

May 28, 2013

Alice Hirt  
Don't Waste Michigan  
[alicehirt@gmail.com](mailto:alicehirt@gmail.com)

Dear Ms Hirt,

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 embrittlement of the Palisades' reactor vessel and concerns related to the predictability of assessing this irradiation embrittlement. 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 Concerns

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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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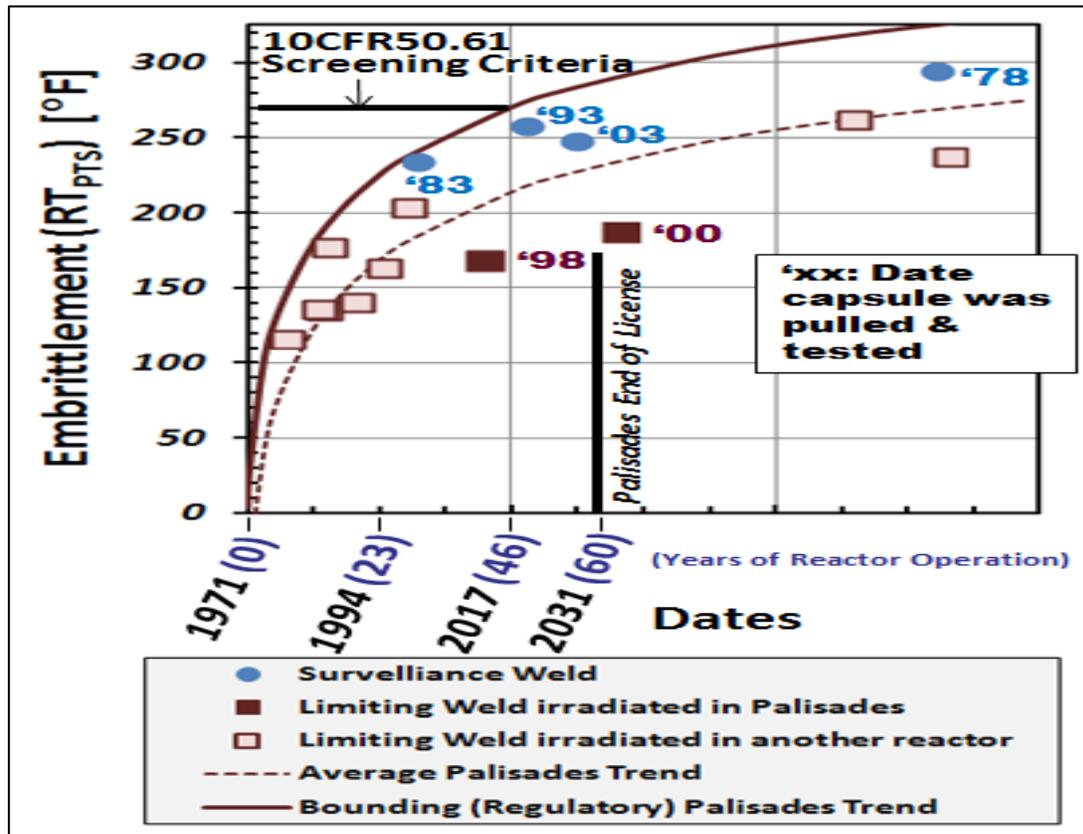
**Response to Concerns Raised in Letter Sent to the NRC by  
Ms. Alice Hirt**

**1. Concerns regarding the embrittlement of the Palisades' reactor vessel and the extension of their operating license.**

As was mentioned in your letter, the date by which Palisades reactor vessel is projected to exceed the screening criteria of the pressurized thermal shock (PTS) rule (10 CFR 50.61) has changed over time. This relates mostly to the greater availability, as time goes on, of data on the steel embrittlement characteristics which the Palisades reactor vessel is made of. In 2011, the staff reviewed and approved (see ADAMS ML112870050) the licensee's most recent evaluation, which showed that the PTS screening criteria will not be exceeded until April 2017. This evaluation featured more accurate estimates of the radiation exposure to the Palisades reactor vessel, as well as a thorough evaluation of not only the Palisades surveillance information, but also information obtained on the limiting weld in Palisades through surveillance testing of the same limiting material performed at the H.B. Robinson and Indian Point nuclear power plants. As discussed during the webinar held on March 19, 2013, (ADAMS ML13108A336) it is expected that Entergy will take steps in the future, through the development of new information, to demonstrate that the Palisades reactor can be operated safely beyond April 2017. Should Entergy pursue this course of action it will need to present its case to the NRC no later than 2014 to remain compliant with the provisions of 10 CFR 50.61. If an adequate assessment cannot be made, the plant would need to shut down.

**2. Concerns with the predictability of assessing this irradiation embrittlement.**

In your letter you also raised concerns regarding the quality of information available concerning the key factors that control the sensitivity of steels to radiation embrittlement (e.g., copper and nickel). In fact, more information of this type is available for Palisades than for most other operating reactors in the United States. Nevertheless, uncertainties do remain, and it is for this reason that the NRC uses an upper-bound estimate of radiation embrittlement in its licensing calculations. As is shown in the graph below, the NRC's predictions well represent the embrittlement data from Palisades, and the upper-bound estimate used for licensing purposes exceeds any measurement made on the Palisades weld material.



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. The NRC uses this reference temperature to quantitatively assess brittleness. It can roughly be described as the temperature below which the steel has a greater tendency towards brittle behavior (more likely to break than bend) and above which the steel has a greater tendency towards ductile behavior (more likely to bend than break). Higher reference temperatures correspond to higher levels of 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 capsule 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.

Finally, the staff is aware of the comments made by Professor Hiromitsu Ino regarding embrittlement predictions in general, and regarding data recently made available from the Genkai Unit 1 reactor. Through its work on the alternative PTS rule (10 CFR 50.61a) and on its own embrittlement prediction formulas (Regulatory Guide 1.99) 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. As described in the answer to the second part of this question, 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.