Pilgrim Nuclear Power Plant (PNPP): Safety and Severe Solar Storm Issues

HG Brack, Department of Environmental History, Davistown Museum, www.davistownmuseum.org

Figure 1

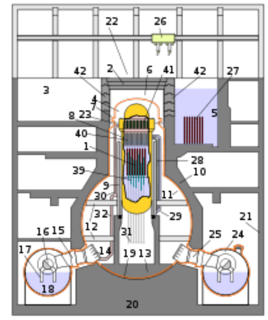

Figure 2

A public information update is urgently needed about the probable impact of a severe solar storm on our now highly interconnected power grid, including its impact on the continued safe operation of the Pilgrim Nuclear Power Plant (PNPP). One of many safety issues at PNPP is the unfortunate juxtaposition of the spent fuel pool slightly above and alongside the reactor containment vessel (see 27 in Figure 2). The Pilgrim plant shares the same General Electric Mark I design as the Fukushima Daiichi reactors (Figure 1), where a series of core meltdowns spread to the similarly placed spent fuel pools. At Fukushima Daiichi, 4,368 fuel assemblies were involved in the multiple interlocking meltdown events (MIME), which involved three reactor vessels containing 1,496 fuel assemblies and 4 spent fuel pools containing 2,872 fuel assemblies (Brack 2011). There are 3,279 fuel assemblies in the Pilgrim spent fuel pool, each containing at least 10,000 curies (ci) of radiocesium. The Chernobyl accident involved 400 fuel assemblies and resulted in the disbursement of 2,700,000 ci of radiocesium (Aarkrog 1994; Borovoi 1995), approximately 65% of its inventory. In the case of a major accident at Plymouth, emissions will impact millions of New England residents, in contrast to the accident at Fukushima Daiichi, where prevailing winds transmitted most emissions over the open ocean (Figure 3) (Brack 2011). The low cost but accident-prone design of General Electric's vulnerable Mark I reactor, in contrast to the more robust design of a pressurized water reactor (PWR) e.g. Seabrook, NH, gives a whole new meaning to the term "sub-prime real estate".

Figure 3. Tokyo had the luck of the Irish

Of special interest with respect to the safety of PNPP is the probable impact of a severe solar storm derived from a coronal mass ejection (CME). Such a black swan event (Taleb 2010) would result in a geomagnetic induced current (GIC) triggering destructive voltage surges in America's highly interconnected power grid. The largest GIC event in American history occurred between August 27th and September 7th, 1859 (Figure 4). Recently released reports explore the possibility of a total electric grid failure (JASON 2011; Royal Academy of Engineering 2013; Marusek 2007; etc.) A worst case scenario discusses the probable destruction of ±700 major transformers with a rebuilding time for the electric power grid of 2 to 10 years (Kappenman 2010). This raises a question of whether backup generators at the PNPP protect against a super solar storm induced voltage surge and how reliable their operation would be for a year or more in the context of a long duration failure of the electric grid? Such a disruption would impact all digital networks, including transportation and communication, cell phones, hospitals, water and sewage supplies, and most emergency response equipment. The probability of this event causes us to ask what additional equipment modifications and emergency planning preparations can the NRC, PNPP, state and local governments, and all citizens do to mitigate the potentially disastrous impact of a severe solar storm event?

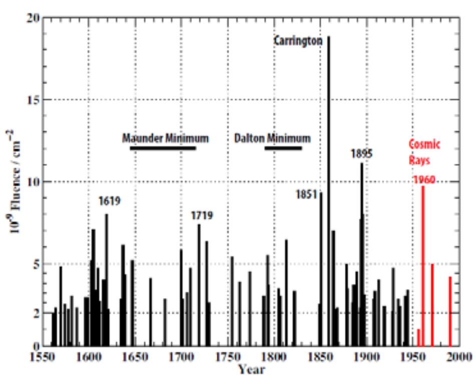

Figure 4

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