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Comment:	AS INDICATED BY THE TESTIMONY OF JULY 22, 2015 BEFORE THE SENATE HOMELAND SECURITY COMMITTEE, THE RISKS AND POTEN NEED TO RESPOND TO TRANSFORMER THREATS ARE REAL, AND SOL

ARE REQUIRED. Testimony of Joseph McClelland In order to better understand and quantify the effect of EMP and GMD on the power grid, FERC staff, the Department of Energy and the Department of Homeland Security sponsored a study conducted by the Oak Ridge National Laboratory in 2010. The results of the study support the general conclusion of prior studies that EMP and GMD events pose substantial risk to equipment and operation of the Nation's electric grid and under extreme conditions could result in major long-term electrical outages. Testimony of Richard Garwin Missing in Federal policy and practice is a program to 1. train and equip utility and transmission operators to bring down within seconds (switch off) transmission lines that are at risk of being damaged. 2. implement "rapid islanding" of the grid, to maintain a large fraction of the power consumers in operation by the use of whatever island generation capacity exists; this also facilitates restoring the Bulk Power System to operation, in contrast with a "black start." 3. fit transmission lines on a priority basis with "neutral current blocking devices" (capacitors) in the common neutral-to-ground link of the 3-phase transformers of EHV transmission systems at one end of the line-- whether 3-phase transformers or 3 single- phase transformers. Where transformers at both ends are autotransformers this may not be possible, in which case series-blocking capacitors in the power lines themselves should be installed (even if shorted until an EMP event is recognized). 4. alert grid operators and others to a high-altitude nuclear explosion within milliseconds of the event (by detection of the unambiguous very brief E1pronounced "Ee-one"-- pulse). NY Times MAR 14, 2012 discussed a test of transformer replacement-found that transport of heavy transformers was difficult, installation was delayed, and using smaller, variable voltage transformers could enhance ability to respond to transformer grid issues. Using a different transformer for each phase allowed shrinking the weight of the transformer from about 400,000 pounds for a single one to roughly 125,000 pounds for each of the three-phase units. In operation, the transformers are oil-filled, but in this case, the oil was shipped in tanker trucks in the convoy, to decrease weight. With three transformers, three crews can work simultaneously to set them up, and setting up a small transformer is faster than setting up a big one.In addition, installing a transformer usually requires pouring a concrete foundation, but one of these transformers was mounted on skids, eliminating that need.. Even with all these shortcuts, there were speed bumps. One is that utility executives think a stockpile is a good idea, but nobody is quite sure what to stockpile, or where. The industry rule of thumb is that for every 13 transformers in the field, there are 10 designs. And the initial model that they will stockpile will only work as a replacement for about 500 of the 2,100 transformers in the system. The next step will be a transformer unlike almost any in the field, that can be configured to work between more than two different voltages say, operating not just between 138 kilovolts and 345 kilovolts, but also between 115 kilovolts and 345 kilovolts. That would cover a few hundred more. WHAT IS NEEDED IS: 1. A DEFENSE IN DEPTH OF THE GRID AND TRANSFORMER SYSTEM 2. REA TIME RESPONSE AND SHUT DOWN AS RECOMMENDED BY RICHARD 3. A PLAN FOR TRANSFORMER REPLACEMENT AND SUBSTITUTION,

	POTENTIALLY USING SMALLER, MULTI-VOLTAGE COMPONENTS. INFORMATION ABOUT EXISTING TRANSFORMERS, INVENTORY OF REPLACEMENTS AVAILABLE, AND CONTINGENCY PLANS IS A START DEALING WITH AND MITIGATING THIS RISK, WITH AN OBJECTIVE OF HAVING AN EFFECTIVE RISK MANAGEMENT PLAN IN PLACE WITHIN YEARS, OR BY 2025. *
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