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February 11, 2016

Mr. Victor M. McCree
Executive Director for Operations
Nuclear Regulatory Commission

Ms. Annette L. Vietti-Cook
Secretary
Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Subject: Comments of the Foundation for Resilient Societies, Inc. on "Mitigation Strategies for Beyond-Design-Basis Events," NRC Docket No. NRC-2014-0240, 80 FR 70609.

Dear Mr. McCree and Ms. Vietti-Cook:

Attached please find our comments in regard to NRC Docket No. NRC-2014-0240.

Respectfully submitted by:

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Comments of the
Foundation for Resilient Societies, Inc. on
Mitigation Strategies for Beyond-Design-Basis Events

NRC Docket No. NRC-2014-0240,
80 FR 70609

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Background on Foundation for Resilient Societies

The Foundation for Resilient Societies, Inc. is a 501(c)(3) non-profit organization engaged in research and education for the purpose of enhancing the resilience of critical infrastructures in the United States and internationally. One of our goals is to identify cost-effective measures to strengthen the availability and reliability of baseload electric generation, including nuclear electric generation.

Before our incorporation in the State of New Hampshire in March 2012, our first initiative was to petition the Nuclear Regulatory Commission (NRC) seeking, in February 2011 (before the tsunami and accidents at Fukushima Dai-ichi in March 2011) to engage in rule-making to provide long-term unattended cooling for spent fuel pools at commercial licensee facilities. In PRM 50-96 we submitted a probabilistic risk assessment (PRA-III) model indicating the cost-effectiveness of more robust backup power to protect local spent fuel storage in the event commercial grid outage due to severe solar geomagnetic disturbance. The Commission accepted PRM-50-96 for rulemaking in December 2012, and has, in conjunction with the Near Term Task Force lessons learned, supported both the industry-sponsored FLEX program and initiatives by nuclear power plant owners to extend on-site power capabilities to cope with various hazards. We commend the Commission and its staff for these post-Fukushima initiatives, including the requirement for spent fuel facility instrumentation that will enable remote assessment of capabilities to protect spent fuel assemblies and facilities at licensee controlled sites.

We also support the more robust, integrated response capabilities for command and control, enhanced onsite emergency response capabilities, and the ongoing deployment of regional spare equipment, including high voltage transformers, at two (later three) regional facilities, together with mutual assistance agreements among electric utility owner-operators and among mutual assurance regions.

An All-Hazards Framework for Risk Management & Mitigation

Resilient Societies urges the NRC, and specifically its Office of Nuclear Reactor Regulation, to adopt an "all hazards" framework for risk assessment and for prioritization of mitigation initiatives. Why is an "all hazards" framework beneficial?

We start with the premise that the reliable availability of electricity is not only one of society's critical infrastructures but the specific critical infrastructure upon which all others depend. We do not discount the benefits of reducing global warming, for which nuclear electric power is beneficial, but our primary concern is the protection and enhancement of electric grid reliability.

The Northeast blackout of August 14, 2003, affected as many as 50 million people, for as long as four days in the United States and more than a week in parts of Canada, cost between $4 and $10 billion dollars.[1] In the aftermath of that outage, which involved cyber impacts upon diminished control center visibility, and non-implementation of industry (NERC) guidelines, causing needless cascading of the outage, a consensus developed that mandatory reliability standards were essential. The U.S. Energy Policy Act of 2005, now Section 215 of the Federal Power Act, created a system to develop, implement, and enforce mandatory reliability standards.

As participants in the "reliability standard" development process at the Federal Energy Regulatory Commission (FERC) over the past four years, we observe a shared consensus that the overall reliability of the North American electric grid is become *more reliable* relative to the frequency of localized, short-term electric outages, but *less reliable* in insuring against catastrophic, widespread, and extended blackouts. Why is this apparent to a wide array of participants in the reliability mitigation process?

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[1] See U.S.-Canada Power System Outage Task Force, Final Report on the August 14, 2003 Blackout in the United States and Canada, April 2004, at p. 1.

First, the development of geographically broader electric markets, while a source of efficiency and cost containment, creates greater dependency upon long distance transmission. Second, the secular decline in coal as the predominant source of electric generation results in greater dependency upon just-in-time fuel deliveries, particularly via interstate gas pipelines – which are not subject to "reliability" regulation.[2] Third, the increased utilization of wind power, and to a lesser extent solar photovoltaic power, reduces the share of electric generation that can be reliably dispatched. Fourth, global trends indicate that critical infrastructure, and especially electric infrastructure, are increasingly the target of both non-state and state acts of terrorism or sabotage, and cyber infiltration and potential for cyber-attack.[3]

Hydroelectric power can be a reliable but limited source of baseload power. But without nuclear power, which produces 18% to 19% of electric generation in the United States, our electric grid will be at risk of prolonged loss of reliable baseload electric power. In New England, where Resilient Societies is based, we anticipate loss of all five large coal-fired electric generators, plus the recent retirement of Vermont Yankee, and anticipated early retirement of Pilgrim Nuclear Power Station. To provide reliability for electric dispatch, and to enable greater reliance on renewables, we urge the Commission to strengthen nuclear electric reliability by balanced investments against "all hazards" to the nuclear electric infrastructure.

The NRC Staff Assessment of the National SAFER Response Centers[4] established in response to NRC Order EA-12-049[5] analyzes the Guidance of the Nuclear Energy Institute in NEI 12-06. This Beyond Design Basis scope of mitigation is applicable to five enumerated "external hazards" from five classes of events:

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[2] The U.S. Department of Transportation regulates gas pipeline safety but not pipeline reliability. The Natural Gas Act does not provide FERC or other federal regulators authority to enhance gas pipeline reliability. Each year, approximately one percent of compressors utilized by gas pipeline operators are converted from gas to electric. A Southwestern blackout in the winter of 2010-2011 demonstrated the compounding of outages and delayed recovery due to loss of gas pipeline pressure when electrify became unavailable for compression.

[3] The electric grid in Yemen was attacked and blacked out in year 2013. The Israeli transmission system was subjected to international denial of service attack in June 2014; and eight regional electric utilities in the Ukraine experienced takeover of control centers and blackouts on December 23, 2015. Earlier this month President Obama announced a National Cyber Strategic Plan and support for cyber protection legislation.

[4] See ADAMS ML14259A223

[5] NRC Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," ADAMS ML12054A736, March 12, 2012.

(1) Seismic Impact (all sites);
(2) External Flooding;
(3) Severe Storms with High Winds (Hurricanes, Tornados, etc.);
(4) Snow, Ice and extreme Cold Temperatures; and
(5) Extreme High Temperatures.[6]

Resilient Societies observes that the limitation of the scope of mitigation to these five hazards leaves largely without mitigation, and surely without adequate mitigation, three hazards that could place the North American electric grid, or major regions of it at significant risk of extended electric blackout. These hazards are: ***severe solar geomagnetic disturbances***, which scientists now estimate at a frequency of 10% to 12% per decade; ***high altitude electromagnetic pulse attack***, which being an event that depends upon human intent has unknown probability that may depend upon the scope of preemptive mitigation; and ***cyber-attack*** by nation states or sub-national antagonists.

These hazards have the common characteristic of posing the threat of prolonged and widespread electric grid outages. As the Commission's "lessons learned" findings indicate, prolonged regional electric grid outages can result in extraordinary losses of life and property, and great expenses to the future economy.

We urge the Commission to include these three hazards in the scope of "Beyond Design-Basis Event" assessment and mitigation, partly to assure that the licensee power plants remain safe, but also to protect the future viability of nuclear electric power as an essential component of baseload electric generation.

In FERC Order No. 779 (May 2013), the Federal Energy Regulatory Commission (FERC) required assessment and mitigation against solar geomagnetic disturbances without concurrently assessing risks and mitigation options for man-made electromagnetic pulse attack.[7]

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[6] See White Paper, National SAFER Response Centers," ML14259A223

[7] However, on November 25, 2015 President Barack Obama signed the Defense Authorization Act for FY2016, wherein Section 1089 requires assessment of both man-made EMP attack and natural occurring geomagnetic disturbance (GMD) hazards and mitigation, with a report to the Congress due in June 2017. Other legislation that

Some of the same mitigation equipment protects against both hazards: neutral ground blocking equipment reduces electromagnetic pulses carried by long transmission lines, whether originating form solar storms or from man-made EMP attack. If the benchmark model proposed by the North American Electric Reliability Corporation (NERC) and so far accepted in a Notice of Proposed Rulemaking by FERC is adopted, almost no electric generating facilities will be required to utilize hardware to protect against severe solar storms. This would make it impossible to concurrently protect extensively against man-made EMP attacks, because mere purchase of E-1 surge protectors (for the fast-rise nuclear voltage spikes) would leave the same high voltage transformers at risk of damage or destruction via the slower E-3 pulses.

Similarly, the hardening of control centers from EMP hazards requires checking and assessing cable penetrations into control centers, which is concurrently an element of cyber protection.

We urge the Commission to adopt "all hazards" scope of review. Without that full scope, we find that specific licensing requirements could address relatively low probability hazards, while failing to address and mitigate the higher risks of a severe solar geomagnetic disturbance. Without full scope assessment and mitigation for all hazards, the Commission may inadvertently undermine the public acceptability of nuclear electric power. We would regret that outcome, which could lead to greater dependence upon just-in-time fuel delivery to electric generating facilities and an overall increase in risks of sustained electric blackouts.

Moreover, to engage in an "all hazards" assessment the Commission should further modify the "Enemy of the State" Rule (1967), as the Commission has earlier done to require protections against terrorism and strengthening of cyber security.

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passed the House of Representatives on December 4, 2015 is pending before the U.S. Senate, and would also require concurrent assessment of natural occurring and man-made EMP hazards.

Black Starting: Hydro to Nuclear, Nuclear-to-Nuclear, and Nuclear-to-Fossil Generating Facilities

We encourage safety and reliability programs that encourage joint retrofitting initiatives or future design initiatives that utilize an "all hazards" framework. The Commission's "Beyond Design-Basis-Events Rulemaking" provides an opportunity for the Commission to consider potentially beneficial retrofit requirements and future redesign of nuclear power facilities to enable these facilities to "black start" other electric generation facilities during extensive electric blackouts.

We are the only non-industry organization that routinely files in "electric reliability" dockets of the Federal Energy Regulatory Commission (FERC). Many of our filings are available on our website, found at www.resilientsocieties.org. We have ongoing concerns that the regulatory procedures by which FERC must depend upon industry-initiated reliability standard proposals, per Section 215 of the Federal Power Act, has the effect of impairing the reliability of outside power upon which commercial nuclear power plants depend.

Comments in Regard to Changes to 10 CFR Parts 50 and 52

NRC proposes that changes to 10 CFR Parts 50 and 52 will address, in part, issues brought forth in rulemaking for PRM-50-96. We dispute this interpretation. Proposed changes to 10 CFR Parts 50 and 52 allow provision of offsite resources to address Beyond Design Basis Events. In contrast, the fundamental premise of PRM-50-96 is that a severe geomagnetic disturbance could cause such widespread disruption to normal societal processes that no outside resources would be available to licensees.

In PRM-50-96 we propose that mitigation measures for spent fuel pools to operate in <u>unattended mode</u> for a period of time sufficient for the rods to cool down and therefore not result in spent fuel pool fires were the pools to boil off. This is not the equivalent of using "reasonable" measures to provide assistance from offsite resources as proposed in the current rulemaking docket. Accordingly, we respectfully request that the NRC continue to address PRM-50-96 as a separate rulemaking.

Other Comments

Solar geomagnetic storms: beyond design-basis events that NRC should assess for cost-effective safety retrofits.

The record of FERC Docket RM15-11-000, which concerns standards to mitigate solar geomagnetic storm damage to long lead-time grid equipment, indicates that FERC has allowed the industry standard-setting body (NERC) to protect against solar storms of magnitude well below the magnitude of a 1 in 100-year storm. The proposed NERC standard also benchmarks transformer failure thresholds at 75 amps per phase, when the evidence is more consistent with need for protection of transformers at 15 amps per phase. We estimate that the NERC model, with biases in model components that are multiplicative, has the effect of underestimating solar geomagnetic storms by a factor of 12X to 15X, and with a prudent margin of safety, by a factor of 18X to 22X.[8] Under this flawed model and flawed standard, almost none of the Generator Step Up (GSU) transformers at U.S. nuclear power plants will be subject to mandatory protection.

There is some evidence that stators vibrate and overheat during solar storms, and that generator turbines are at risk of damage. As a result, NRC licensed commercial power plants could be at risk of extended loss of AC power (ELAC) for months or years in the aftermath of a severe solar geomagnetic storm. Various NASA and U.S. Department of Energy (DOE) scientists now agree that a geomagnetic disturbance (GMD) of the magnitude of the New York Central Railroad storm of May 1921, or of the Carrington Event of August-September 1859 has a probability of occurrence in the range of 10-12 percent per decade. Over the next half century, it is more likely than not that the earth will experience a severe solar geomagnetic disturbance,

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[8] See Foundation for Resilient Societies, Solar Geomagnetic Storm Mitigation Standards, comments submitted to FERC July 27, 2015, as corrected August 10, 2015 in FERC Docket RM15-11-000. See also, Foundation for Resilient Societies, Comments Relating to DOE-Released Los Alamos Report on NERC Reliability Standard TPL-007-1, Oct. 22, 2015, in FERC Docket RM15-11-000.

while increasing dependence upon semiconductor chips and higher voltage transmission systems make the electric grid more vulnerable.

A solar geomagnetic disturbance that destroys a significant share of large power transformers is not a low probability event; it is a contingency for which this Commission should require preparations as one of the most likely “Beyond Design Basis Events” for which mitigation measures have not as yet been required.

The Commission can benefit from the October 28, 2015 White House Space Weather Strategy and Space Weather Action Plan, and follow-up implementation by various federal departments and agencies.

An NRC engineer testified at an April 30, 2012 FERC Technical Conference on proposed standards for “operating procedures” to protect critical grid equipment during solar storms.[9]

The essence of the testimony was that the Nuclear Regulatory Commission would order the shutdown (“scram” of the power reactor) for any NRC-licensed commercial power plant at risk of experiencing a severe solar geomagnetic disturbance. The same considerations applied to a severe earthquake or a hurricane, with safe shutdown being the primary goal.

The record of solar geomagnetic events since the Carrington events of 1859 indicates that a Poisson probabilistic frequency distribution provides a best fit. Accordingly, there is a far greater frequency of moderate level solar geomagnetic disturbances than the frequency of severe solar geomagnetic disturbances. If near-real time monitoring of solar storms and their impacts on vulnerable transformers is feasible, at a low price, then safety can be enhanced while protecting operator-owner revenues.

We request that the Commission, as part of its “Beyond Design-Basis Event” assessment, consider a retrofit Order requiring that all commercial nuclear power plant licensees install *geomagnetic induced current* (GIC) monitors at the neutral of Generator Step Up (GSU)

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[9] See FERC Docket AD12-13-000, transcript of Technical Conference, Washington, D.C. April 30, 2012.

transformers of nuclear power plants. The cost per GIC monitor at a transformer has dropped by more than one order of magnitude. Current GIC monitors cost about $15,000 per unit, and include the capability to set at least three thresholds of alarm, to record GIC levels at the transformer neutral, to measure vibrations of the transformer, to measure dissolved gases associated with overheated transformer coolants, and to measure transformer thermal hotspots.

Additionally, associated password-protected SCADA devices can be programmed to transmit near-real-time GIC data to the utility control centers, to the regional Reliability Coordinator, and to the NRC Operations Center. Consideration should also be given to use of hardened SCADA systems, so that in a solar storm or EMP attack, these devices do not fail. Avoiding just a one-day shutdown of a nuclear power plant, at an estimated revenue loss of roughly $600,000 per day, can be averted through purchase of a monitoring device that costs just $15,000 per GSU transformer. [10]

This GIC monitoring equipment is cost-effective, if only by avoiding NRC -ordered power plant shutdowns during just moderate level solar storms; but without GIC monitoring, the Commission might order shutdowns that are otherwise unnecessary. Moreover, the availability of a multi-sensor GIC monitor at every GSU transformer for nuclear power plants can enable an understanding of whether each particular high voltage transformer is a candidate for neutral ground blocking or other protective hardware purchase. There would be safety benefits, through avoidance of unnecessary “scram” events; and indirectly, safety benefits from the election to replace a damaged transformer before a transformer explosion in one or more subsequent solar storm as a result of cumulative geomagnetic disturbance -caused degradation.[11]

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[10] Hardened SCADA systems are under development for DoD facilities. Ultimately, costs for commercial, hardened SCADA systems should decrease, just as GIC monitoring prices have decreased.

[11] At Maine Yankee, for example, where the GSU transformer was not equipped with GIC monitoring, damage to the GSU transformer in the 12-13 March 1989 solar storm led management to expedite purchase of a parallel, backup 345 kV GSU transformer within the following two weeks. NRC needed more time to approve the purchase as of 27 March 1989. Without GIC monitoring of its degradation at a coastal Maine site, the first Maine Yankee GSU transformer caught fire and exploded in April 1991 during a minor solar storm. The parallel GSU transformer, then on-site, was available to take over promptly. Thereafter, both of the on-site GSU transformers were replaced

The proposed FERC hardware protection standard (with a rulemaking due imminently) in FERC Docket RM15-11-000 does not mandate the use of GIC monitors. It does not mandate sharing of GIC data where such data could assist the Reliability Coordinator in the region, or the NRC Operations Center. And the earlier requirements for "operating procedures" excludes mitigation responsibilities for generator operators on the dubious grounds that they might not have "visibility" of a geomagnetic disturbance in their area of operations, so they should not be responsible for participating in operational mitigation measures.[12]

The Nuclear Regulatory Commission should assess solar GMD events as a threat to extended loss of AC power, so-called ELAP conditions. But the Commission could encourage retrofits so that nuclear power plants could operate through solar GMD events. This could reduce the risks of Loss of Offsite Power (LOOP), Loss of extended or cascading outages in a region, since nuclear power is a contributor to stability of baseload electric grid operations.[13]

With relatively modest retrofit costs, NRC licensee power plants could be modified so they can "operate through" solar geomagnetic storms. One Minnesota company offers neutral ground blocking devices that have been third-party tested and verified by DOE's Idaho National Laboratory. The cost is about $400,000 per neutral blocking device, plus transportation costs.[14]

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with new GSU transformers at a coastal site that lacked GIC monitors or protective equipment. There was needless expense in managing and purchasing four GSU transformers, when just one was needed; and ultimately a loss of public trust that resulted in premature shutdown of the entire Wiscasset, Maine power plant. GIC monitors are cost-effective, a money saver, and a benefit to plant safety, both avoiding needless scram events at nuclear power plants and extending expected life of transformers and possibly stators and generators.

[12] Resilient Societies collected data indicating that at least 102 GIC monitors were deployed in the U.S. as of mid-year 2014, with 69 to 70 percent of those identified deployed at GSU transformers managed by generator operators. FERC concluded that our data was untimely filed, and continues to exclude generator operators from FERC-mandated "operating procedure" duties in solar geomagnetic disturbance events. FERC defers to NRC as to NRC determination to mitigate solar GMD events or to require NRC-licensees to protect long replacement time equipment from GMD effects, or to require GIC monitor installation and reporting.

[13] G.H. Baker, Nuclear Power as a Major Resource to Prevent Long-Term Outage of the National Power Grid, *Blackout Wars*, pp 185-192, 2015

[14] Costs were earlier quoted at $250,000 to $300,000 per neutral blocking device. A later model is now priced at $400,000 per unit, with possible protection of more than one GSU transformer per blocking device. This device includes protection from long line (E-3) pulses, and it contains protection from fast rise-time or E-1 pulses that might damage the blocking devices themselves. However, this equipment does not protect against E-1 (fast rise-time) pulses that can damage the associated transformer in a man-made electromagnetic pulse (EMP) event.

American Transmission Company in Wisconsin has successfully beta-tested a prototype neutral blocker in their commercial grid since February 2015.

Potential retrofit of NRC licensee power plants could enable at reasonable costs survival and recovery following both severe solar storms and high altitude EMP (HEMP) attack.

Following Cuba's veto of on-site inspections after the Cuban missile crisis of 1962, concerns arose that nuclear power plants in Florida would be at risk of missiles that might be fired from Cuba. This caused the Atomic Energy Commission (now the NRC) to promulgate the "Enemy of the State" doctrine.[15] This doctrine exempts nuclear power plant owner-operators from responsibility to defend their facilities from threats that are responsibilities of the United States government.

The Enemy of the State Doctrine has been modified to require some protective measures against terrorists or cyber threat actors. In its present form, however, with the proliferation of nuclear weapons and public understanding of vulnerabilities to HEMP attack, the Enemy of the State Doctrine invites attacks designed to blackout electric grids, and turn nuclear power plants into Fukushima-class radioactive fallout sources.[16]

Should an ability to "operate through" or to recover from a High Altitude Electromagnetic Pulse, a so-called HEMP attack, be a responsibility of nuclear power plant operators in an era of *asymmetrical warfare*?

The world has witnessed an attack on the electric grid of Yemen in 2013; a less than successful denial of service attack on the Israeli electric grid in June 2014; and a temporarily successful attack that shut down eight regional electric utilities in the Ukraine by foreign cyber attackers on 23 December 2015.

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[15] 32 FR 13455, September 26, 1967, upheld in *Siegel v. AEC*, 400 F. 2d 778 (D.C. Cir. 1968). The current rule is found at Title 10 CFR § 50.13.

[16] The Enemy of the State Doctrine, found at 10 CFR, section 50.13,provides: "An applicant for a license to construct and operate… or for an amendment to such license, is not required to provide for design features or other measures for the specific purpose of protection against the effects of (a) attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government or other person, or (b) use or deployment of weapons incident to U.S. defense activities."

What can be done to enhance deterrence of attacks on critical infrastructure, of which the electric grid is a prime target? It should not be necessary to protect the entire electric grid of North America to enhance deterrence of high altitude EMP (HEMP) attack. One study estimates that protection of 20 percent of the electric grid could enable recovery of about 60 percent of the economy. What is the minimal level of protection needed to deter attack? And how much would that effort cost.[17]

How much would it cost to protect a commercial nuclear power plant from a High Altitude Electromagnetic Pulse (HEMP) device? A firm in Newtown, Connecticut, which operates EMP test laboratories, estimates that the cost to protect a high voltage commercial generating facility would be about $250,000, largely irrespective of generating capacity; and the cost to protect (against E-1 and E-3) for a Step Up Transformer would be about 10 percent of the transformer cost, roughly an additional $300,000 to $600,000, depending upon the specific transformer.[18] The same protections would also be afforded from severe solar geomagnetic storms.

Some nuclear generating facilities have been partially tested for their electronic equipment's immunity against electromagnetic interference. The primary purpose of the testing was to assure safe shutdown of the nuclear reactor. There appears to be substantial, but incomplete E-1 EMP protection of nuclear power plants due to the attenuation of EMP fields by facility walls.[19] However, EMP transients penetrating the facility on incoming cabling remain a significant problem.

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[17] The Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack: Critical National Infrastructures, April 2008 found at: http://www.empcommission.org/reports.php, estimated the costs to protect about 2,000 transformers would cost about $2 billion in year 2007 dollars. Additional protection, without specific costs, plus inflation, suggest that Commission's cost projections amount to about $5 billion in year 2015 dollars. More recently, the Foundation for Resilient Societies has estimated costs to protect against both solar geomagnetic storms and man-made EMP attack in a range from about $10 billion to about $30 billion in year 2015 dollars. See Foundation for Resilient Societies, EMP and GMD Cost Estimate, Rev. 18 (2015).

[18] Personal Communication, Curtis Birnbach to William R. Harris, December 2015.

[19] See David M. Ericson, Jr., et al, Electromagnetic Pulse Effects on Commercial Nuclear Power Plant Systems SAND82-0660C, which involved field testing of Watts Bar 1 and 6 other nuclear power plants for E-1 but not long line E-3 effects.

Resilient Societies proposes that as a “Beyond Design-Basis Event” Category, the Nuclear Regulatory Commission develop, in cooperation with industry and the national laboratories, criteria for (1) “operate through” capabilities for solar storms, and (2) “prompt recovery” capabilities of nuclear power plants, after high altitude electromagnetic pulse events, including protection of “black start” cranking paths from designated black start plants (usually hydroelectric or internal combustion-driven generators) to nuclear power plants.

The goal would be to develop standards for “demonstration projects” whereby some combination of hydroelectric generators and nuclear generators, and possibly pumped storage hydroelectric facilities would be protected.

This is not a proposal to *mandate* EMP protection for NRC licensed nuclear power plants. It is a proposal to develop design and safety criteria for *demonstration programs* that might enable existing and future nuclear power plants to operate through solar geomagnetic storms and to limit damage from man-made EMP attack, and to recover after either a severe solar geomagnetic storm or a high altitude electromagnetic pulse event occurs.