May 28, 2013

Kraig Schultz
Michigan Safe Energy Future (South Haven)
11919 Mill Lane
Grand Haven, MI 49417

Dear Mr. Schultz,

I very much appreciated your time and the engaged conversation during the meeting on March 25 at the Beach Haven Event Center in South Haven Michigan. As promised, I am responding to your letter dated March 25, 2013, which expressed concerns regarding the safe operation of Palisades. A record of these and other questions from local citizens, as well as my responses, is documented in the Nuclear Regulatory Commission's (NRC) Agencywide Documents Access and Management System No. ML13142A424. The discussion with you and the other participants was very helpful to me as I continue to consider public concerns about nuclear safety.

You raised issues regarding the status of embrittlement testing, plant improvements, decommissioning funds and aging structures at nuclear power plants. In the enclosure, I have provided specific responses to the issues you raised.

The NRC maintains safety as our top priority to ensure the protection of our citizens and the environment. I and all my colleagues at the agency are firmly dedicated to ensuring the safe operation of nuclear power plants and to protecting public health and safety.

Thank you for sharing your views and insights. If you have any additional questions, don't hesitate to contact me at 301-415-8430.

Sincerely,

/RA/

William D. Magwood, IV

Enclosure:
Responses to Questions

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The correspondence addresses policy issues previously resolved by the Commission, transmits factual information, or restates Commission policy.

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Responses to Questions and Concerns Raised in Letter Sent to the NRC by Mr. Kraig Schultz of Grand Haven Michigan

1. Embrittlement Testing Status

In your letter you asked for information related to how embrittlement at the Palisades Nuclear Plant may be advancing at a faster rate than prediction models might indicate. Your questions were:

i. Given the findings in Japan related to non-expected and rapid increases in reactor vessel embrittlement that fall well outside of projection models, we are concerned that embrittlement may be advancing more quickly than prediction models might indicate. This may mean that embrittlement at Palisades is far worse than we predict it to be.

The Japanese plant in question is Genkai Unit 1. In April 2009 the fourth surveillance capsule was removed from the reactor vessel as part of its twenty-sixth refueling outage. The amount of radiation to which this capsule had been exposed corresponded to 58 full years of operation, a level of radiation exposure that will not occur in the vessel until the year 2052. The specimens inside the fourth capsule were tested to measure the amount of radiation embrittlement. As reflected in your question, this measurement significantly exceeded the prediction formula for radiation embrittlement used in Japan. These data prompted Japan's Nuclear and Industrial Safety Agency (NISA) to require that detailed additional analyses and experiments be performed by the licensee (Kyusyu Electric Power Company). These analyses and experiments were extensively reviewed by a panel of Japanese experts between November 2011 and July 2012; the panel published its findings in August 2012. Briefly, the panel concluded the following:

- Detailed microstructural characterizations showed that the embrittlement mechanisms operative in the Genkai Unit 1 reactor pressure vessel steel are identical to those expected and characterized by the Japanese prediction model.
- The under-prediction of the results from the fourth surveillance capsule by the Japanese prediction model was attributed to the sparseness of detailed surveillance data for such high levels of radiation exposure.
- An analysis performed using the measured embrittlement data from the fourth surveillance capsule confirmed the operating safety of Genkai 1 through the year 2052.

The NRC was made aware of the Genkai 1 data in December 2011. Through its work on the alternative pressurized thermal shock (PTS) rule (10 CFR 50.61a) and on our own embrittlement prediction formulas (Regulatory Guide 1.99, *"Radiation Embrittlement of Reactor Vessel Materials," Revision 2)* http://pbadupws.nrc.gov/docs/ML0037/ML003740284.pdf) the NRC staff was already aware of the possibility that embrittlement levels at high radiation exposure may be under-predicted. The staff has taken the following steps to improve the accuracy of these models and to ensure that the measured data are not under-predicted:

- The commercial nuclear power industry, working under the auspices of the Electric Power Research Institute, has undertaken programs designed to obtain more surveillance information at high levels of radiation exposure.
- The NRC staff is working with the American Society of Testing and Materials Subcommittee E10.02 (Behavior and Use of Nuclear Structural Materials) to develop more accurate embrittlement prediction models.
- The NRC has adopted regulatory practices to use measured data, not predictions, when the measured data significantly exceed the predictions.

For the Palisades Nuclear Plant it should be noted that none of this information from Japan indicates cause for an immediate safety concern. The level of radiation exposure associated with the fourth surveillance capsule at Genkai Unit 1 is three times higher than the Palisades vessel will experience on the date its license expires (in 2031). Additionally, the radiation to which the Palisades reactor will be exposed by 2031 is well within the range where the NRC's prediction model performs. The model performs well. The surveillance data for the Palisades reactor shows good agreement with projected trends to levels of irradiation exposure far beyond those that will be experienced in the licensed operating lifetime of the vessel.

ii. Additionally you asked for the following information:

a. *Please provide us with the exact dates and with reports for each of the actual samples that have been taken from the Palisades Reactor (1971-2013).*

b. *Please provide us with the dates that are planned for future samples to be taken.*

The table below summarizes the Palisades surveillance program, and provides the information requested in parts (a) and (b) of the question.

Summary of surveillance capsules in the Palisades nuclear power plant.

Capsule Type	Capsule ID	Title	Adams # for Report	Year of Capsule Pull
Unirradiated		Final Report On Palisades Pressure Vessel Irradiation Capsule Program: Unirradiated Mechanical Properties		
Irradiated	A-240	Final Report On Palisades Nuclear Plant Reactor Pressure Vessel Surveillance Program: Capsule A-240	7907120344	1978
Irradiated	W-290	Analysis Of Capsules T-330 and W-290, Consumers Power Company, Palisades Reactor Vessel Radiation Surveillance Program	8411200379	1983

Capsule Type	Capsule ID	Title	Adams # for Report	Year of Capsule Pull
Thermal	T-330	Analysis Of Capsules T-330 and W-290, Consumers Power Company, Palisades Reactor Vessel Radiation Surveillance Program	8411200379	1983
Irradiated	W-110	Analysis Of Capsule W-110 From The Consumers Power Company Palisades Reactor Vessel Radiation Surveillance Program	9406270173	1993
Irradiated	W-100	Analysis Of Capsule W-100 From The Consumers Power Company Palisades Reactor Vessel Radiation Surveillance Program	ML040910069	2003
Irradiated (Supplemental)	SA-60-1	Test Results of Capsule SA-60-1 Consumers Energy Palisades Nuclear Plant Reactor Vessel Material Surveillance Program		End of Cycle 13
Irradiated (Supplemental)	SA-240-1	Test Results of Capsule SA-240-1 Consumers Energy Palisades Nuclear Plant Reactor Vessel Material Surveillance Program		End of Cycle 14
Irradiated	W-80		Installed	2019 (planned)
Irradiated	W-280		Installed	Testing not planned, to be held in reserve
Irradiated	W-260		Installed	
Thermal	T-150		Installed	

Definition of Capsule Types

Unirradiated:	Not a capsule, but a report that summarized the properties of the pressure vessel steels in the as-built condition, before radiation occurs.
Irradiated:	Used to measure the effects of radiation. Installed when the reactor was first started.
Thermal:	Used to measure the effects of thermal aging. Installed when the reactor was first started.
Irradiated (Supplemental):	Used to measure the effects of radiation. Installed after the reactor was first started.

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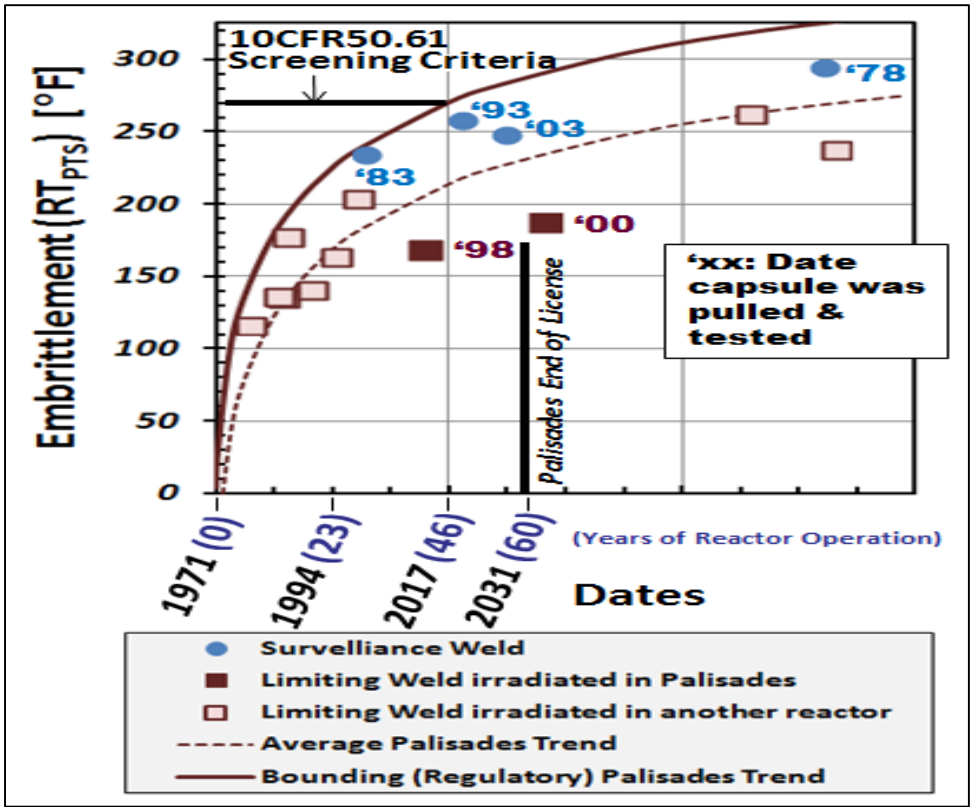
c. *Please provide us with a plot of the prediction model that shows actual data points taken during Palisades operating history.*

The plot requested is provided below. The plot, which was used as part of the end-of-cycle public meeting held on April 2, 2013, (see ADAMS ML13093A191) shows the variation of the embrittlement reference temperature (RT_{PTS}) with years of

radiation exposure. This reference temperature the NRC uses to quantitatively assess brittleness can roughly be described as the temperature below which the material transitions from ductile to brittle behavior during a pressurized thermal shock (PTS) event. The higher the temperature corresponds to the higher the temperature at which the material transitions from brittle to ductile behavior and thus the higher the embrittlement.



Data from the surveillance capsules (squares and circles) are shown for the Palisades surveillance weld as well as for the weld in the Palisades vessel (labeled "limiting weld" on the plot), which have similar chemical composition. The plot shows that these measurements agree well with the NRC's predictive formula and trend for Palisades from Regulatory Guide 1.99 (dashed curve), and are all over-estimated by the Regulatory Guide 1.99 bounding prediction (solid curve). Beyond the data irradiated in Palisades, information is also available from surveillance programs conducted in the H.B. Robinson and Indian Point reactor pressure vessels; these data appear as lightly filled squares. The plot demonstrates that surveillance data are already available for levels of radiation exposure far in excess of that which the Palisades vessel will reach when its license expires in the year 2031.

d. *During the embrittlement webinar last week there was mention of two samples left. How many data points on the embrittlement chart will the remaining samples provide?*

The statement that was made during the webinar about two capsules remaining in the reactor was in error (this error was corrected in the "Minutes of the Webinar", see ADAMS ML13108A336). As detailed in the table provided above, there are actually

four capsules left in the Palisades reactor vessel: W-80, W-280, W-260, and T-150. Of these, only testing of capsule W-80 is required to be compliant with NRC regulations; this testing is planned in the year 2019. Each irradiated capsule contains Charpy V-notch samples taken from the reactor vessel plate material as well as the weld material. Multiple Charpy V-notch samples must be tested to determine each RT_{PTS} value. Testing of the Charpy V-notch specimens in the W-80 capsule will therefore produce a new RT_{PTS} measurement for the Palisades plate and surveillance weld materials.

2. Status of Plant Improvement Projects

Capital expenditures at the plants are monitored by the NRC only to the extent that the regulations are complied with for those components. We believe this question is better answered by the licensee. I will communicate the answer to this question by a separate correspondence.

3. Decommissioning Funds

In your letter you asked for detailed accounting of how the Palisades decommissioning fund shrunk from having:

a. $566 million on March 1, 2007, to only $230.8 million on July 31, 2009

The NRC regulations directly place responsibility on the licensee to acquire all the funds needed for decommissioning to NRC standards during the life of the operating license, and to preserve decommissioning funding assurance. Decommissioning funding assurance means that a licensee will have all the funds necessary to decommission when the reactor permanently ceases operations. The decommissioning funds are placed in an external trust outside the direct control of the licensee but under the management of a trust fund manager. Typically, the trust funds are invested in government notes and corporate stocks and bonds. By regulations, the licensee must report the status of their decommissioning funds to the NRC every two years. In the 2008 – 2009 timeframe, the economy in general underwent a severe downturn; and specifically in the case of Palisades, the decommissioning trust fund lost money. In fact the balance on December 31, 2006, was $597 million, and by December 31, 2008, the balance was $218 million.

b. Also, how much remains in the decommissioning fund today?

The latest information that has been reviewed by the NRC is dated December 31, 2010, which indicated that the balance in the decommissioning trust was $279 million. The next report, which was due March 31, 2013, and reflects the decommissioning fund status as of December 31, 2012, was received on March 29, 2013 (ADAMS ML13092A121). This report indicates that the balance in the decommissioning trust is $318.14 million. However, this report is still under NRC review. It takes about six months for the NRC staff to review and determine that all licensees have fulfilled the decommissioning funding assurance requirements under the regulations.

c. Given that we have so little experience operating Nuclear Power plants past the age of 40 years, why did the NRC allow the fund to be depleted?

The NRC did not, nor does it allow withdrawals from the decommissioning trust, until the licensee has permanently shut down the reactor and is in decommissioning. As mentioned before, the decrease in the decommissioning fund was due to adverse economic conditions that resulted in the fund losing value. The licensee is required to have adequate funding to support decommissioning, and they are required to take action if that is not the case.

4. Age and Breakdowns

In your letter you mentioned that one of your major concerns relates to re-licensing a plant to continue to operate beyond its designed life of 40 years. Additionally, you mentioned your concern over the number (8 – Note the actual number is 9 based on the recent shut down for a safety injection refueling water storage tank) of unplanned shutdowns Palisades has had since September 2011 and had the following questions:

a. Does the NRC consider this frequency of unplanned shutdowns acceptable?

The number of unplanned shutdowns is, by itself, not necessarily a concern to the NRC. However, the reason for the shutdown, any associated safety-significance findings and the licensee's corrective actions would all be assessed by the NRC for acceptability. For this reason, the NRC has a performance indicator program that looks at the number of unplanned power changes and plant trips (rapid shutdowns). If certain thresholds are reached, the NRC takes additional actions. Currently these indicators are Green, and below thresholds. This is discussed in section (b) below.

In addition, the NRC does need to follow-up on several ongoing technical issues at Palisades. Some of these issues have caused unplanned shutdowns (e.g., safety injection refueling water storage (SIRW) tank and control rod drive mechanism (CRDM) leaks). Due to the concerns stated above, the NRC has determined that additional inspection was warranted to provide assurance that they will not lead to a more significant concern. Therefore, the NRC approved a deviation from the Reactor Oversight Program (ROP) to perform 1,000 hours of inspections above the baseline inspection program, which is approximately a 50 percent increase in the number of inspection hours. These additional inspections will provide assurance of the continued safe operation of the Palisades Nuclear Plant. Additional information regarding the areas that will be inspected with the additional hours can be found in a memorandum to R.W. Borchardt, Executive Director of Operation, dated November 8, 2012 (ADAMS ML12306A367).

b. Does the NRC track the Mean Time Between Failures (MTBF) or other metrics that provide non-subjective criteria to rank how well a plant is being maintained and how well its design is holding under the stress of age? What metrics are used?

The NRC does not track MTBF specifically. But we do track failures of key pieces of equipment with certain thresholds that objectively assess equipment performance. The NRC assesses plant performance continuously through the ROP by analyzing two distinct inputs: inspection findings resulting from NRC's inspection program and performance indicators (PIs) reported by the licensee. The PIs are objective data regarding licensee performance in the ROP cornerstones of safety and security. PIs

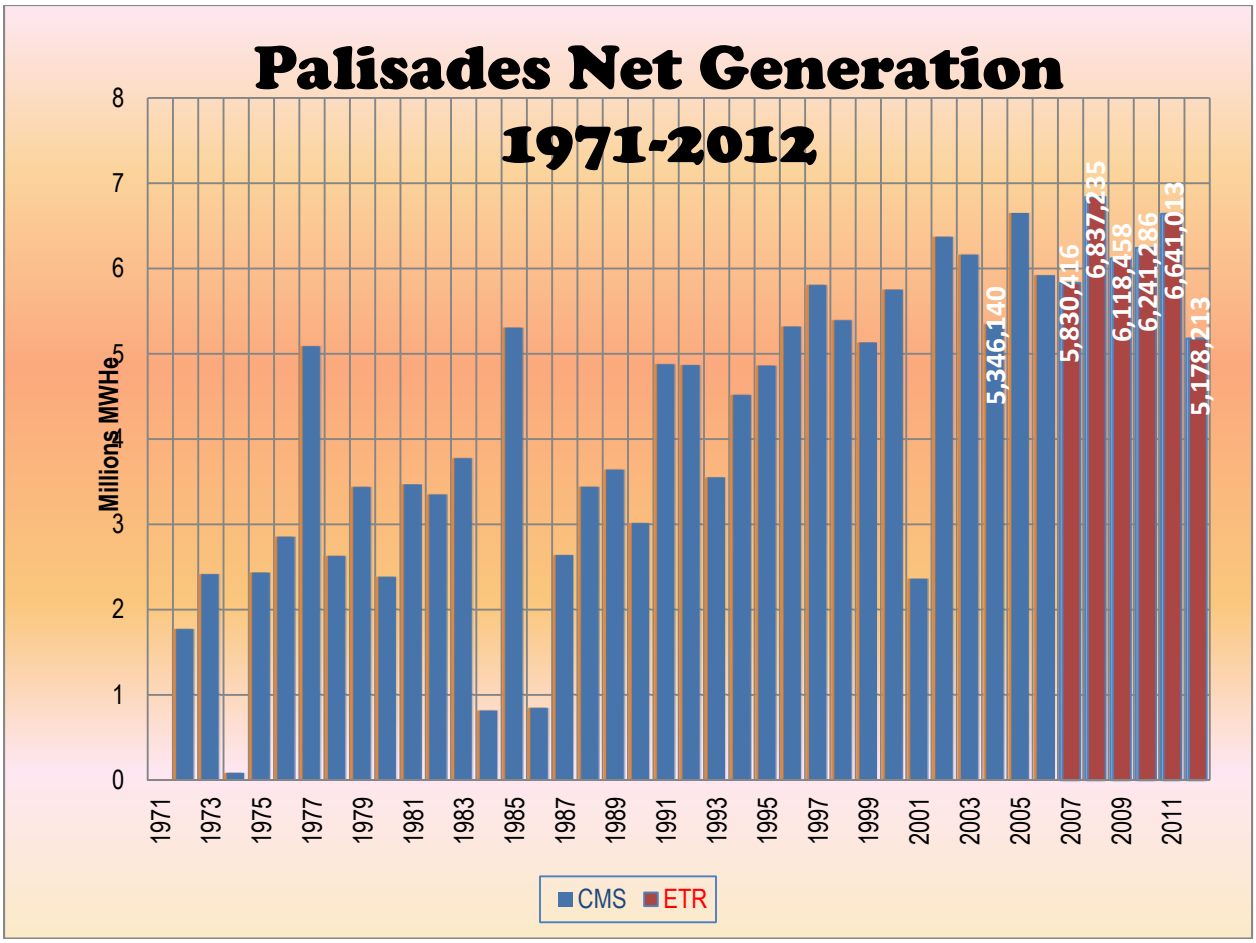
are a means of tracking licensee performance. PIs provide indication of problems that, if uncorrected, may increase the probability and/or the consequences of an off-normal event. The PI data submitted by the licensee is reviewed by the NRC during baseline inspections to verify that the data is accurate. There is data for 17 PIs that is submitted to the NRC on a quarterly basis. Examples of PIs include areas such as: unplanned scrams, unplanned power changes and safety system functional failures. Because not all aspects of licensee performance can be monitored by PIs, safety and security significant areas not covered by PIs are assessed using the ROP Inspection Program. A list of all the performance indicators and their current values for all the operating nuclear plants can be found on the NRC website. The following link contains a list of Palisades Performance Indicators:

http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/PALI/pali_chart.html

Let me call your attention to an indicator that directly measures failures of equipment important to safety. It is called the Mitigating System Performance Index (MSPI). This metric monitors the performance of key systems based on their ability to perform safety functions from a risk perspective. It takes into account the failures of pieces of equipment and equipment availability. The NRC metrics are objective and provide clear threshold for NRC action.

c. *Is there a chart or graph that indicates how Palisades has performed over its entire 42 year lifespan for reliability? Has Palisades always been this bad, or is it getting worse?*

The following graph was provided by the licensee and it shows Palisades' net power generation from 1971-2012.



The blue (1971 – 2006) indicates power generation during the time that Palisades was owned by CMS Enterprise/Consumers Energy (CMS) and the red (2007 – 2011) indicates power generation when Entergy Nuclear Operations, Inc. (ETR) owned Palisades. As can be seen in this graph reliability has improved over time, although in 2012 net generation went down due to a planned refueling outage and several issues discussed previously.

d. *I wouldn't drive a car that's as unreliable as Palisades, why should our entire community put their very lives at stake to allow the continued operation of Palisades? Wind and Solar PV are now less expensive than Nuclear without the risk. Palisades is operating today, because the NRC extended its license. What is the NRC's justification for allowing Palisades to continue putting millions of people at risk?*

The NRC's oversight of Palisades continues to show that the plant is operating safely. If at any point the NRC deemed Palisades to be unsafe, the NRC would take action to shut down the plant.