIZE TO THE GRID. AT 1804 A MAIN TURBINE TRIP AND MAIN TRANSFORMER TROUBLE ALARM WAS RECEIVED IN THE CONTROL ROOM. SUBSEQUENT TO THE TURBINE TRIP, MAIN GENERATOR TRANSFORMER FIRE ALARMS WERE RECEIVED AND VISUAL VERIFICATIONS CONFIRMED A FIRE ON THE "C" PHASE OF THE MAIN GENERATOR TRANSFORMER. THE FIRE DELUGE SYSTEM

ACTIVATED, AND ALTHOUGH EXTERNAL INDICATION THE FIRE HAD CEASED, IT IS
EXPECTED THAT THE FIRE CONTINUES TO BURN INTERNALLY TO THE TRANSFORMER. ALL
OFFSITE POWER SOURCES ARE STILL AVAILABLE. NO OFFSITE FIRE ASSISTANCE HAS
BEEN REQUESTED. THE FIRE HAS BEEN ONGOING INTERNALLY FOR APPROXIMATELY TWO
HOURS. THEY ARE IN THE PROCESS OF ELECTRICALLY ISOLATING THE TRANSFORMER
FROM BOTH THE GENERATOR AND THE GRID AND TAGGING IT OUT. DELUGE ACTUATION
HAS BEEN SECURED AND THEY ARE SPRAYING THE TRANSFORMER WITH FIRE WATER. THEY
ARE ALSO MAKING PREPARATIONS TO USE A FOAM FIRE SUPPRESSION AGENT.
FURTHER EVALUATION CONTINUES IN REGARD TO THE ENVIRONMENTAL IMPLICATIONS OF
THE EVENT. SPECIFICALLY, THE ABILITY OF THE PLANT OIL WASTE SYSTEM TO
PROPERLY PROCESS THE MIXTURE OF WATER AND OIL THAT WERE PRODUCTS OF THE
COMPONENT FAILURE AND SUBSEQUENT FIRE FIGHTING EFFORTS.
THE LICENSEE WILL KEEP THE NRC INFORMED OF ANY ADVERSE CHANGES.
THE NRC RESIDENT INSPECTOR WILL BE INFORMED.

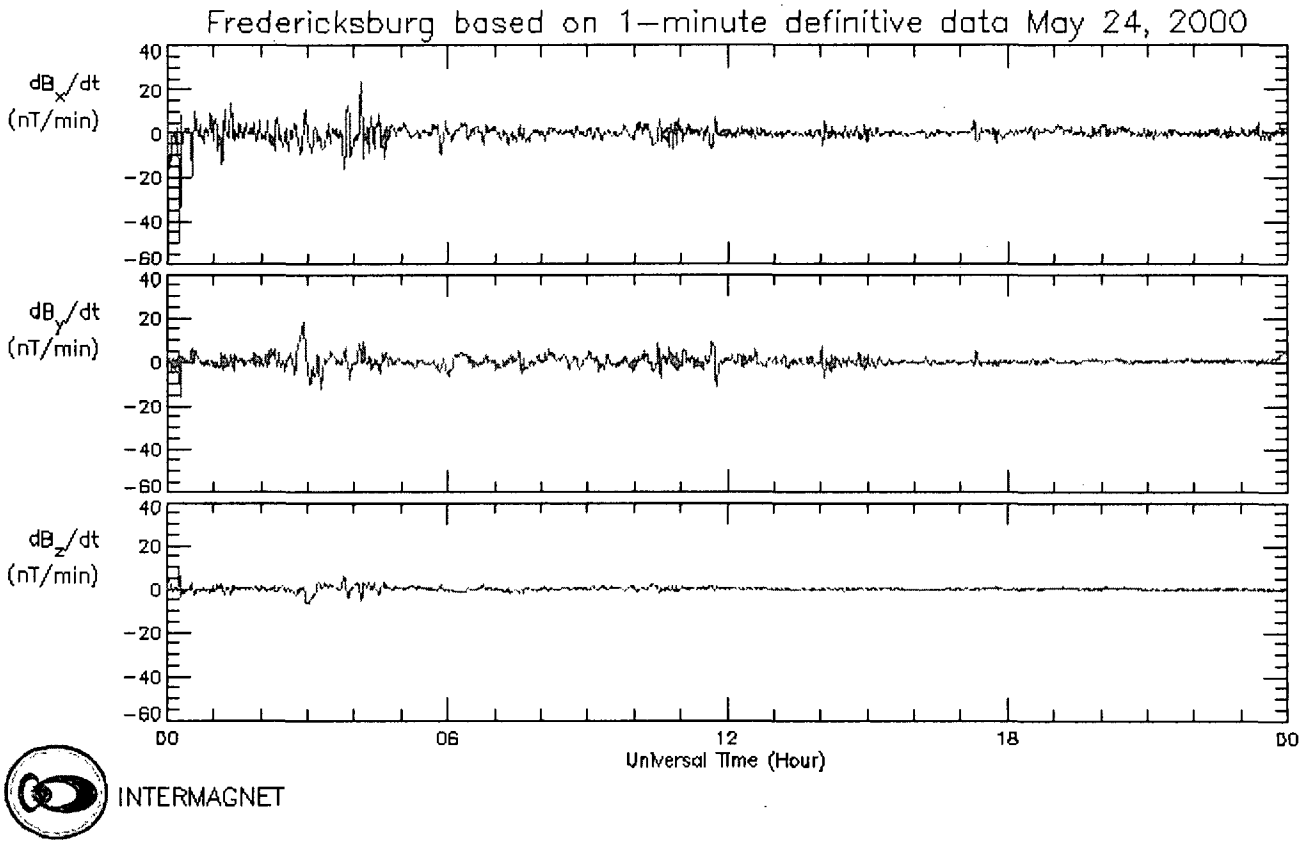
Third, I have researched the (dB/dt) magnetic flux changes for solar storms during three key periods: April 6-7, 2000; May 24, 2000; and July 15-16, 2000. Graphs of readings from the Fredericksburg Observatory are presented below.

Note the solar storm that started on April 6 and the significant dB/dt spike of approximately 125 nanoTeslas/minute early on April 7, 2000 which probably resulted in substantial GIC at Salem and Hope Creek. Hope Creek was holding power at 97% capacity on that day due to "feedwater heater outage" and then proceeded on April 12 to a refueling outage without ever increasing power back to 100%. After reactor refueling was completed on May 23, the Main "C" transformer was reenergized late on May 24. The Main "C" transformer then exploded with only 16% power at 18:04 on May 24.

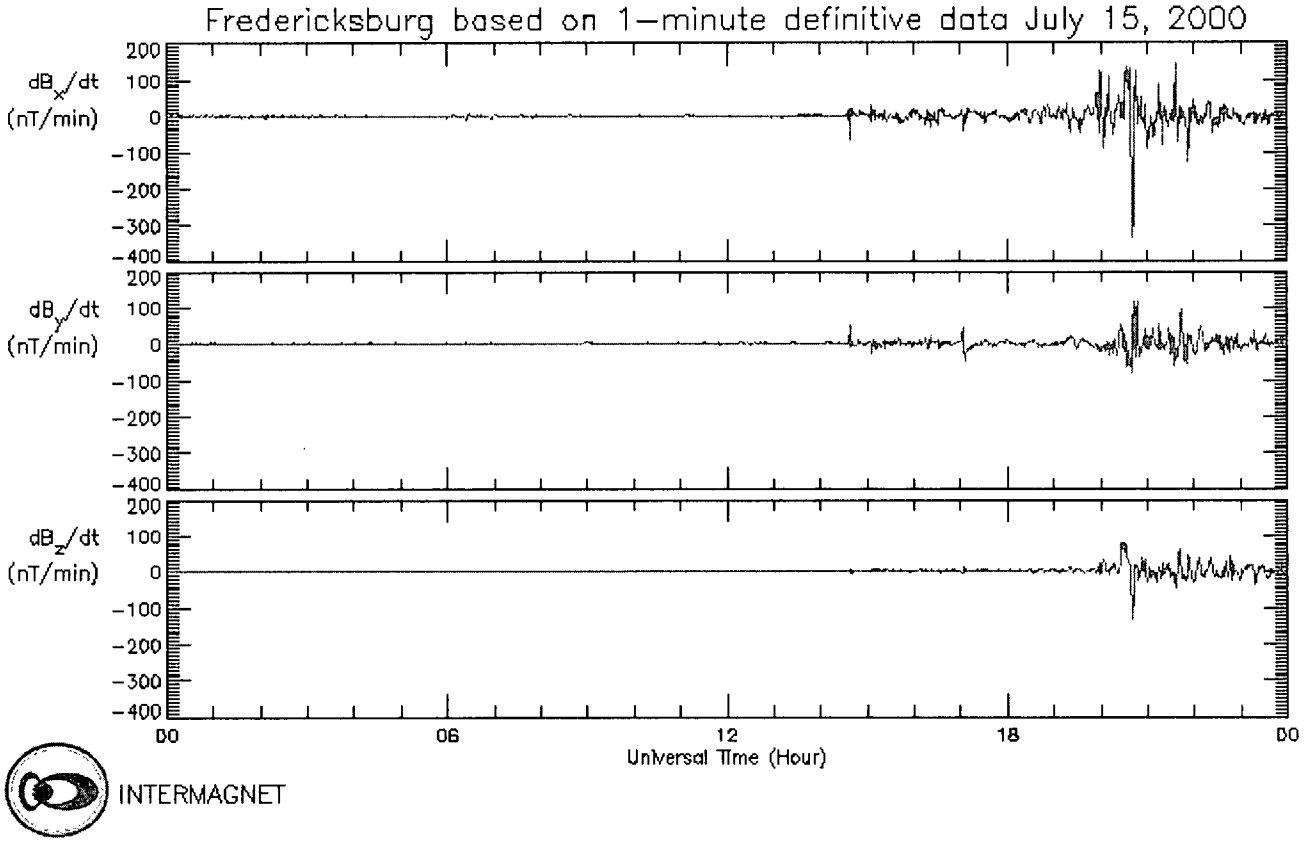

Fredericksburg based on 1-minute definitive data April 6, 2000
dBx/dt (nT/min)
dBy/dt (nT/min)
dBz/dt (nT/min)
60
40
20
0
-20
-40
-60
00
06
12
18
00
Universal Time (Hour)
INTERMAGNET

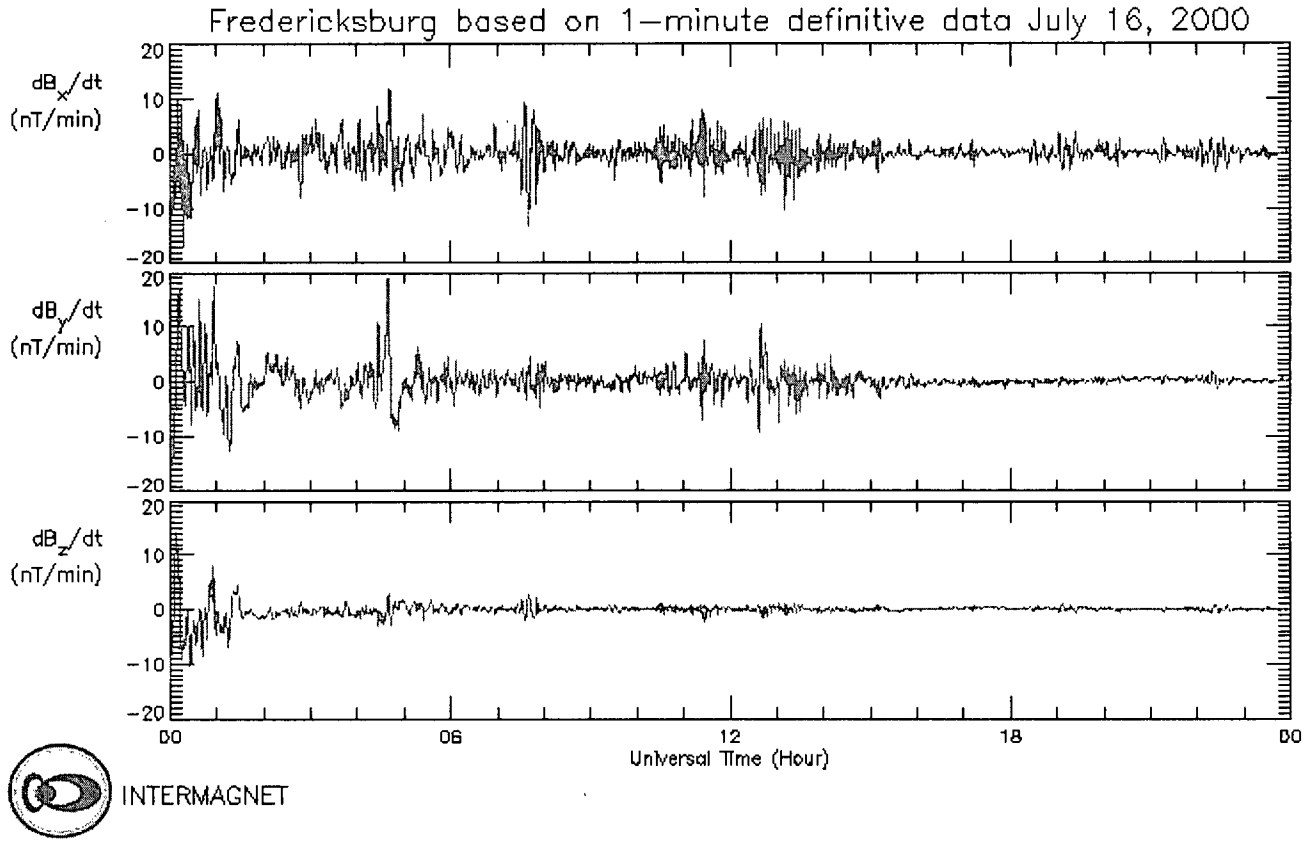


Note that at 18:04 on May 24, 2000 (date and time of the Hope Creek Main "C" transformer explosion), there was minimal measure dB/dt, so it is unlikely that large GIC currents would have been flowing at that time. As a result, there is little evidence that the Main "C" transformer failed due to *GIC that was present on May 24.* (The AK index for May 24 was high at 46, but any dB/dt and associated GIC spike would have had to be within the one minute sample time.)



Note the large dB/dt spike of approximately -350 nanoTeslas/minute around 20:30 July 15, 2000. On the next day, July 16, NRC reports show that power was reduced to 80% at the co-located Salem plants due to "grid disturbance caused by solar magnetic disturbance."


Fredericksburg based on 1—minute definitive data July 15, 2000
dB$_x$/dt (nT/min)
dB$_y$/dt (nT/min)
dB$_z$/dt (nT/min)
200
100
0
−100
−200
−300
−400
00
06
12
18
00
Universal Time (Hour)
INTERMAGNET



Fourth, I have extracted the Hope Creek records from the NRC Power Reactor Status Reports for the months of April-August 2000. The records are below. Note that Hope Creek was operating at only 55% power on July 15, 2000. A significant solar storm occurred on July 15 with dB/dt of approximately -350 nanoTeslas/minute and on the next day the Hope Creek Power Reactor Status Reports read "HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION," with power reduced to 80%. It is interesting to note that the holding of power at 80% due to transformer "degradation" continued for 8 days, including during times where there was minimal solar activity. There was no holding of power of the Main "C" transformer in the period immediately before the July 15, 2000 solar storm, nor any notation of transformer "degradation" in the Power Reactor Status Reports.

Hope Creek Power Reactor Status Reports with AK Indexes from Fredericksburg Observatory

Date	UnitName	Power	AK Index	Reason
4/1/2000	HOPE CREEK	70%	12	REDUCED POWER FOR FEEDWATER HEATER OUTAGE
4/2/2000	HOPE CREEK	95%	14	HOLDING POWER FOR FEEDWATER HEATER OUTAGE
4/3/2000	HOPE CREEK	98%	12	HOLDING POWER FOR FEEDWATER HEATER OUTAGE - 95% TURBINE LOAD

4/4/2000	HOPE CREEK	97%	23	HOLDING POWER FOR FEEDWATER HEATER OUTAGE - 95% TURBINE LOAD
4/5/2000	HOPE CREEK	97%	14	HOLDING POWER FOR FEEDWATER HEATER OUTAGE - 95% TURBINE LOAD
4/6/2000	HOPE CREEK	97%	34	HOLDING POWER FOR FEEDWATER HEATER OUTAGE - 95% TURBINE LOAD
4/7/2000	HOPE CREEK	97%	34	HOLDING POWER FOR FEEDWATER HEATER OUTAGE - 95% TURBINE LOAD
4/8/2000	HOPE CREEK	90%	8	REPAIRING MAIN FEEDWATER HEATER
4/9/2000	HOPE CREEK	90%	12	REPAIRING MAIN FEEDWATER HEATER
4/10/2000	HOPE CREEK	96%	14	
4/11/2000	HOPE CREEK	99%	8	
4/12/2000	HOPE CREEK	98%	7	COASTDOWN TO REFUELING OUTAGE
4/13/2000	HOPE CREEK	97%	3	COASTDOWN TO REFUELING OUTAGE
4/14/2000	HOPE CREEK	98%	2	COASTDOWN TO REFUELING OUTAGE
4/15/2000	HOPE CREEK	97%	7	COASTDOWN TO REFUELING OUTAGE
4/16/2000	HOPE CREEK	97%	16	COASTDOWN TO REFUELING OUTAGE
4/17/2000	HOPE CREEK	96%	11	COASTDOWN TO REFUELING OUTAGE
4/18/2000	HOPE CREEK	96%	5	COASTDOWN TO REFUELING OUTAGE
4/19/2000	HOPE CREEK	96%	9	COASTDOWN TO REFUELING OUTAGE
4/20/2000	HOPE CREEK	95%	18	COASTDOWN TO REFUELING OUTAGE
4/21/2000	HOPE CREEK	95%	7	COASTDOWN TO REFUELING OUTAGE
4/22/2000	HOPE CREEK		4	REFUELING OUTAGE
4/23/2000	HOPE CREEK		4	REFUELING OUTAGE
4/24/2000	HOPE CREEK		14	REFUELING OUTAGE
4/25/2000	HOPE CREEK		7	REFUELING OUTAGE
4/26/2000	HOPE CREEK		3	REFUELING OUTAGE - MAKING PREPARATIONS FOR CORE ALTERATIONS
4/27/2000	HOPE CREEK		12	REFUELING OUTAGE - CORE ALTERATIONS IN PROGRESS
4/28/2000	HOPE CREEK		11	REFUELING OUTAGE - CORE ALTERATIONS IN PROGRESS
4/29/2000	HOPE CREEK		12	REFUELING OUTAGE - CORE ALTERATIONS IN PROGRESS
4/30/2000	HOPE CREEK		10	REFUELING OUTAGE - CORE ALTERATIONS IN PROGRESS
5/1/2000	HOPE CREEK		12	REFUELING OUTAGE - CORE ALTERATIONS IN PROGRESS
5/2/2000	HOPE CREEK		13	REFUELING OUTAGE - DEFUELED
5/3/2000	HOPE CREEK		13	REFUELING OUTAGE - DEFUELED
5/4/2000	HOPE CREEK		5	REFUELING OUTAGE - DEFUELED

5/5/2000	HOPE CREEK		12	REFUELING OUTAGE - DEFUELED
5/6/2000	HOPE CREEK		8	REFUELING OUTAGE - DEFUELED
5/7/2000	HOPE CREEK		6	REFUELING OUTAGE - DEFUELED AUTOMATIC REACTOR SCRAM SIGNAL DURING MAINTENANCE (EN #36977)
5/8/2000	HOPE CREEK		6	REFUELING OUTAGE
5/9/2000	HOPE CREEK		7	REFUELING OUTAGE
5/10/2000	HOPE CREEK		5	REFUELING OUTAGE
5/11/2000	HOPE CREEK		4	REFUELING OUTAGE
5/12/2000	HOPE CREEK		19	REFUELING OUTAGE
5/13/2000	HOPE CREEK		15	REFUELING OUTAGE
5/14/2000	HOPE CREEK		11	REFUELING OUTAGE
5/15/2000	HOPE CREEK		10	REFUELING OUTAGE
5/16/2000	HOPE CREEK		14	REFUELING OUTAGE
5/17/2000	HOPE CREEK		20	REFUELING OUTAGE
5/18/2000	HOPE CREEK		8	REFUELING OUTAGE
5/19/2000	HOPE CREEK		7	REFUELING OUTAGE
5/20/2000	HOPE CREEK		4	REFUELING OUTAGE
5/21/2000	HOPE CREEK		5	REFUELING OUTAGE
5/22/2000	HOPE CREEK		8	REFUELING OUTAGE
5/23/2000	HOPE CREEK	2%	19	STARTUP TESTING
5/24/2000	HOPE CREEK	6%	46	STARTUP TESTING
5/25/2000	HOPE CREEK	16%	23	HOLDING POWER - SEE EVENT # 37030
5/26/2000	HOPE CREEK	15%	19	HOLDING POWER, WAITING ON MAIN TRANSFORMER PHASE 'C' REPLACEMENT
5/27/2000	HOPE CREEK	14%	8	HOLDING POWER AT THIS LEVEL FOR MAIN TRANSFORMER PHASE 'C' REPLACEMENT
5/28/2000	HOPE CREEK	15%	10	HOLDING POWER AT THIS LEVEL WITH THE UNIT OFF LINE FOR MAIN TRANSFORMER PHASE 'C' REPLACEMENT
5/29/2000	HOPE CREEK	14%	19	HOLDING POWER AT THIS LEVEL WITH THE UNIT OFF LINE FOR MAIN TRANSFORMER PHASE 'C' REPLACEMENT
5/30/2000	HOPE CREEK	14%	12	HOLDING POWER AT THIS LEVEL WITH THE UNIT OFF LINE FOR MAIN TRANSFORMER PHASE 'C' REPLACEMENT
5/31/2000	HOPE CREEK	14%	9	HOLDING POWER AT THIS LEVEL WITH THE UNIT OFF LINE FOR MAIN TRANSFORMER PHASE 'C' REPLACEMENT
6/1/2000	HOPE CREEK	10%	9	HOLDING POWER AT THIS LEVEL WITH THE UNIT OFF LINE FOR MAIN TRANSFORMER PHASE 'C'

				REPLACEMENT
6/2/2000	HOPE CREEK		12	GOING TO A COLD SHUTDOWN CONDITION FOR MAIN TRANSFORMER PHASE 'C' REPLACEMENT
6/3/2000	HOPE CREEK		9	MAIN TRANSFORMER REPAIR IN PROGRESS
6/4/2000	HOPE CREEK		11	MAIN TRANSFORMER REPAIR IN PROGRESS
6/5/2000	HOPE CREEK		22	MAIN TRANSFORMER REPAIR IN PROGRESS
6/6/2000	HOPE CREEK		13	MAIN TRANSFORMER REPAIR IN PROGRESS
6/7/2000	HOPE CREEK		13	MAIN TRANSFORMER REPAIR IN PROGRESS
6/8/2000	HOPE CREEK		34	MAIN TRANSFORMER REPAIR IN PROGRESS
6/9/2000	HOPE CREEK		4	MAIN TRANSFORMER REPAIR IN PROGRESS
6/10/2000	HOPE CREEK		16	MAIN TRANSFORMER REPAIR IN PROGRESS
6/11/2000	HOPE CREEK		22	MAIN TRANSFORMER REPAIR IN PROGRESS
6/12/2000	HOPE CREEK		12	MAIN TRANSFORMER REPAIR IN PROGRESS
6/13/2000	HOPE CREEK		10	MAIN TRANSFORMER REPAIR IN PROGRESS
6/14/2000	HOPE CREEK		27	MAIN TRANSFORMER REPAIR IN PROGRESS
6/15/2000	HOPE CREEK		21	MAIN TRANSFORMER REPAIR IN PROGRESS
6/16/2000	HOPE CREEK		5	PLANT STARTUP IN PROGRESS
6/17/2000	HOPE CREEK	12%	6	HOLDING POWER
6/18/2000	HOPE CREEK	10%	10	HOLDING POWER
6/19/2000	HOPE CREEK	10%	8	HOLDING POWER
6/20/2000	HOPE CREEK	18%	9	INCREASING POWER
6/21/2000	HOPE CREEK	18%	6	INCREASING POWER
6/22/2000	HOPE CREEK	18%	11	INCREASING POWER
6/23/2000	HOPE CREEK	25%	20	INCREASING POWER
6/24/2000	HOPE CREEK	50%	10	HOLDING POWER AT THIS LEVEL TO PERFORM FEEDWATER HEATER TESTING AFTER EXITING A MAINTENANCE OUTAGE
6/25/2000	HOPE CREEK	43%	11	HOLDING POWER AT THIS LEVEL TO PERFORM FEEDWATER HEATER TESTING AFTER EXITING A MAINTENANCE OUTAGE
6/26/2000	HOPE CREEK	75%	22	HOLDING POWER AT THIS LEVEL AFTER EXITING A MAINTENANCE OUTAGE - WAITING FOR RAMP RATES BEFORE RAISING POWER
6/27/2000	HOPE CREEK	62%	14	HOLDING POWER AT THIS LEVEL TO PERFORM ROD PATTERN ADJUSTMENTS AND TO LET XENON PEAK AFTER EXITING A MAINTENANCE OUTAGE
6/28/2000	HOPE CREEK	98%	11	
6/29/2000	HOPE CREEK	98%	7	
6/30/2000	HOPE CREEK	100%	3	
7/1/2000	HOPE CREEK	100%	7	
7/2/2000	HOPE CREEK	100%	3	

7/3/2000	HOPE CREEK	100%	8	
7/4/2000	HOPE CREEK	100%	10	
7/5/2000	HOPE CREEK	100%	6	
7/6/2000	HOPE CREEK	100%	6	
7/7/2000	HOPE CREEK	100%	6	
7/8/2000	HOPE CREEK	100%	6	
7/9/2000	HOPE CREEK	100%	6	
7/10/2000	HOPE CREEK	100%	18	
7/11/2000	HOPE CREEK	100%	31	
7/12/2000	HOPE CREEK	100%	12	
7/13/2000	HOPE CREEK	100%	18	
7/14/2000	HOPE CREEK	100%	33	
7/15/2000	HOPE CREEK	55%	148	REDUCED POWER FOR ROD PATTERN ADJUSTMENT
7/16/2000	HOPE CREEK	80%	32	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/17/2000	HOPE CREEK	80%	8	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/18/2000	HOPE CREEK	80%	8	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/19/2000	HOPE CREEK	80%	10	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/20/2000	HOPE CREEK	80%	28	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/21/2000	HOPE CREEK	80%	6	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/22/2000	HOPE CREEK	80%	11	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/23/2000	HOPE CREEK	80%	20	HOLDING DUE TO "C" MAIN POWER TRANSFORMER DEGRADATION
7/24/2000	HOPE CREEK	15%	4	REACTOR OFF LINE TO REPAIR "C" MAIN POWER TRANSFORMER
7/25/2000	HOPE CREEK	15%	4	REACTOR OFF LINE TO REPAIR "C" MAIN POWER TRANSFORMER
7/26/2000	HOPE CREEK	16%	16	REACTOR OFF LINE TO REPAIR "C" MAIN POWER TRANSFORMER
7/27/2000	HOPE CREEK	48%	6	INCREASING POWER AFTER TAKING THE UNIT OFF LINE TO REPAIR THE "C" MAIN POWER TRANSFORMER (UNIT PLACED ON LINE AT 1955 ON 07/26/00)
7/28/2000	HOPE CREEK	80%	16	HOLDING POWER AT THIS LEVEL TO PERFORM A

				TRANSFORMER EVALUATION
7/29/2000	HOPE CREEK	80%	17	PERFORMING A TRANSFORMER EVALUATION
7/30/2000	HOPE CREEK	74%	10	PERFORMING A TRANSFORMER EVALUATION
7/31/2000	HOPE CREEK	80%	17	PERFORMING A TRANSFORMER EVALUATION
8/1/2000	HOPE CREEK	80%	11	PERFORMING A TRANSFORMER EVALUATION
8/2/2000	HOPE CREEK	80%	9	PERFORMING A TRANSFORMER EVALUATION
8/3/2000	HOPE CREEK	80%	8	PERFORMING A TRANSFORMER EVALUATION
8/4/2000	HOPE CREEK	87%	13	PERFORMING A TRANSFORMER EVALUATION
8/5/2000	HOPE CREEK	95%	19	HOLDING POWER AT THIS LEVEL TO PERFORM A TRANSFORMER EVALUATION
8/6/2000	HOPE CREEK	100%	15	
8/7/2000	HOPE CREEK	100%	8	
8/8/2000	HOPE CREEK	100%	7	
8/9/2000	HOPE CREEK	100%	-1	
8/10/2000	HOPE CREEK	100%	16	
8/11/2000	HOPE CREEK	100%	39	
8/12/2000	HOPE CREEK	100%	55	
8/13/2000	HOPE CREEK	100%	16	
8/14/2000	HOPE CREEK	100%	11	
8/15/2000	HOPE CREEK	100%	9	
8/16/2000	HOPE CREEK	100%	9	
8/17/2000	HOPE CREEK	100%	9	
8/18/2000	HOPE CREEK	100%	3	
8/19/2000	HOPE CREEK	100%	3	
8/20/2000	HOPE CREEK	100%	3	
8/21/2000	HOPE CREEK	100%	9	
8/22/2000	HOPE CREEK	100%	3	
8/23/2000	HOPE CREEK	100%	5	
8/24/2000	HOPE CREEK	100%	7	
8/25/2000	HOPE CREEK	100%	3	
8/26/2000	HOPE CREEK	100%	4	
8/27/2000	HOPE CREEK	100%	7	
8/28/2000	HOPE CREEK	100%	17	
8/29/2000	HOPE CREEK	100%	21	
8/30/2000	HOPE CREEK	100%	12	
8/31/2000	HOPE CREEK	100%	12	

Fifth, I have located a research paper authored by Peter Balma of PSEG on transformer failures due to GIC at Hope Creek. This paper contains information on the Main "B" transformer at Salem 1 that was damaged in the March 1989 solar storm and may have been kept onsite as an emergency spare. Perhaps PSEG could tell the GMD Task Force if this was the spare installed in

May 2000 at Hope Creek for replacement of the Main "C" transformer, after the April 6-7, 2000 solar storm. Excerpts from the Balma paper follow:

GEOMAGNETIC EFFECTS ON A BANK OF SINGLE PHASE GENERATOR STEP-UP TRANSFORMERS

Peter M. Balma, P.E.
Public Service Electric and Gas Company
Distribution Systems Department
80 Park Plaza
Newark, New Jersey 07101

ABSTRACT

On March 13, 1989 a severe geomagnetic storm of K9 intensity impacted the Pennsylvania, New Jersey, Maryland, (PJM) 500 kV system. Numerous effects were observed across the system, and severe damage to a bank of single phase, generator step-up, transformers occurred. The failure, transformer design, and methods of protection and mitigation are discussed.

From pages 4-5 of the Balma report:

In Phase B, severe thermal deterioration was also found in the same location as the failures in the other two units. The damage to Phase B was not as severe, and was temporarily repaired in the field. The repair was considered only suitable

for use in an emergency situation, and permanent factory repairs will be required to make this unit available as an acceptable site spare.

There is important data that is still missing. PSEG, the utility operating Salem/Hope Creek, has disclosed that it has DC Current monitoring records since the original Salem event in 1989. I ask PSEG to release the DC Current and transformer condition (temperatures, dissolved gas in oil, acoustic emissions, etc) monitoring records to the GMD Task Force, particularly for the period April 1-August 31, 2000. Also, PSEG has disclosed that there are "root cause investigations" for the transformer incidents at Hope Creek. I ask that PSEG release the "root cause investigation" reports for the May 2000 and July 2000 power transformer impacts to the GMD Task Force. Finally, PSEG has disclosed that it was following "approved operating procedures" for power reductions to mitigate GIC at Salem/Hope Creek. I ask that PSEG release the "approved operating procedures" for Salem/Hope Creek to the GMD Task Force, including any power reduction curves included in these operating procedures and the dates these operating procedures were in effect.

While it might take a while for PSEG to access and compile this data, the "root cause investigation" reports should be readily available as PSEG already referred to them in response to my earlier email. At the very least, I hope that PSEG will be able to provide the root cause investigation reports by the next task force meeting.

Once we examine additional data together, I think we will have a much more complete picture of events at Salem/Hope Creek and will be able to better judge the vulnerability of power transformers at other locations. In particular, we should be able to:

- More accurately evaluate the circumstances of the May 2000 "replacement" of the Main "C" transformer (as described in NRC records)

- More accurately evaluate the circumstances of the July 2000 "degradation" of the Main "C" transformer (as described in NRC records)

- More accurately evaluate the circumstances of the July 2000 "repair" of the Main "C" transformer (as described in NRC records)

- Evaluate the risk of transformer failure due to GIC at Salem/Hope Creek and at other locations

- Evaluate the efficacy of "operating procedures" as a means of GIC mitigation at Salem/Hope Creek and at other locations

When I use the terms "replacement," "degradation," and "repair" in relation to the Main "C" transformer, I am quoting specific language in the NRC Power Reactor Status Reports.

Several government-sponsored bodies have examined the threat due to geomagnetic disturbance for the electric grid. Estimates of casualties range into the millions if power is lost for 1-2 years over large areas of the United States due to geomagnetic disturbance. We would be derelict in our duty as a task force if we did not take this opportunity to learn as much as possible about the geomagnetic disturbance threat by more fully examining events at the Salem and Hope Creek plants on Artificial Island.

Finally, I would point out that a cost-effective solution to the issue of geomagnetic disturbance and GIC—hardware blocking devices—is becoming more feasible. So we should be motivated to examine these issues not just because of electric grid reliability concerns, but also because fixing geomagnetic disturbance vulnerability could have a positive payback for utilities and their ratepayers.

Should anyone on the GMD Task Force have comments on this email before our upcoming meeting, please hit the "Reply All" button and let us know what you are thinking.

Many thanks,

Thomas Popik
Foundation for Resilient Societies

November 1, 2011 Email from Mark Lauby of NERC

On Tue, Nov 1, 2011 at 4:13 PM, Mark Lauby <Mark.Lauby@nerc.net> wrote:

Thomas,

Looks like you are proposing that PSEG should consider if technical study is warranted, and if they are willing to pursue it with you. If so, they (PSEG) can report back to the GMD Task Force once a technical conclusion is reached. I should our contact on the GMTF is Justin Lane at Justin.Lane@pseg.com.

No point in taking up the GMD TF time on this issue until the technical work is done.

Regards,

Mark S. Lauby
Vice President and Director, Reliability Assessments and Performance Analysis
North American Electric Reliability Corporation
3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
O: 404-446-2560; D: 404-446-9723; C: 609.651.9420

November 2, 2011 Email from Chris Beck of Electric Infrastructure Security Council

From: Chris Beck [mailto:chris.beck@eiscouncil.org]
Sent: Wednesday, November 02, 2011 4:11 PM
To: GMDTF
Subject: Re: GMD Task Force Discussion about Salem/Hope Creek

Hi Mark, Tom, and GMDTF members,

I wanted to follow up on this discussion thread that Tom Popik and Mark Lauby had yesterday regarding Hope Creek. Mark noted that Tom's comments and the data he provided possibly indicated a need for a technical study. I personally doubt that a new PSEG technical study is needed. I do think, though, that their discussion has underscored the need for the GMDTF to obtain and fully understand the entire root cause investigation report for the Hope Creek transformer failure, as well as other such reports on significant incidents that the GMDTF has discussed. This is something I had brought up during the conference call on 10/18. The idea received approval from the group, and Mark asked that a list of important incidents be provided to him so that he could follow up and obtain the necessary reports. I appreciate Tom's efforts in putting together information that the NRC keeps on this, it is certainly helpful. But I think we could do even better by obtaining and reading actual root cause investigation reports for transformer failures prepared by the owners and operators of the equipment where GIC impact is strongly suspected or confirmed. The list below is probably a good place to start. I think all of these incidents are mentioned to some degree in the current whitepaper draft.

PSEG

- Salem Unit 1 Main "A," "B," and "C" transformers on March 13, 1989
- Salem Unit 2 Main "B" transformer on September 19, 1989
- Hope Creek Main "C" transformer on May 24, 2000
- Hope Creek Main "C" transformer on July 15, 2000

Hydro-Quebec

- Two transformers at La Grande 4 Generating Station on March 13, 1989

Allegheny Power System (APS)

- Eight transformers on March 13, 1989

Eskom, South Africa

- Lethabo power station on November 17, 2003
- Matimba power station #3 transformer on November 23, 2003
- Tutuka power station on January 19, 2004
- Matimba power station (#5 and #6) in June 2004

Transpower New Zealand

- Transformer T4 at Halfway bush on November 6, 2001

Swedish Utilities

(as reported in "Space weather events in July 1982 and October 2003 and the effects of geomagnetically induced currents on Swedish technical systems" by M. Wik, R. Pirjola, H. Lundstedt, A. Viljanen, P. Wintoft, and A. Pulkkinen)

- 13–14 Jul 1982: 4 transformers and 15 lines tripped in the high-voltage power system
- 13–14 Mar 1989: 5 130 kV lines tripped, 5-degree temperature increase in a generator
- 24 Mar 1991: 9 220 kV lines and a transformer tripped
- 6 Apr 2000: Largest GIC ever measured in a transformer (about 300 A)
- 30 Oct 2003: Power blackout in Malm¨o, excess heating in a transformer
- 8 Nov 2004: GIC of over 100A measured in a transformer in southern Sweden

PSEG, Hydro-Quebec, and Allegheny Power System (now owned by First Energy) are all subject to NERC requirements, so I would assume requests from NERC for root cause investigation reports should receive a quick response. In fact, for the May 24 and July 15, 2000 Hope Creek incidents, Justin Lane forwarded some information from PSEG that referred specifically to their root cause investigation report, so we know that report exists and it is reasonable that these reports could be made available to us, hopefully before the task force meeting next week. Again, I think it makes sense for us all to look at the original documentation of these incidents by those that experienced and investigated them.

I'd assume that requesting and accessing the reports from the foreign utilities listed may take a bit longer, but this information would be important and helpful as well as we go forward.

Best Regards,
Chris

--

Chris Beck
Electric Infrastructure Security Council
p: 202-248-5025
f: 202-289-6539
e: chris.beck@eiscouncil.org

November 2, 2011 Email from Peter Pry of EMPact America

From: Peter Pry [mailto:peterpry@verizon.net]
Sent: Wednesday, November 02, 2011 6:08 PM
To: Mark Lauby; Watkins,Donald S - TO-DITT2; kozaf@pjm.com; gmdtf@nerc.com
Cc: Thomas S Popik; JKappenma@aol.com; chris.beck@eiscouncil.org
Subject: Responsibility to Investigate Geomagnetic Disturbance Risks

Mr. Lauby:

I am confused by your message. You seem to indicate that Mr. Popik should individually approach PSEG and ask them to conduct a technical study of geomagnetic disturbance risks at Hope Creek.

On Slide 3 of Chairman Don Watkins "GMDTF Framing" presentation it clearly states:

> The Geomagnetic Disturbance Task Force (GMDTF) will ***investigate*** bulk power system reliability implications of [GMD] risks and develop solutions to help mitigate this risk.

Mr. Popik brings forth credible evidence of geomagnetic disturbance risks at the Hope Creek nuclear plant. He asks that PSEG provide data (not a technical study) so that the GMD Task Force can ***investigate*** these risks.

It is incumbent on the GMD Task Force to make the data request to PSEG and conduct a GMD risk investigation, consistent with its charter. It is not appropriate to push the investigative burden onto a private individual without the authority of NERC, the designated Electric Reliability Organization.

Dr. Peter Vincent Pry
President
EMPact America

November 2, 2011 Email from Mark Lauby of NERC

From: Mark Lauby [mailto:Mark.Lauby@nerc.net]
Sent: Wednesday, November 02, 2011 6:41 PM
To: GMDTF
Cc: Thomas S Popik; JKappenma@aol.com; chris.beck@eiscouncil.org
Subject: RE: Responsibility to Investigate Geomagnetic Disturbance Risks

Dr. Pry,

Much of the information and circumstances behind the transformer failures over the last few decades have already been discussed at the GMD Task Force, and we need to press on towards finalizing our report as well as development of conclusions and recommendations.

I do need to sort out your comments regards the responsibility of the task force specific to obtaining information. It is not incumbent on the task force to obtain data or information, nor conduct an event investigation from industry participants on individual transformer component events that occurred well over a decade ago. Further, regards "pushing this off" to a private individual, I believe Dr. Popik is representing the Foundation for Resilient Society (as his e-mail suggests). In either case, I would direct those who have this deeper detailed interest (organizations or individuals) to the those utilities wherein the information is located. I leave it to the written report recommendations and conclusions specific to directionality and value for further investigation of historical outages.

In any event, NERC is assessing the landscape of risks to the bulk power system, specific to solar storms. However, we do not complete this assessment by performing root-cause or event investigations. Rather industry engineering experts review and vet information using engineering concepts to determine the state of potential vulnerabilities as well as develop recommendations and conclusions.

It is these recommendations that will drive next steps and industry actions.

Mark S. Lauby
Vice President and Director, Reliability Assessments and Performance Analysis
North American Electric Reliability Corporation
3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
O: 404-446-2560; D: 404-446-9723; C: 609.651.9420

December 15, 2011 Letter from Thomas Popik of Foundation for Resilient Societies

Foundation for Resilient Societies
52 Technology Way
Nashua NH 03060

December 15, 2011

Via Federal Express Overnight Delivery

Ralph Izzo
Chairman, CEO, and President
PSEG
80 Park Plaza
Newark, NJ 20515

Dear Mr. Izzo:

First, I would like to thank you for the proactive stance PSEG has taken to protect electric reliability in the context of EPA clean air rules. I appreciate your recent letter to the Wall Street Journal on this topic.

There is another electric reliability issue that I ask you to address on behalf of your company. Gerry Cauley, CEO of the North American Electric Reliability Corporation (NERC), identified the risk from solar storms and resulting geomagnetic disturbance as "urgent" in February 8, 2011 testimony before the Federal Energy Regulatory Commission. NERC has convened a task force on geomagnetic disturbance (the "GMD Task Force") and I am a member of that task force.

Your company owns and operates the Hope Creek nuclear plant, located on Artificial Island, New Jersey. During past geomagnetic disturbance events, transformers at the Salem nuclear plants, co-located on Artificial Island, have experienced damage from geomagnetically-induced currents. Documents from the Nuclear Regulatory Commission show that transformers at Hope Creek may also have been affected, particularly during solar storms in April and July 2000.

Events at Hope Creek have been an active topic of discussion among members of the GMD Task Force. Your employee at PSEG, Justin Lane, is a member of the GMD Task Force and has been involved in these discussions.

Several members of the task force have requested that NERC ask for PSEG documents on transformers and geomagnetically-induced currents at Hope Creek. Management at NERC has instead suggested that we ask PSEG directly.

The findings of the GMD Task Force are currently under consideration, with a comment period scheduled between December 27, 2011 and January 6, 2012. If we could get additional information from PSEG by December 27, it could substantially assist in improving task force recommendations.
We request this information that Mr. Lane referenced in preparing his previous correspondence with the GMD Task Force, which should be readily available:

1. Root cause investigation reports for the Hope Creek Main "C" transformer maintenance actions during April-July 2000.
2. Records of Geomagnetically-Induced Currents (GIC) at Hope Creek during April-July 2000.
3. Maintenance records for the Hope Creek transformers through July 2000, including any Dissolved Gas Analysis.

If PSEG has other analyses of geomagnetically induced currents at power plants on Artificial Island, and effective mitigation measures, these would be appreciated as well. The Foundation for Resilient Societies is interested in identifying cost-effective options to enhance electric grid reliability.
Any information that PSEG may be able to provide will be forwarded to all members of the GMD Task Force by email, so if PSEG has the information in electronic format, this would be very helpful. Here are emails for transmittal, including my email and task force management emails:

Thomas Popik:	thomasp@resilientsocieties.org
Donald Watkins, Chairman of GMD Task Force:	dswatkins@bpa.gov
Frank Koza, Vice-Chair of GMD Task Force:	kozaf@pjm.com
Eric Rollison, Secretary of GMD Task Force:	Eric.Rollison@nerc.net

Many thanks for considering this request. For questions, I can be reached at 603-321-1090.

Sincerely,

Thomas S. Popik
Director
Foundation for Resilient Societies

January 12, 2012 Email from Donald Holdsworth of PSEG

From: Holdsworth, Donald M. [mailto:Donald.Holdsworth@pseg.com]
Sent: Thursday, January 12, 2012 1:17 PM
To: thomasp@resilientsocieties.org
Subject: Foundation for Resilient Societies

Mr. Popik,

As a follow up to our conversation in December 2011, I am writing to confirm that PSEG has received your request. During our conversation I explained the Company would not be forwarding any additional information as outlined in your letter. PSEG Nuclear has previously summarized the events from April-July 2000 and provided that summary to the GMDTF group mailing list. The records requested are beyond the purview of the GMDTF based on the PSEG Nuclear summary response of the actual events. I would appreciate any further contact with PSEG be directed to me at the information given below.

Thank you for your anticipated cooperation.

Don Holdsworth
Director NERC Compliance
80 Park Plaza T-2B
Newark, NJ 07102
Office 973-456-3532
Cell 973-713-1161
donald.holdsworth@pseg.com

APPENDIX B: Letter to NERC Board of Trustees

Task Force on National and Homeland Security

Foundation for Resilient Societies

Instant Access Networks

ADVANCED FUSION SYSTEMS LLC

February 21, 2012

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North American Electric Reliability Corporation
3353 Peachtree Road,
N.E. Suite 600, North Tower
Atlanta, GA 30326

Dear Trustees:

We are writing to you in regard to your pending review and requested approval of the Geomagnetic Disturbance (GMD) Task Force Report, which is scheduled for 2-3pm ET on February 23, 2012. We call on you as Trustees to decline to approve this report. We also ask you to direct NERC to make a data request with legal force to investigate impacts of past geomagnetic disturbances on power transformers and to make the information gathered by this request available to the GMD Task Force for study during open sessions.

The report of the GMD Task Force should not be approved because of pervasive and persistent procedural issues in its preparation which are in apparent conflict with the Title 16 United States Code §215, Title 18 Code of Federal Regulations §39, the NERC Rules of Procedure, and the NERC By-Laws. Procedural issues include a lack of reasonable notice and opportunity for public comment, a lack of due process, a lack of openness, and an imbalance of interests in the conduct

of the GMD Task Force. These procedural issues affect not only the accuracy and credibility of the GMD Task Force Report, but due to the public safety and national security implications of widespread and persistent blackout from geomagnetic disturbance, could also call into question the legislative basis of the self-regulatory system for electric reliability. Willful non-compliance of NERC with federal law by failing to develop reliability standards or otherwise exercise its duties could also call into question the recertification of NERC as designated Electricity Reliability Organization (ERO).

We give the lack of notice of your upcoming Board of Trustees meeting on February 23, 2012 as a prime example of procedural non-compliance. The NERC By-Laws read:

> **Section 4 Meetings of the Board to be Open** Notice to the public of the dates, places, and times of meetings of the board, and all nonconfidential material provided to the board, shall be posted on the Corporation's Web site, and notice of meetings of the board shall be sent electronically to members of the Corporation, within 24 hours of the time that notice or such material is given to the trustees. Meetings of the board shall be open to the public, subject to reasonable limitations due to the availability and size of meeting facilities; provided, that the board may meet in or adjourn to closed session to discuss matters of a confidential nature, including but not limited to personnel matters, compliance and enforcement matters, litigation, or commercially sensitive or critical infrastructure information of any entity. Any or all of the trustees, or members of a committee, may participate in a meeting of the board, or a meeting of a committee, by means of a communications system by which all persons participating in the meeting are able to hear each other.

An email notice of this meeting and website posting was delayed until February 17, 2012, a full nine days after its announcement at the NERC Members Representative Meeting. Moreover, the nonconfidential material to be considered at this meeting in public session—namely, the full text of the GMD Task Force Report—has not been posted on the NERC website or conveyed by email link, in contrast to other background materials for other February 23 meeting agenda items which were conveyed by email link and placed on the NERC website. These kinds of procedural issues are not one-time events for the North American Electric Reliability Corporation. Notices of Board of Trustees meetings on key issues, including a blackout that affected millions of people, have not been posted on the Corporation's website calendar. Reports to be considered for approval at these public Board of Trustee meetings have not been posted on the NERC website until after the meetings.

Procedural issues affect not only NERC and the conduct of the Board of Trustees in its business but also extend down to the conduct of the GMD Task Force. Task force observers have been excluded from closed meetings. Task force observers have not been given proper notice of meetings to review and approve the GMD Task Force Report. Finally and most importantly, task

force observers have not been given a copy of the GMD Task Force Report as presented to Board of Trustees for approval.

These procedural issues are not mere formalities, because they fundamentally affect the potential accuracy and credibility of the conclusions and recommendations of the GMD Task Force. An emerging narrative within the GMD Task Force may have erroneously minimized the likelihood of permanent damage to power transformers from geomagnetic disturbance events. Key elements of this erroneous and misleading narrative may well include:

1. A potential geomagnetic storm with intensity ten times the 1989 Hydro-Quebec disturbance has no supported scientific basis; the narrative also omits scientific data from storms in 1972, 1982, and 1989 with recorded intensities approximately five times the intensity of the 1989 Hydro-Quebec disturbance, and scientific data from a storm in 1921 with an estimated intensity approximately ten times the 1989 Hydro-Quebec disturbance.

2. Geomagnetic storms of likely intensity would be too small to produce currents large enough to overheat and damage most power transformers.

3. The currents produced by geomagnetic storms do not last long enough to overheat and damage most power transformers.

4. Transformer impacts due to geomagnetic disturbance have been confined to transformers built before a certain date, or transformers having an old design, or transformers having insulation near end-of life. By implication, other transformers would not be vulnerable to damage from geomagnetic disturbance.

This is a convenient narrative for the electric power industry because it minimizes the necessity for immediate action, other than continuance of so-called "operating procedures" and further study.

The preponderance of scientific evidence and previous reports indicate that the above narrative is simply incorrect. Scientific evidence includes peer-reviewed and published incidents of power transformer overheating and damage found after geomagnetic disturbance events. Previous scientific studies include reports of the congressionally chartered EMP Commission, the National Academy of Sciences, the Oak Ridge National Laboratory, and a report jointly commissioned by the Department of Energy and NERC itself. More recently, the JASONs, a group of scientists independent of the electric power industry, performed a study, "Impacts of Severe Space Weather on the Electric Grid," which concluded that "Possible widespread and sustained grid damage is within the broader view of national security issues taken after 9/11, and severe space weather could be one of the causes." (The Department of Homeland Security attempted to suppress the public release of this JASON report marked "Approved for public release; distribution unlimited," but a leaked copy of the report was placed on the Internet.)

We ask the NERC Board of Trustees to be especially alert to any potential misrepresentations in the GMD Task Force Report of the findings of a study by Oak Ridge National Laboratory for the Federal Energy Regulatory Commission in joint sponsorship with the Department of Energy and the Department of Homeland Security, "Geomagnetic Storms and Their Impacts on the U.S. Power Grid," Meta-R-319, with John Kappenman as principal investigator. In particular, any representation that the Oak Ridge study claims large numbers of power transformers will "instantaneously" or "simultaneously" fail when subjected to a moderate level of Geomagnetically-Induced Current (GIC) such as 90 amps is patently false. *The Oak Ridge National Laboratory study does not claim that power transformers will "instantaneously" or "simultaneously" fail when subjected to 90 amps GIC.* The Oak Ridge study explains that transformer failures due to GIC can appear over weeks or even months after the GIC exposure: "Other anecdotal evidence, post-March '89, suggested that many other important transformers in the network sustained damage that *eventually precipitated failures.*" (Emphasis added.) Because we know that some participants in the GMD Task Force seek to discredit the government-sponsored Oak Ridge study, we must quote at length to show what the study really said:

> Very large GICs from extremely intense geomagnetic storms could pose the concern of large-scale and geographically widespread failures and permanent loss of the EHV transformers on the network. If enough of these key assets are lost, the restoration of the EHV power grid could also be considerably delayed. Because there is considerable uncertainty as to the threshold level of GIC that will cause transformer failure, two levels of minimum GIC (30 amps per phase and 90 amps per phase) were considered as the screening level for possible transformer failure for the severe geomagnetic storm 4800nT/min threat environment. For evaluations that were reported to the National Academy of Sciences and for the economic impact analysis performed for FEMA, a damage level threshold of 90 amps/phase was utilized, which makes overall estimates of damage levels more conservative. In contrast, a 30 amp/phase level is the approximate GIC withstand threshold for the Salem nuclear plant GSU transformer and possibly for others of similar less robust design in the legacy population of U.S. EHV transformers. Also, it is also important to note that other transformer failures have been observed at much lower thresholds and that other transformers have been exposed to levels higher than 30 amps/phase without indication of permanent damage. These variations largely stem from the diversity of design of the internal core and coil assemblies of large EHV transformers.

The vast majority of peer-reviewed literature on GIC-induced failures supports the Oak Ridge study finding that transformer failures from GIC are generally delayed. Moreover, other peer-reviewed research shows that levels of GIC far lower than 90 amps can cause transformer failure. Finally, as the Oak Ridge study explains at length, the principal problem with transformer failures in the aftermath of a geomagnetic disturbance is not that the failures will occur

"instantaneously" or "simultaneously," but that the failures will occur faster than replacement units can be manufactured and installed.

When confronted with peer-reviewed and published reports of previous power transformer damage and results of previous scientific studies, the action of NERC management has been to hold closed meetings and prevent disclosure of the results of these meetings to the majority of task force participants who do not work for electricity generators or transmission companies. (In fact, only representatives of electricity generators or transmission companies—so-called "Registered Entities"—are now designated as "members" of the GMD Task Force in the latest task force roster published on February 2, 2012.) Even more significantly, multiple task force participants have specifically asked that NERC request data from electric utilities on impacts of past geomagnetic disturbance events on power transformers, but these requests have been ignored or declined by NERC management.

Instead of investigating real-world transformer impacts due to geomagnetic disturbance, NERC management has promoted the scientifically unsound practice of convening a handpicked panel of purported transformer "experts" to meet in closed session and provide information to be used in preparation of the GMD Task Force Report. For your reference we present an attached PDF of correspondence between NERC management and task force observers on event investigations, wherein a NERC official stated:

> In any event, NERC is assessing the landscape of risks to the bulk power system, specific to solar storms. However, we do not complete this assessment by performing root-cause or event investigations. Rather industry engineering experts' review and vet information using engineering concepts to determine the state of potential vulnerabilities as well as develop recommendations and conclusions.

We know that a closed teleconference meeting of transformer "experts" was held sometime in January 2012. We know that a prepared list of questions was given to the "experts," but NERC management has declined to give us the list of questions. We would expect that the results of this meeting of "experts" have been incorporated into the final GMD Task Force Report.

We have great difficulty as observers in commenting on the final report of the GMD Task Force because this report has been kept secret from us. Based on the over 300 comments submitted by January 19, 2012 in response to a prior draft, and based on the fact that a closed meeting with transformer "experts" occurred after the date of the most recent draft provided to task force observers, we believe that the GMD Task Force Report presented to you for approval has been substantially revised from previous versions, including critically important conclusions and recommendations that have not been reviewed by the entire GMD Task Force.

In your review of the GMD Task Force Report we ask you to look for material misstatements and material omissions of fact, particularly if generalized assertions are made in the passive

voice and without reference, as we have seen in previous drafts. Material misstatements could include:

1. Any statement that a potential geomagnetic storm with intensity ten times the 1989 Hydro-Quebec disturbance has no supported scientific basis. In fact, there is recorded scientific data on storms in 1972, 1982, and 1989 with intensities approximately five times the intensity of the 1989 Hydro-Quebec disturbance. In fact, the government-sponsored Oak Ridge study estimated the intensity of a storm in 1921 as approximately ten times the 1989 Hydro-Quebec disturbance, based on real-world data of electric circuit potential collected at the time of the 1921 storm.
2. Any statement that the majority of power transformers are unlikely to overheat or otherwise sustain damage from geomagnetic disturbance, because only older transformers or transformers built before a certain year are vulnerable. In fact, there has been no inventory taken of the vintages of power transformers in service. In fact, there has been no comprehensive testing program of power transformers in service under Geomagnetically-Induced Current (GIC) conditions. In fact, there is no recognized standard for "GIC withstand" of power transformers.
3. Any statement that most power transformers are largely invulnerable to overheating because of results from a theoretical model of an idiosyncratic transformer design, especially when the model has not been published or peer-reviewed.
4. Any revisionist statements that power transformers suspected to have failed due to GIC, as described in peer-reviewed and published reports, are determined by "experts" to have instead failed due to other causes. In fact, such claims have not been substantiated.
5. Any statement that space weather and geomagnetic disturbance can be reliably forecast and these forecasts will likely prevent blackouts. In fact, forecasts of geomagnetic disturbance depend almost entirely on the Advanced Composition Explorer (ACE) satellite. The ACE satellite is past its planned operational life and there is no budgeted replacement. ACE satellite is a single point of failure and there is no backup or ready replacement.
6. Any statement that the electric grid can be made reliable during geomagnetic disturbance by employing so-called "operating procedures." In fact, "operating procedures" depend on geomagnetic disturbance forecasting. In fact, "operating procedures" have never been tested during extreme solar storm conditions. In fact, there is published and peer-reviewed evidence that GIC can arise so quickly that electric grid operators will not have time to react with effective "operating procedures." In fact, the premise of "operating procedures" is to reduce power generation, which could cause blackouts. In fact, there has been no published calculation of power reductions during "operating procedures" on reserve margins. In fact, the power reduction curves used in operating procedures have not been tested on the vast majority of power transformers in service and therefore there is no conclusive evidence that "operating procedures" would protect power transformers from damage.

7. Any statement that the GMD Task Force did significant study of the issue of reactive power consumption (so-called "VAR consumption") and associated voltage instability under geomagnetic disturbance conditions as a task force, with observers participating. Any statement that the GMD Task Force, as a group and with observers participating,

determined reactive power consumption and associated voltage instability is the most likely risk for the North American power grids. In fact, there was no chapter or separate treatment of reactive power consumption in the most recent January 9, 2012 draft report provided to the GMD Task Force, including observers.

8. Any statement that GMD Task Force, as a group and with observers participating, determined that rapid electric grid collapse caused by reactive power consumption and associated voltage instability would likely protect power transformers from permanent damage. In fact, the NERC Hydro Quebec GMD Event Report (1989) determined that "Among the major pieces of damaged equipment were two La Grande 4 generating station step-up transformers damaged by overvoltage when the network separated and a shunt reactor at Nemiscau that requires factory repair." In fact, NERC CEO Gerry Cauley testified at the Electric Infrastructure Security Summit on April 12, 2011: (1) "The rapid manifestation of the storm and impacts to the Québec power grid did not allow system operators sufficient time to fully assess the situation or to meaningfully intervene." (2) "Two large generator step-up transformers were damaged due to overvoltage condition." (3) "This storm proved that individual transformers may be damaged from overheating, which can result in long-term outages of key transformers in the network."
9. Any material misrepresentation of the findings of previous studies on geomagnetic disturbance, especially government-sponsored studies.

Material omissions of fact could include:

1. Any omission of evidence of the vulnerability of individual power transformers to GIC, when that evidence has been made known to the GMD Task Force, including peer-reviewed research, published articles, records of the Nuclear Regulatory Commission, investigative transcripts, and/or records of legal proceedings, and especially when the evidence concerns vulnerabilities for transformers of newer design or so-called "non-shell form" design.
2. Any omission of statistical evidence of the aggregate vulnerability of power transformers to GIC, when that evidence has been made known to the GMD Task Force, including a statistical study of claims performed by an insurance company.
3. Deletions of photographic evidence of damage to power transformers from GIC, when these photographs were contained in a previous draft of the GMD Task Force Report.
4. Any omission of information that transformer manufacturers have actively sold transformers that are purportedly resistant to GIC, because of the risk of GIC-induced blackout and/or GIC-induced damage to vulnerable transformers. In fact, manufacturers have sold transformers with assurances that their transformers are resistant to damage from GIC currents. In fact, in a 2006 press release, "ABB engineering protects power plant from solar storms," ABB disclosed that it sold a newly designed power transformer "immune to solar storms" to nuclear utility in Sweden to prevent future blackouts. The ABB press release further stated: "Solar flares unleash magnetic storms that hit the earth's magnetic field and create geomagnetic currents that can enter power lines and the neutral point of transformers. GICs frequently lead to severely damaged transformers and voltage collapse at a cost of millions of dollars per hour in lost revenues and damaged assets."

5. Any omission of information that electric utilities have spent millions of dollars replacing transformers vulnerable to GIC, before the transformers failed. In fact, multiple electric utilities have replaced power transformers before failure with units that are purportedly more resistant to GIC, although there is no recognized standard for GIC withstand. In fact, these transformer replacement programs have been discussed during GMD Task Force meetings.
6. Any omission of information that multiple nuclear power plants have regularly employed "operating procedures" to protect their transformers against geomagnetic disturbance and that power downratings during "operating procedures" have been up to 35%. Any omission of information on the effect of power downratings during solar storms on reserve margins.
7. Any omission of information that the Electric Power Research Institute (EPRI) has worked with electric utilities for 20 years to collect data on GIC as part of its "Sunburst" program. Any omission of the fact that the EPRI GIC data provided to the GMD Task Force was one graph of maximum GIC readings by year, without reference to the location of the readings.

Should the GMD Task Force Report be approved, and should it contain any material misstatements or material omissions of fact, NERC and its Board of Trustees should expect tremendous public scrutiny, not only for the contents of the report, but for the manner in which the report was prepared.

The disenfranchisement of GMD Task Force members who do not work for electric utilities, now classified as "participant observers," has had a real effect on the subject areas examined by the task force. As a result, there has been a lost opportunity to understand the economic impact of geomagnetic disturbance and the financial benefits of protection. EMPrimus, a vendor of protective equipment and task force "observer," had drafted a report chapter on the costs and financial benefits of hardware protection, but this work was not included in the most recent draft of the GMD Task Force report distributed on January 9, 2012. Moreover, economic data available from other studies was not included either. For example, the Oak Ridge National Laboratory study, previously referenced, found that "The cost of damage from the most extreme solar event has been estimated at $1 to $2 trillion with a recovery time of four to ten years, while the average yearly cost of installing equipment to mitigate an EMP event is estimated at less than 20 cents per year for the average residential customer." The JASONs report, previously referenced, found that "Mitigation should be undertaken as soon as possible to reduce the vulnerability of the U.S. grid. The cost appears modest compared to just the economic impact of a single storm, e.g. $8B in August 2003."

A description of potential operational cost savings due geomagnetic disturbance protection were not included in the most recent draft of the GMD Task Force report distributed on January 9, 2012. These cost savings could result from fewer and less severe power downratings resulting in increased generation revenue during geomagnetic disturbances, higher capacity utilization, and

less reactive power consumption and associated transmission "uplift costs" during VAR-related congestion.

The risk of widespread and long-term blackout due to geomagnetic disturbance is fundamentally different than most issues addressed by NERC such as vegetation management, relay misoperations, and frequency response. These day-to-day issues, while important, are unlikely to cause blackouts extending beyond a few hours or days. Because geomagnetic disturbance has the potential to damage hard-to-replace equipment such as power transformers and generators, and because loss of life from months-long or years-long blackouts could be extraordinary, adherence to procedural requirements set forth for NERC by Congress—including independence from owners and operators of the bulk-power system and balanced decision-making— is especially important.

While there has much attention to the 1-in-100 year probability of a extreme solar storm and resulting geomagnetic disturbance—a so-called Carrington Event—there has been much less attention to the much higher probability of a smaller event that nonetheless will cause a significant blackout. A major blackout due to geomagnetic disturbance occurred during Solar Cycle 22 in Canada and another major blackout occurred during Solar Cycle 23 in Sweden.

Since the end of Solar Cycle 23 in December 2008 the electric grid is in a more precarious state; reserve margins are low, non-dispatchable renewable power has been placed on the grid, and the transformer fleet is older and more vulnerable to geomagnetic disturbance. A significant blackout due to geomagnetic disturbance in the upcoming solar cycle is by no means a low-probability or theoretical event. Should any significant blackout occur due to geomagnetic disturbance during the upcoming solar cycle, a formal investigation of the conduct of NERC in regard to geomagnetic disturbance protection is a near certainty—especially because NERC has studied geomagnetic disturbance effects for over 20 years without setting a regulatory standard on geomagnetic disturbance.

We, as members of the public and observers of the GMD Task Force, call on you to exercise your legal responsibilities as an independent board and decline to approve the report of the GMD Task Force in its current state. We ask you to direct NERC to perform a real investigation of the effects and risks of geomagnetic disturbance by reforming the GMD Task Force and making a data request to electric utilities.

The results of any data collected by NERC on geomagnetic disturbance should not be held in a data clearinghouse as "confidential information" or withheld from the public under the pretense of the data being of "Critical Energy Infrastructure Information" under FERC regulations. Already, the results of a scenario prepared by a consultant to NERC, showing which power transformer locations would be most vulnerable to geomagnetic disturbance, has been withheld from the GMD Task Force under the pretense that this data is "Critical Energy Infrastructure Information." This is akin to saying that information regarding which nuclear power plants lay

on earthquake fault lines is "Critical Energy Infrastructure Information"; in any case, concealment of information is no protection against naturally occurring phenomena such as earthquakes or solar storms.

We urge the NERC Board of Trustees to take great caution in reviewing the GMD Task Force Report and to take the opportunity to closely question NERC officials during the scheduled February 23, 2012 meeting. Were the Trustees to approve and release a report that propounds key elements of the false narrative described above, and that deliberately omits key evidence, through a secret process inconsistent with the requirements of 16 U.S.C. § 215, we could only conclude that NERC would have knowingly and willfully made materially false statements to FERC Commissioners charged with electric reliability oversight, and to the Congress of the United States, and to the American and Canadian public.

If NERC officials were to knowingly and willfully transmit to federal officials a document with materially false statements or representations, which could constitute a felony per 18 U.S.C. § 1001, we will have no alternative but to call for a Congressional investigation of both the persistent breaches of due process and the junk science born of secrecy. If requested by members of Congress, we would then offer our personal testimony to the improper procedures that excluded pertinent evidence and in secrecy conveyed materially false misrepresentations. The NERC Board of Trustees has a fiduciary duty to set reliability standards and protect the American and Canadian public from long-term and widespread blackout. We call on you to perform your duty.

Sincerely (by electronic concurrence),

Dr. Peter Vincent Pry
Executive Director
Task Force on National and Homeland Security
U.S. House of Representatives

Dr. George H. Baker
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Director, Foundation for Resilient Societies
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Attachments:

1. Title 16 United States Code § 215

2. Correspondence on Event Investigation of GIC Impacts to Transformers

Title 16 United States Code§ 215

__SEC. 215. ELECTRIC RELIABILITY...

__(b) JURISDICTION AND APPLICABILITY.—(1) The Commission shall have jurisdiction, within the United States, over the ERO certified by the Commission under subsection (c), any regional entities, and all users, owners and operators of the bulk-power system, including but not limited to the entities described in section 201(f), for purposes of approving reliability standards established under this section and enforcing compliance with this section. All users, owners and operators of the bulk-power system shall comply with reliability standards that take effect under this section.

__(2) The Commission shall issue a final rule to implement the requirements of this section not later than 180 days after the date of enactment of this section.

__(c) CERTIFICATION.—Following the issuance of a Commission rule under subsection (b)(2), any person may submit an application to the Commission for certification as the Electric Reliability Organization. The Commission may certify one such ERO if the Commission determines that such ERO—

__(1) has the ability to develop and enforce, subject to subsection (e)(2), reliability standards that provide for an adequate level of reliability of the bulk-power system; and

__(2) has established rules that—

__(A) assure its independence of the users and owners and operators of the bulk-power system, while assuring fair stakeholder representation in the selection of its directors and balanced decisionmaking in any ERO committee or subordinate organizational structure;

__(B) allocate equitably reasonable dues, fees, and other charges among end users for all activities under this section;

__(C) provide fair and impartial procedures for enforcement of reliability standards through the imposition of penalties in accordance with subsection (e) (including limitations on activities, functions, or operations, or other appropriate sanctions);

__(D) provide for reasonable notice and opportunity for public comment, due process, openness, and balance of interests in developing reliability standards and otherwise exercising its duties; and

__(E) provide for taking, after certification, appropriate steps to gain recognition in Canada and Mexico.

Rulemaking Comments

From: Gallagher, Carol
Sent: Wednesday, June 13, 2012 3:46 PM
To: Rulemaking Comments
Subject: Comment on Proposed Rule - Onsite Emergency Response Capabilities
Attachments: NRC-2012-0031-DRAFT-0009.pdf

Attached for docketing is a comment from William R. Harris on the above noted proposed rule (77 FR 23161; April 18, 2012) that I received via the regulations.gov website on June 13, 2012.

Thanks,
Carol