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Biweekly Notice: Applications and Amendments to Facility Operating Licenses and Combined Licenses Involving No Significant Hazards Considerations

Comment On: NRC-2014-0207-0001

Applications and Amendments to Facility Operating Licenses and Combined Licenses Involving No Significant Hazards Considerations

Document: NRC-2014-0207-DRAFT-0003

Comment on FR Doc # 2014-23015

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RULES AND DIRECTIVES
SECTION
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General Comment

See attached file(s)

Attachments

10 30 14 Palisades PTS comments

SUNSI Review Complete
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Add= *M. Henderson (matt)*

Public Comments re: Docket ID NRC-2014-0207

Submitted by Kevin Kamps, Radioactive Waste Specialist, Beyond Nuclear, and Board of Directors Member, Representing the Kalamazoo Chapter, for Don't Waste Michigan

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Entergy Nuclear's Response: No. We challenge this response.

2. Does the proposed change create the possibility of a new or different type of accident from any accident previously evaluated?

Entergy Nuclear's Response: No. We challenge this response.

3. Does the proposed change involve a significant reduction in a margin of safety?

Entergy Nuclear's Response: No. We challenge this response.

The NRC staff states that it "has reviewed the licensee's analysis and, based on this review, it appears that the three standards of 10 CFR 50.92(c) are satisfied," and "Therefore, the NRC staff proposes to determine that the amendment request involves no significant hazards consideration." We challenge NRC staff's determination.

BASIS FOR OUR CHALLENGES

On July 8, 1993, Michael J. Keegan of the Coalition for a Nuclear Free Great Lakes published *Pressurized Thermal Shock Potential at Palisades: History of Embrittlement of Reactor Pressure Vessels in Pressurized Water Reactors*. He rekeyed this document on August 3, 2005. The report documents that Palisades first violated NRC's reactor pressure vessel embrittlement/pressurized thermal shock safety standards in 1981, a mere 10 years into operations. The report also documents repeated rollbacks of the NRC PTS regulations up to that point in time, enabling Palisades to continue operating, despite its degraded condition. This weakening of PTS safety standards continues to the present day, as with this proposed license amendment.

We hereby incorporate as if rewritten the entirety of Keegan's 1993 report. We will also submit the report for the official record on this proceeding. This document is also posted online at <http://www.nirs.org/reactorwatch/licensing/071805pressurizedthermalshockpotentialpalisades.pdf>.

A U.S. Nuclear Regulatory Commission document (Date Submitted: October 26,

2004; Revised: December 14, 2004), "Generalization of Plant-Specific Pressurized Thermal Shock (PTS) Risk Results to Additional Plants," Table 1. Plants with highest RTNDT, showed that Palisades had the fifth "most embrittled materials" in the U.S. This document is posted online at <http://www.nirs.org/reactorwatch/licensing/121404nrc30mostembrittledrpvs.pdf>. It will also be submitted for the record on this proceeding.

However, at an NRC public meeting held at the Beach Haven Event Center in South Haven, MI in late Feb., 2012, in response to a direct question I made (I participated by telephone from Washington, D.C.), NRC's Office of Research's Jennifer Uhle confirmed that Palisades has the most embrittled RPV in the U.S. So, in the short space of eight years, Palisades had moved from fifth worst, to single worst embrittled RPV in the U.S.

This dubious distinction was confirmed by an NRC resident inspector at Palisades, during a meeting between environmental group representatives and concerned local residents with NRC Chairman Macfarlane on June 5, 2014. The meeting was held in Benton Harbor, MI. To a direct question raised by Michael Keegan of Coalition for a Nuclear Free Great Lakes (who also serves as a board member of Don't Waste MI), the NRC resident inspector at Palisades, who took part in the meeting, also admitted that Palisades has the worst embrittled RPV in the U.S.

On August 8, 2005, Don't Waste MI, and a number of additional environmental group intervenors, as well as concerned local citizens, intervened against the Palisades' 20-year license extension application. This petition for hearings is posted online at <http://www.nirs.org/reactorwatch/licensing/petition.pdf>, and has been submitted for the record on this proceeding.

The very topmost of PETITIONERS' TECHNICAL/HEALTH/SAFETY ANALYSIS CONTENTIONS was:

1. The license renewal application is untimely and incomplete for failure to address the continuing crisis of embrittlement. The Petitioners allege that the Palisades license renewal application is fundamentally deficient because it does not adequately address technical and safety issues arising out of the embrittlement of the reactor pressure vessel and unresolved Pressure Thermal Shock ("PTS") concerns that might reasonably result in the failure of the reactor pressure vessel ("RPV"). The Palisades nuclear power station is identified as prone to early embrittlement of the reactor pressure vessel, which is a vital safety component. As noted in the opinion of Petitioners' expert on embrittlement, Mr. Demetrios Basdekas, retired from the Nuclear Regulatory Commission, the longer Palisades operates, the more embrittled its RPV becomes, with decreasing safety margins in the event of the initiation of emergency operation procedures. Therefore, a hearing on the public health and safety effects of a prospective additional twenty years of operation, given the present and prospective embrittlement trend of the RPV is imperative to protecting the interests of those members of the petitioning organization who are affected by this proceeding. (Page 4)

The intervenors also submitted this related contention:

8. Increased embrittlement of re-used fuel rods as buffers to reduce embrittlement of RPV walls. To mitigate the prospect of increased embrittlement of the reactor pressure vessel (RPV), the Palisades operator uses previously-irradiated fuel to create a buffer next to the RPV wall. The second-use of irradiated fuel assemblies in the reactor core tends to weaken and damage the cladding on the fuel rods, making future waste handling, storage, and ultimate disposal - whether on-site at Palisades, in transport, and at future storage or dump sites - problematic. It poses an elevated risk for the safety of Palisades workers and the general public. Moreover, the U.S. Department of Energy ("DOE") depends on the integrity of the fuel cladding as a means of preventing or minimizing the chances of unanticipated fissioning in storage casks or other units - in effect, as a means of delaying radiation releases into the groundwater at the Private Fuel Storage (Utah) and Yucca Mountain (Nevada) sites. (Page 7)

This submitted contention is also relevant, for it represents one of many scenarios that could lead to the need to activate the ECCS at Palisades, which could initiate PTS, RPV rupture, LOCA, containment failure, and large-scale release of hazardous radioactivity to the environment:

11. Threats of terrorist attack and sabotage against the Palisades nuclear power plant. Located on the shoreline of Lake Michigan, the source of drinking water, fish, recreation, and other economic value to tens of millions of people downstream, Palisades represents a target for potentially catastrophic terrorist attack or sabotage intended to release large amounts of radioactivity into the Great Lakes basin. Palisades represents a radioactive bull's eye on the shore of 20% of the planet's surface fresh water, the Great Lakes. The operating reactor (containing many billions of curies of radioactivity) and high-level waste storage pool (containing tens to hundreds of millions of curies) are vulnerable to such attack, as are the outdoor dry storage casks, so highly visible stored in plain sight. (Page 9)

Regarding Mr. Demetrios Basdekas, retired from the Nuclear Regulatory Commission staff, he had authored the following op-ed in the *New York Times*, published on the third anniversary of the Three Mile Island meltdown (March 28, 1982). Entitled "The Risk of a Meltdown," the op-ed is posted online at <http://www.beyondnuclear.org/storage/kk-links/Basdekas%20op%20ed%20NYT%203%2029%201982.pdf>, and has been submitted for the record of this proceeding.

As the faxed version of the op-ed is not entirely legible, I have rekeyed it for legibility sake. Here is the full text, within brackets below:

[The Risk of a Meltdown

By Demetrios L. Basdekas

New York Times Op-Ed, March 29, 1982 [the 3rd anniversary of the Three Mile Island meltdown]

Washington—There is a high, increasing likelihood that someday soon, during a seemingly minor malfunction at any of a dozen or more nuclear power plants around the United States, the steel vessel that houses the radioactive core is going to crack like a piece of glass. The result will be a core meltdown, the most serious kind of accident, which will injure many people, destroy the plant, and probably destroy the nuclear industry with it.

On the third anniversary of the Three Mile Island Accident, the Government and industry are unable or unwilling to deal honestly and urgently with far-reaching nuclear-safety problems.

Another serious accident is very likely because the wrong metal was used in the reactor vessels, and with each day of operation, neutron radiation is making the metal more brittle, and more prone to crack in case of sudden temperature change under pressure.

One manufacturer of nuclear reactors has reported to the Nuclear Regulatory Commission that in three to five more years, the vessels in some plants will be too brittle to operate safely. But this estimate is wishful thinking, based on unrealistic assumptions about plant operators' actions and accident sequences. Some plants are already too dangerous to operate without corrective measures.

The commission could do a great deal to prevent such an accident, and stretch out the lives of many of these brittle vessels, if it ordered the type of corrective steps already taken at some European reactors. But the commission, regulating an industry that has serious financial and technical problems, instead of taking initiatives tends to sweep difficult technical problems under the rug, reacting to crises only after they occur.

The commission must realize that this crisis is upon us. A temperature change severe enough to crack a brittle reactor vessel already has occurred, in California, but not at one of the older, more vulnerable plants. The commercial nuclear industry's admirable safety record – no deaths caused by radiation – still is intact, but this cannot last much longer, because the reactor vessels and other critical components are aging.

For many years, it has been known that vessels are becoming brittle. What makes the problem urgent is that the metal is aging more rapidly than expected, and the circumstances that would cause such an accident now seem more likely.

(continued)

At the Rancho Seco plant, near Sacramento, Calif., in March 1978 a worker dropped a small light bulb into an instrument panel, causing an electrical short circuit. The short wreaked havoc on the plant's control systems – a variety of instruments that run crucial pumps and valves – and the result was that too much water was pumped through the reactor, chilling it suddenly. It is very doubtful that some of the older plants operating today would be able to withstand the same shock. Fortunately, Ranch Seco had been in operation less than two years; had it been in operation for 10, its pressure vessel most likely would have ruptured.

The kinds of control systems that went haywire at Rancho Seco are very likely to fail at crucial times in other nuclear power plants. When a pipe bursts, or a seal fails, or a valve sticks, automatic control and safety systems almost instantly take action to compensate, but they do not always take the right action.

Control systems are not reviewed by the Nuclear Regulatory Commission. They are not immune to fire or power failure; they often have no backups, so are prone to simple failure. They are not even earthquake-proof.

The N.R.C. staff has taken the position that if a plant gets into trouble because of control-system malfunctions, it has safety systems to take care of any problems. But this is not so, as events of the last few years show. At Rancho Seco, at Three Mile Island, and at other plants, control systems not thought vital to the safe operation of a plant ended up causing serious problems.

The Nuclear Regulatory Commission is charged with ensuring that nuclear plants are operated "with adequate protection" of the public health and safety. But bureaucratic foot-dragging and preoccupation with public relations and financial problems of the industry are contributing to a shortsighted view – that technical problems can wait or do not exist. Some members of the staff acknowledge the safety problems associated with control systems, but the agency has yet to demand from utilities operating nuclear power plants the technical data on control systems necessary to assess the systems' safety fully.

It may be that we need nuclear power to maintain our standard of living. But there is a vast difference between having to accept something, and making it acceptable. We can make nuclear power acceptable.

The Nuclear Regulatory Commission chairman, Nuncio Palladino, has spoken of cleaning up our nuclear act. As a private citizen, I hope that we do so, beginning with vigilance at the N.R.C. One more accident the size of Three Mile Island's, and the public's reaction almost certainly will foreclose the nuclear option.

Demetrios L. Basdekas is a reactor safety engineer with the Nuclear Regulatory Commission.]

On September 16, 2005, the environmental intervenors made the following response in defense of their PTS/RPV embrittlement contention (Pages 2 to 23 of PETITIONERS' COMBINED REPLY TO NRC STAFF AND NUCLEAR MANAGEMENT COMPANY ANSWERS, posted online at <http://www.nirs.org/reactorwatch/licensing/contnresp.pdf> and submitted for the record of this proceeding):

Response as to Contention No. 1 (The license renewal application is untimely and incomplete for failure to address the continuing crisis of embrittlement)

NMC and NRC staff have argued that Contention 1 regarding the Application's proposed management of the embrittlement of the Palisades reactor pressure vessel is inadmissible because the Contention (i) fails to challenge the Application and demonstrate the existence of a genuine dispute on a material issue of fact or law; (ii) fails to provide a factual basis to support any dispute with the application, and; (iii) improperly challenges Commission regulation. These assertions are incorrect.

1) The embrittlement contention is within the scope of the proceeding

The extended operation of the Palisades nuclear steam supply system falls squarely under 10 CFR § 54.21 and § 54.29(a) which focuses on the management of aging of certain systems, structures, and components and the review of time-limited aging evaluations.

A genuine dispute exists within the Application that is germane to the health and safety of the petitioners who live, work and recreate out to 50 miles from the Palisades nuclear power station in Covert, Michigan.

The Palisades Reactor Pressure Vessel is the subject component. There is no safety redundancy to this single largest component in the Palisades nuclear steam supply system. Palisades is arguably one of the most embrittled reactor pressure vessels, if not the most embrittled vessel, in the United States. The nuclear steam supply system for Palisades was the first of the Combustion Engineering line licensed for construction. Documentation as early as 1970 identifies

Surveillance specimens in the vessel will be used to monitor the radiation damage during the life of the plant. If these specimens reveal changes that affect the safety of the plant, the reactor vessel will be annealed to reduce radiation damage effects. The results of annealing will be confirmed by tests on additional surveillance specimens provide for this purpose. Prior to the accumulation of a peak fluence of 10 E 19 nvt (>1 Mev) on the reactor vessel wall, the Regulatory Staff should reevaluate the continued suitability of the currently proposed startup, cool down, and operating conditions. [Footnote 1: Report on Palisades Plant, Letter from Joseph Hendrie (ACRS) to Glen Seaborg, Chair AEC, January 27, 1970.]

Exhibit 1-A. All exhibits are found in "Petitioners' Appendix of Evidence in Support of Contentions" (Pet. App.), a copy of which is provided with this response in hard copy to the ASLB and the parties.

The Petitioners have been able to establish that the licensee could not provide surveillance materials for critical weld material in the Palisades vessel beltline welds in 1994. [Footnote 2: Palisades Thermal Shock, NRC Staff Presentation to the ACRS, Viewgraphs, December 09, 1994, p.3.] See Exhibit 1-B.

A commitment was made for the Palisades plant as early as 1970 to make actual physical efforts by annealing the vessel to restore ductility should any "radiation damage" affecting plant safety be discovered. In fact, calculations later recognized by NRC staff concluded that the Palisades vessel could have surpassed its Pressure Thermal Shock ("PTS") limits as early as 1995. Repeated Palisades re-analyses have produced a widening range of resulting estimates for exceeding vessel embrittlement limits with a very broad range of uncertainty (as much as $\pm 25\%$) with as many PTS values for the severely-embrittled reactor vessel. Palisades has neared the maximum-embrittlement goalposts time and again over the years, [Footnote 3: "For example that is sort of a summary of the regulatory framework that applies to annealing. With regard to Palisades, we completed an evaluation in April of 1995 in which we concluded that they would reach the screening criteria. At least they were okay until 1999. That evaluation was consistent with the 50.61, the Pressurized Thermal Shock Rule. The current license for Palisades expires in 2007 so they would fall somewhat short of the current operating license with regard to the life of the vessel."], but each time they have been moved back following rejiggering of the assumptions and calculations. In 1995, for example, the NRC staff noted that the "Palisades RPV . . . is predicted to reach the PTS screening criteria by late 1999, before any other plant."]

The filing continued, as mentioned, until page 23. This filing is incorporated by reference, as if rewritten in its entirety, herein.

On March 17, 2006, environmental intervenors filed PETITIONERS' NOTICE OF APPEAL FROM ASLB DENIAL OF HEARING, AND SUPPORTING BRIEF. This filing is posted online at <http://www.nirs.org/reactorwatch/licensing/objections031706.pdf>, in incorporated by reference as if rewritten in its entirety herein, and has been submitted for the record of this proceeding.

This filing included these relevant sections: Status of Demetrios Basdekas as Petitioners' Expert on Embrittlement; Appeal of dismissal of Contention No. 1 (The license renewal application is untimely and incomplete for failure to address the continuing crisis of embrittlement).

On March 20, 2006, NIRS and a grassroots coalition sent letters to U.S. Senators Carl Levin and Debbie Stabenow of Michigan, requesting General Accounting Office investigation into RPV embrittlement and PTS at Palisades and reactors across the U.S.

The letters also urged that GAO investigate why -- instead of protecting public health and safety and the environment against such risks -- NRC had instead weakened embrittlement/PTS standards, allowing dangerously deteriorated reactors such as Palisades to continue operating.

These two letters are posted online at:

<http://www.nirs.org/reactorwatch/licensing/032006gaorequestltrtolevin.pdf>

and

<http://www.nirs.org/reactorwatch/licensing/032006gaorequestltrstabenow.pdf>.

Both letters are incorporated by reference herein as if rewritten in their entirety. They have also been submitted for the record of this proceeding.

Please note that the signatories to these letters included the following: Citizens Action Coalition of Indiana * Citizens for Alternatives to Chemical Contamination * Citizens For Renewable Energy * Coalition for a Nuclear-Free Great Lakes * Don't Waste Michigan * Great Lakes United * The Green Party of Michigan * Kalamazoo Nonviolent Opponents of War * Lone Tree Council * Michigan Citizens for Water Conservation * Michigan Environmental Council * Michigan Land Trustees * National Environmental Trust * Nuclear Energy Information Service * Nuclear-Free Great Lakes Campaign * Nuclear Information and Resource Service * Nukewatch * PIRGIM * Radiological Evaluation & Action Project, Great Lakes (REAP-GL) * Sierra Club, Mackinac Chapter * Van Buren County Greens * WAND Michigan: Women's Action for New Directions * West Michigan Environmental Action Council.

Note that the Consumers Energy (previous owner of Palisades before Entergy bought it) admitted to the Michigan Public Service Commission in spring 2006 that "Reactor vessel embrittlement concerns" were a primary reason it was selling the plant. This document is posted online at: <http://www.nirs.org/reactorwatch/licensing/pg2.jpg>. It has also been submitted for the record.

A Consumers Energy official told me directly that the reason the company was selling the plant to Entergy was so that Entergy -- a much bigger company with more nuclear power experience and expertise -- could fix such problems as the RPV embrittlement. However, no such fix has ever been made, not since ownership transferred in 2007. And Entergy has no plans to make such a fix. But the fix is in, so to speak. Entergy has asked NRC to weaken applicable RPV PTS regulations, yet again, to enable its degraded reactor to keep operating.

On May 18, 2006, a coalition of groups submitted "Halting 20 Extended Years of Risky Reactor Operations and Radioactive Waste Generation and Storage on Lake Michigan at Palisades Nuclear Power Plant" as Comments on NUREG-1437, Supplement

27 to the Generic Environmental Impact Statement for License Renewal of the Palisades Nuclear Power Plant. This document is posted online at <http://www.nirs.org/reactorwatch/licensing/cntsnureg1437supplement27.pdf>, and submitted for the record. It is incorporated by reference, as if rewritten herein in its entirety.

On pages 26-27, the coalition states:

[XI. Plant Aging Increases Accident Risk

A top concern directly related to the re-licensing of Palisades for 20 additional years, is the aging of the plant, in particular embrittlement, or the gradual weakening of the reactor pressure vessel (RPV) from decades of bombardment by neutrons emitted by the nuclear chain reaction in the core. It is generally acknowledged that the reactor pressure vessel at Palisades is one of the most embrittled in the nation. The longer Palisades operates, the more embrittled its RPV becomes, increasing the risk for Pressurized Thermal Shock (PTS), a condition caused by any number of system malfunctions which can result in a severe, sudden overcooling of the reactor pressure vessel. This, combined with the intense pressurization in a pressurized water reactor, can stress the RPV such that its walls could crack or rupture, leading to a loss-of-coolant accident, meltdown, and catastrophic release of radiation to the entire Great Lakes basin. Age-related failure of Palisades' systems could initiate the sequence of events that leads to PTS. Examples of aging systems at Palisades are evident in this short list of recent incidents:

1. Alert Declared Due to Loss of Shutdown Cooling (Event # 39699 March 25, 2003)
2. Failure of the Control Rod Drive Mechanism (see PNO-III-04-010 August 11, 2004)
3. Reactor Manually Tripped Due to Fire in 2B Condensate Pump (Event# 41002 August 31, 2004)
4. Relief Requests for Reactor Vessel Head Penetration problems (NMC Request 10/4/04)
5. Reactor Vessel Head Nozzle Cracking - Through Wall Cracks (Degraded Condition 10/17/2004)
6. Manual Reactor Trip/Main Condenser Vacuum (Event # 41319) 26
7. Emergency Declared on Primary Coolant System Integrity (Event # 41681)
8. Control Rod Stuck in Reactor Core (Event #42569 May 11, 2006)

The embrittlement at Palisades, the unresolved risks of PTS, and the ever-increasing likelihood of the failure of the RPV as Palisades ages warrant special environmental considerations. This type of accident is considered one that goes beyond the design of the reactor. NRC has not, however, included the issue in the EIS nor incorporated it in "Beyond Maximum Credible Accident" scenarios for Palisades as a potential accident. Further, NMC in its Environmental Report, has declined to undertake major refurbishment for Palisades' license renewal, despite Consumers Energy's earlier pledge to "anneal" (super-heat) the reactor pressure vessel. This super-heating theoretically can bring back ductility or flexibility to the metal, thus reducing potential for PTS.

Annealing has never been performed in the U.S., however, and thus raises concerns itself as an experimental procedure. Please include for the record the Adobe PDF document entitled "Palisades Nuclear Plant Yearly Capacity Factors" & "Palisades Plant - Record of Transients or Operational Cycles" for Occurrence #1 dated 1/11/1972 through Occurrence # 126 dated 1/9/2005. This is a record which has major implications for embrittlement and the Reactor Pressure Vessel at Palisades. A hard copy will be sent. Please enter it into the record. Age-related deterioration also increases the likelihood of unintentional leaks, as plant systems, structures and components wear out and fail. Palisades' age-related degradation means increasing amounts of radioactivity will be "routinely" released over time. Plans for addressing embrittlement and other aging issues at Palisades are not provided in NMC's Environmental Report in the EIS. Any discussion of 20 additional years of operation at Palisades necessitates a specific plan for addressing embrittlement and aging issues. The most recent NRC report on a potential accident at Palisades, done in 1982, (Calculation of Reactor Accident Consequences or CRAC- 2), predicted that a meltdown and large-scale radiation release from the Palisades reactor would cause 1,000 fatalities and 7,000 injuries in just the first year, 10,000 cancer deaths over time, \$52.6 billion in property damage (based on 1980 census, expressed in 1980 dollars, thus significantly underestimating current and future impacts due to population growth and inflation; adjusting for inflation, property damage could exceed \$100 billion expressed in year 2005 dollars). The above CRAC - 2 report did not take into account a "Beyond Maximum Credible Accident" scenario. We request the EIS provide assessment of the consequences of a "Beyond Maximum Credible Accident" as Palisades' embrittlement status increases the likelihood of such an accident.]

In June, 2011, Jeff Donn of the AP published a four-part exposé on nuclear power safety risks. In his first article, "US nuke regulators weaken safety rules," Donn pointed to rollbacks on PTS standards as the top example of this. See:
<http://www.ap.org/company/awards/part-i-aging-nukes>

Palisades suffered numerous serious accidents in 2011. One, on September 25, 2011, led to an NRC "yellow finding," and landed Palisades on NRC's short list of worst performing reactors in the country. See:
<http://www.beyondnuclear.org/home/2012/1/25/palisades-its-an-accident-waiting-to-happen.html>, including a link to a major, front page exposé in the *Detroit Free Press*:
<http://www.beyondnuclear.org/storage/Freep%201%2015%202012.pdf>.

That very incident, as revealed in NRC's own inspection report, pushed a number of Palisades' degraded systems, structures, and components to the breaking point:
<http://archive.freep.com/assets/freep/pdf/C4183882113.PDF>

Although the ECCS was inadvertently activated, it did not completely work. If it had, the risk of PTS would have been increased even further than it was during the accident.

Embrittlement risks and NRC's weakening of PTS safety regulations to accommodate Palisades was a major subject matter of discussion with NRC Chairman Jaczko at Beach Haven Event Center in South Haven on May 25, 2012. Michael Keegan of Coalition for a

Nuclear-Free Great Lakes, and Don't Waste Michigan, facilitated the presentation made by two dozen environmental group representatives and concerned local residents. The environmental watchdogs expressed skepticism and deep concern when Chairman Jaczko indicated that, if Palisades RPV could not meet embrittlement standards, the methodology could be adjusted. We protested such pencil whipping, such weakening of public health, safety and environmental protections. See <http://www.beyondnuclear.org/home/2012/5/26/environmental-coalition-concerned-residents-met-with-nrc-cha.html>.

I handed copies of the following to Chairman Jaczko and the entire NRC entourage who accompanied him:

“Aging Nuclear Power Plants focusing in particular on irradiation embrittlement of pressure vessels,” by Ino Hisamitsu, published in Nuke Info Tokyo No. 148 (May/June, 2012), posted online at http://www.cnic.jp/english/newsletter/nit148/nit148articles/irradiation_embrittlement.html.

Despite handing out copies to a large number of NRC officials, including the chairman and regional administrator, I never heard back from them about the concerns raised in this article.

The article was continued in the next issue of the newsletter:

“Aging Nuclear Power Plants focusing in particular on irradiation embrittlement of pressure vessels,” by Ino Hisamitsu, published in Nuke Info Tokyo No. 149 (July/August 2012), the newsletter of CNIC Tokyo (Citizens Nuclear Information Center). This article is posted online at http://www.cnic.jp/english/newsletter/nit149/nit149articles/06_aging.html

Embrittlement concerns were also central to the discussion when NRC Commissioner William Magwood IV met with environmental group representatives and concerned local residents at Beach Haven Event Center in South Haven on March 25, 2013. See: <http://www.beyondnuclear.org/home/2013/3/27/coalition-of-concerned-citizens-details-concerns-about-palis.html>

As mentioned above, PTS risks at Palisades was also a central issue discussed with NRC Chairman Macfarlane on June 5, 2014 in Benton Harbor. See: <http://www.beyondnuclear.org/nrc/2014/6/4/residents-environmental-groups-elected-official-meet-with-nr.html>

In conclusion, a large number of environmental groups and concerned local citizens have long objected to weakening PTS safety regulations at the badly embrittled Palisades atomic reactor. Our concerns only grow deeper as time goes on, and the embrittlement worsens. NRC must not weaken its PTS regulations yet again to enable Palisades to keep operating. The risks are too great.

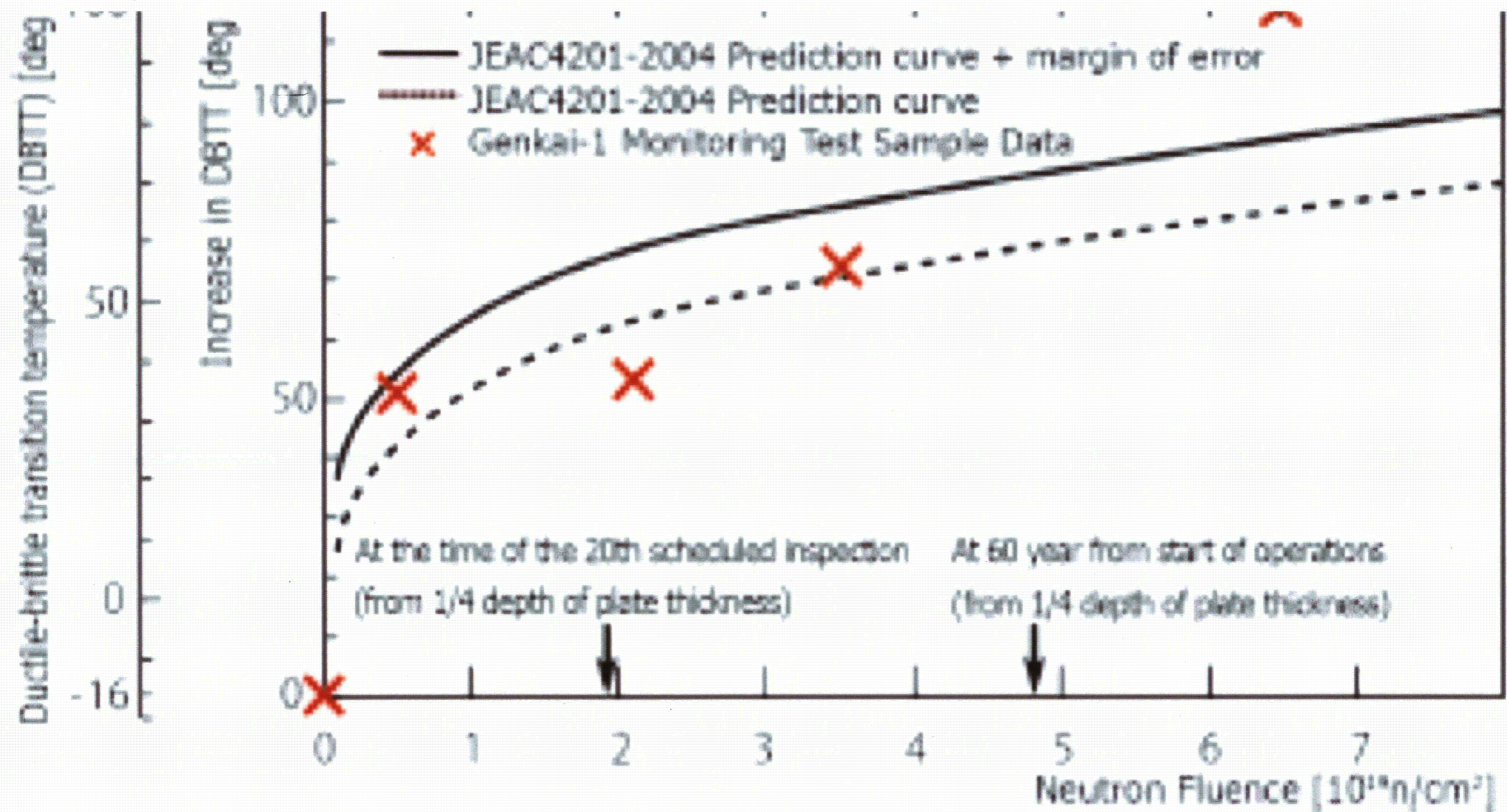


Figure 1.
Genkai-1 Monitoring Test Sample Data and JEAC 4201-2004 Prediction Curve

The Risk of a Meltdown

By Demetrios L. Basdekas

New York Times Op-Ed, March 29, 1982 [the 3rd anniversary of the Three Mile Island meltdown]

Washington—There is a high, increasing likelihood that someday soon, during a seemingly minor malfunction at any of a dozen or more nuclear power plants around the United States, the steel vessel that houses the radioactive core is going to crack like a piece of glass. The result will be a core meltdown, the most serious kind of accident, which will injure many people, destroy the plant, and probably destroy the nuclear industry with it.

On the third anniversary of the Three Mile Island Accident, the Government and industry are unable or unwilling to deal honestly and urgently with far-reaching nuclear-safety problems.

Another serious accident is very likely because the wrong metal was used in the reactor vessels, and with each day of operation, neutron radiation is making the metal more brittle, and more prone to crack in case of sudden temperature change under pressure.

One manufacturer of nuclear reactors has reported to the Nuclear Regulatory Commission that in three to five more years, the vessels in some plants will be too brittle to operate safely. But this estimate is wishful thinking, based on unrealistic assumptions about plant operators' actions and accident sequences. Some plants are already too dangerous to operate without corrective measures.

The commission could do a great deal to prevent such an accident, and stretch out the lives of many of these brittle vessels, if it ordered the type of corrective steps already taken at some European reactors. But the commission, regulating an industry that has serious financial and technical problems, instead of taking initiatives tends to sweep difficult technical problems under the rug, reacting to crises only after they occur.

The commission must realize that this crisis is upon us. A temperature change severe enough to crack a brittle reactor vessel already has occurred, in California, but not at one of the older, more vulnerable plants. The commercial nuclear industry's admirable safety record – no deaths caused by radiation – still is intact, but this cannot last much longer, because the reactor vessels and other critical components are aging.

For many years, it has been known that vessels are becoming brittle. What makes the problem urgent is that the metal is aging more rapidly than expected, and the circumstances that would cause such an accident now seem more likely.

(continued over)

At the Rancho Seco plant, near Sacramento, Calif., in March 1978 a worker dropped a small light bulb into an instrument panel, causing an electrical short circuit. The short wreaked havoc on the plant's control systems – a variety of instruments that run crucial pumps and valves – and the result was that too much water was pumped through the reactor, chilling it suddenly. It is very doubtful that some of the older plants operating today would be able to withstand the same shock. Fortunately, Ranch Seco had been in operation less than two years; had it been in operation for 10, its pressure vessel most likely would have ruptured.

The kinds of control systems that went haywire at Rancho Seco are very likely to fail at crucial times in other nuclear power plants. When a pipe bursts, or a seal fails, or a valve sticks, automatic control and safety systems almost instantly take action to compensate, but they do not always take the right action.

Control systems are not reviewed by the Nuclear Regulatory Commission. They are not immune to fire or power failure; they often have no backups, so are prone to simple failure. They are not even earthquake-proof.

The N.R.C. staff has taken the position that if a plant gets into trouble because of control-system malfunctions, it has safety systems to take care of any problems. But this is not so, as events of the last few years show. At Rancho Seco, at Three Mile Island, and at other plants, control systems not thought vital to the safe operation of a plant ended up causing serious problems.

The Nuclear Regulatory Commission is charged with ensuring that nuclear plants are operated “with adequate protection” of the public health and safety. But bureaucratic foot-dragging and preoccupation with public relations and financial problems of the industry are contributing to a shortsighted view – that technical problems can wait or do not exist. Some members of the staff acknowledge the safety problems associated with control systems, but the agency has yet to demand from utilities operating nuclear power plants the technical data on control systems necessary to assess the systems' safety fully.

It may be that we need nuclear power to maintain our standard of living. But there is a vast difference between having to accept something, and making it acceptable. We can make nuclear power acceptable.

The Nuclear Regulatory Commission chairman, Nuncio Palladino, has spoken of cleaning up our nuclear act. As a private citizen, I hope that we do so, beginning with vigilance at the N.R.C. One more accident the size of Three Mile Island's, and the public's reaction almost certainly will foreclose the nuclear option.

Demetrios L. Basdekas is a reactor safety engineer with the Nuclear Regulatory Commission.

The Palisades Nuclear Power Plant

Highlights of Palisades include:

- Commenced commercial operation in 1971; current NRC operating license expires in 2011.
- License renewal application filed in March 2005; license renewal, anticipated early 2007, would extend the license to 2031.
- Qualified workforce of approximately 470 persons.
- Currently operated on behalf of Consumers by the Nuclear Management Company (NMC).
- Required significant future capital expenditures required above the routine \$20M per year, including:
 - Reactor vessel head replacement \$100 million
 - Steam generator replacement 1991 H.V. L.V. \$ millions
 - Reactor vessel embrittlement concerns
 - Increasing NRC fees and fire protection requirements
 - Containment coatings and sump strainers

Pressurized Thermal Shock Potential at Palisades

Prepared by Michael J. Keegan

Coalition for a Nuclear Free Great Lakes
(July 8, 1993,
Rekeyed August 3, 2005)

History of Embrittlement of Reactor Pressure Vessels in Pressurized Water Reactors

Irradiation embrittlement of the reactor pressure vessels (RPVs) may be the single most important factor in determining the operating life of a PWR. PWR vessels are generally constructed from eight inch thick steel plates, formed and welded to create the vessel structure. The major age-related mechanism associated with this component is embrittlement. Embrittlement is the loss of ductility, i.e., the ability to withstand stress without cracking, in the metals which make up the reactor pressure vessel. Embrittlement is caused by neutron bombardment of the vessel metals and is contingent upon the amount of copper and nickel in the metal and the extent of neutron exposure or fluence. In an unirradiated vessel the metal loses its ductility at about 40 degrees F. As the vessel becomes embrittled, the temperature at which it loses its ductility rises. This change in the mechanical properties of the metal from ductile to brittle is characterized as the reference temperature for nil ductility transition or R_{ndt}. Thus as the reactor ages and RPV is exposed to more radiation the R_{ndt} can shift from its original 40 degrees F to as much as 280-290 degrees F or more in extreme cases. (Server, Odette, Ritchie, "Pressurized Water Reactor Pressure Vessels" Vol. 1, NUREG/CR-4731)

Embrittlement is of even greater concern to those plants constructed prior to 1972. The reason for this is that there is copper in the walls of older vessels. The use of copper was also extensive in the welds of the vessel walls in older reactors. Copper coated wire was routinely used to weld together the large plates which make up the RPV. Palisades began construction in 1967 and went commercial in 1972. (Edelson, "Thermal Shock-New Nuclear Reactor Safety Hazard?", Popular Science, June 1983, p.55-63)

The significance of reactor pressure vessel embrittlement is the increased susceptibility to Pressurized Thermal Shock (PTS). Pressurized Thermal Shock occurs when the reactor pressure vessel is severely overcooled. As the PRV is overcooled, there is a drop in the pressure of the primary coolant loop. This rapid decrease in the pressure of the primary coolant causes the high pressure injection pumps in the emergency core cooling system to automatically inject coolant into the primary loop. As the injection of coolant

repressurizes the RPV, the vessel is subjected to pressure stresses. The stresses placed on the reactor pressure vessel by overcooling and repressurization causes Pressurized Thermal Shock. (Sholly, "Pressurized Thermal Shock Screening Criteria", Report prepared for Nuclear Information and Resource Service, January 1984)

Pressurized Thermal Shock (PTS) can be initiated by a host of mishaps including: instrumentation and control system malfunctions; small-break loss-of-coolant accidents; mainsteam line breaks; feed water pipe breaks; and steam generator tube ruptures. Any of these incidents can initiate a PTS event. If the fracture resistance of the RPV is reduced through neutron bombardment, severe overcooling accompanied by repressurization could cause flaws in inner surface of the RPV to propagate into a crack which breaches the vessel wall. (Thadani, NRC Memorandum RE: Frequency of Excessive Cooldown Events Challenging Vessel Integrity, April 21, 1981)

Without the reactor pressure vessel surrounding the radioactive fuel it would be impossible to sufficiently cool the reactor core and a meltdown would ensue. (Ibid, Thadani) Pressurized Thermal Shock is a safety issue for every pressurized water reactor. (ibid, NUREG/CR-4731 p. 105)

The Nuclear Regulatory Commission has vacillated on the issue of Pressurized Thermal Shock for over twenty five years now. Rtdt limits had been originally set at 200 degrees Fahrenheit. These limits were reached in the early to mid 1980's, the NRC began developing new limits within the framework of the PTS rule. In 1982, the NRC considered Rtdt limits of 230 and 250 degrees F for longitudinal and circumferential welds respectively. By 1985, the NRC sought to amend its regulations on Pressurized Thermal Shock. New reference temperatures established limits of 270 degrees F for plate materials and axial welds and 300 degrees F for circumferential welds. (Ibid, Edelson)

The Commission (NRC) attempted to gloss over the fact that an increase in the Rtdt translated into a decreased margin of safety. An NRC press release said the rule constituted "further protection from Pressurized Thermal Shock". (Demetrios L. Basdekas, Letter to New York Times, 1985) To cope with the most severely embrittled reactors the NRC has allowed some plants to redesign the configuration of the fuel rods so that fewer neutrons bombard the RPV wall.

(The above text has been excerpted from Chapter IV of: "The Aging of Nuclear Power Plants: A Citizens Guide to Causes and Effects" Nuclear Information and Resource Service, August 1988 authored by James Riccio and Stephanie Murphy. Use granted by James Riccio.)

Embrittlement at Palisades

As early as July of 1981 the NRC identified the Palisades reactor as one of fourteen pressurized water reactors (PWR) with serious embrittlement problems. These fourteen embrittled plants are especially troublesome at high pressures and low temperatures, and can cause the pressure vessel to crack like hot glass dunked in cold water. At normal operating temperatures embrittlement poses no problem. But with a rapid drop in coolant temperature, caused by a very common scram or transient, the pressure vessel 's insides try to contract. The outside of the vessel is still very hot and the temperature differential creates enormous tensile stresses. (Excerpts from Not Man Apart, Nov. 1981, published by Friends of the Earth)

According to Public Citizen Nuclear Lemons report (July 8, 1993) Palisades has experienced nine scrams in the previous three years ranking it the tenth worst in the nation (1993). As noted above these are precisely the conditions which can lead to pressure vessel rupture if embrittlement is present. Embrittlement at Palisades in 1981 was reported to occur at temperatures of between 190 and 220 degrees F. (Ibid, excerpts from Not Man Apart) As noted earlier the NRC had originally set reference temperature for nil ductility transition (Rtndt) at 200 degrees F. As early as 1981 Palisades had exceeded these original Rtndt limits.

Very little can be done to forestall or avoid the problem; it is a process of aging. A number of fuel rods can be reconfigured and operating temperatures reduced; this simply slows the rate of embrittlement and substantially reduces the output of the reactor. This reduces the efficiency or capacity factor of the reactor. (Ibid, excerpts from Not Man Apart) Redesign of the configuration of the fuel rods at the Palisades plant is precisely what has been done in attempts to mitigate the ever increasing embrittlement of the Palisades reactor pressure vessel.

The following is a synopsis of a Consumers Power Company document dated May, 1990 entitled: "Analysis of the Reactor Pressure Vessel Fast Neutron Fluence and Pressurized Thermal Shock Reference Temperatures for the Palisades Nuclear Plant" authored by the Reactor Engineering Department at Palisades.

In a cover letter dated May 17, 1990 discussing the May report it is concluded that the Pressurized Thermal Shock (PTS) screening criteria will be exceeded at the axial welds (vertical welds) in September of 2001. Also, "that the flux reductions achieved in the Cycle 8 and 9 core loading patterns are, by themselves, insufficient to allow plant operation to the current expected end of life in (the year) 2011"... "Further measures, eg, greater flux reduction, Regulatory Guide 1.154 analysis, vessel shielding etc, are necessary to allow plant operation to the nominal end of plant life and beyond."

Initiated with fuel cycle 1 and continuing through fuel cycle 7 core loading patterns were typical of out-in fuel management, in that fresh fuel was placed on the core periphery. This approach results in the maximum overall core neutron leakage and flux to the

reactor pressure vessel. This is the neutron bombardment which leads to embrittlement, this took place from 1971 through approximately 1987. Beginning with fuel cycle 8 thrice used fuel assemblies with stainless steel shielding rods were located near the axial weld locations on the core periphery. These are the locations where embrittlement is of the most concern. With the fuel cycle 8 reconfiguration flux reduction of a factor of two were reported at the axial weld locations. Similar measures will be incorporated in fuel cycle 9. (Ibid, May 1990 p.1) However as noted in July of 1981 the Palisades plant was already experiencing embrittlement problems. (Ibid, Not Man Apart)

The old adage "like closing the barn door after the horse is out" comes to mind.

Operation beyond the end of cycle 8 (September 1990) was assumed to occur at 75% capacity. With no flux reduction utilized, the PTS screening criteria would be exceeded at the axial welds in 1995. With flux reduction incorporated in cycle 9 and beyond, the PTS limit would be exceeded at the axial welds in September, 2001. These predicted dates are far short of the assumed nominal plant operating license expiration date of March, 2011. (Ibid, May 1990 p. 4) In order to get to the year 2001 before exceeding PTS limits it is assumed that the plant will not exceed 75% capacity factor after cycle 8. (Ibid. May 1990 p. 12)

The models for determining vessel flux and fluence calculations are extrapolations. The last actual measurement data (from the suspect axial welds) that was taken for comparison from an analysis of radiometric dosimeters irradiated in the W-290 vessel wall surveillance capsule was removed at the end of cycle 5. (ibid, May 1990 p. 8) There are methodological uncertainties with the reliance on proxy indicators of energy generation data, and reactor power history to determine the level of vessel embrittlement. The computer models employed to estimate the level of flux and fluence and ultimately vessel embrittlement are subject to "GIGO". That is garbage in, garbage out, they are at best estimates based on many assumptions, they are not actual analysis of the metal.

Specifically the problem axial welds identified which would limit the life of the Palisades reactor are located at 0 degrees and 30 degrees. It is not clear if these are the only axial welds that are suspect. In the methodology section 3.3 Geometry it is stated that the Palisades reactor exhibits 1/8 th core symmetry, thus only a zero to 45 degree sector has been included in the DOT model. Are there suspect axial welds in the remaining 7/8 th's of the vessel? Are there suspect circumference welds?

Consumers Power Company (Now CMS) acknowledges a calculational uncertainty of + / - 25% is estimated in the calculated vessel wall fluence, this is said to be typical of current neutron transport methodology uncertainties. Considering the consequences of a core meltdown the + / - 25% margin of error is not acceptable.

Consumers Power Company goes on to discuss other means to maximize vessel lifetime including areas of greater flux reduction; waiting for the NRC to again relax PTS standards; data manipulation and use of other estimating models; vessel annealing (artificially overheating the vessel to bring back the ductility); and shielding actions to

reduce the accumulated vessel embrittlement rate. (Ibid, May 1990 p. 45) These are all measures that were never considered or conceived when the promise of "too cheap to meter" was the talk of the day.

As it stands the outside limit on the life of Palisades is the year 2001, running at a 75% capacity factor with a +/- 25% margin of error on neutron bombardment. These are serious economic constraints. All of this with the perpetual threat of loss of the containment due to Pressurized Thermal Shock coupled with the danger of storage of High Level Nuclear Waste on the shore of Lake Michigan. Consider the risk: The NRC commissioned a study from the Sandia Labs which was to provide an assessment of a worst case accident at each U.S. nuclear power plant. The 1982 study concluded that there would be 52.6 billion dollars (1980 dollars) of damage at Palisades. 13,000 deaths due to cancer would occur. This study does not consider the loss of 20% of the world's surface fresh water.

Continued operation of the Palisades nuclear power plant constitutes poor economics and poor public policy. The day has come to shut down Palisades for economic, environmental, and safety reasons. The Coalition for a Nuclear Free Great Lakes calls on the Michigan Public Service Commission to hold public hearings concerning the viability of the Palisades plant and to place the onus upon Consumers Power Company to show cause as to why the plant should not be removed from operation.

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Complete Halt of All Nuclear Power Plants in Japan But for how long can restarts be prevented?



May 5 is "Children's Day" in Japan, a holiday on which the happiness of children is celebrated. On this day in 2012, the children received the special gift of the total shutdown of all Japan's nuclear power plants. The one reactor that was online, Hokkaido Electric Power Company's Tomari Unit 3 (PWR, 912MW) was halted for regular maintenance.

At the time of the accident at Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi Power Station, Japan's nuclear reactors numbered 54. A year later, on April 19, Fukushima Daiichi Power Station's Units 1 to 4 (BWR, Unit

1,460MW, Units 2 to 4, 784MW each) were officially decommissioned, leaving the

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Man wears a Japanese helmet (kabuto) to wish for the happiness and well-being of children at the "Goodbye to Nuclear Power Plants" Rally on May 5 in Tokyo.

number of reactors in Japan currently at 50. After the Fukushima nuclear accident, nuclear reactors that had been halted due to regular maintenance or problems before the Fukushima nuclear accident occurred, and those shut down for regular maintenance one after the other in the weeks and months following the nuclear accident could not be restarted. As a result, all of Japan's nuclear reactors are now shut down.

The government and the power companies have tried desperately to get even one or two reactors restarted in order to avoid this total shutdown scenario, and now that all the reactors have been halted their intention is to break out of this situation as soon as possible. But they are faced with strong resistance; that of gaining the approval of the local administrations of the areas in which the power plants are located. Legally, the local administrations have no power to prevent restarts. Under the safety agreements concluded between the power companies and Fukui Prefecture, Niigata Prefecture and the administrative units (cities, towns and villages) in which the power plants are located, when it is judged that there is a need for special measures to be taken following an on-site inspection by administrative body officials, the administrative body can demand that the power company take appropriate measures, including the shutting down of reactors, and it is specified that in the case of shutdowns consultations must take place before reactors are restarted.

In the case of Fukui, even when

the state establishes a special commission to investigate an accident, there must be consultations prior to reactor restarts. Naturally, however, this is limited to the reactors in which the accident actually occurred. In addition, these are consultations, and it is considered that 'prior approval' is not in fact required. In agreements other than the Fukui and Niigata Prefecture agreements there is not even mention of prior consultations. That restarts cannot be implemented without the prior approval of local administrations is, of course, due to strong public opinion following the Fukushima nuclear accident. Moreover, because of the spread of nuclear contamination that took place as a result of the Fukushima nuclear accident, not only the local administrations where nuclear power plants are located but surrounding administrations are also insisting that the power companies seek their approval before reactor restarts (as well as the conclusion of safety agreements).

On April 13, the government, in a meeting of the Prime Minister, the Minister of Economy, Trade and Industry, the Minister of the Environment and for the Restoration from and Prevention of Nuclear Accidents, and the Chief Cabinet Secretary judged that proposed restarts of the Kansai Electric Power Company's (KEPCO) Ohi nuclear plant Units 3 and 4 (PWR, 1,180MW each) were appropriate. On the next day, April 14, the government explained this decision to the local administration, Ohi Town in Fukui Prefecture, and to adjacent Shiga Prefecture and Kyoto Prefecture on April 23, urging their 'understanding.' In response, Fukui Prefecture indicated that it would initiate verification of the decision in the prefecture's Nuclear Power Safety Specialist Committee and Shiga and Kyoto Prefectures each stated their intention of deliberating the matter in specialist committees of experts.

Prior to the government explanation, Shiga and Kyoto Prefectures submitted a seven-point proposal to the government on April 17 in which they demanded the early establishment of the Nuclear Regulatory Agency and a roadmap indicating a phase-out of reliance on nuclear power, showing that 'understanding' was still quite some way off. Further, on April 10, Osaka Prefecture and Osaka City, one step further away from Fukui Prefecture, announced eight conditions, including the conclusion of safety agreements with local administrations within 100 km of nuclear power plants, which was submitted to the government on April 24. Fukui Prefecture

had already, on September 15, 2011, demanded that the government strengthen disaster prevention measures such as the early construction or improvement of roads for disaster control, as well as making restarts conditional on such matters as the public announcement of all information concerning the Fukushima nuclear accident. Opinion polls conducted by mass media companies also showed that opposition to restarts was running strong and that the hurdles to nuclear reactor restarts are, in fact, very high.

In spite of this, it is not easy to predict how long restarts can be prevented. **The most important thing is to prevent restarts from occurring for as long as possible and show for a fact that there is no non-nuclear power supply shortage problem in Japan, even in overcoming the summer peak power demand.** It is undoubtedly for this reason that the government and the power industry want to restart as many nuclear reactors as possible in order to be able to say that we were spared blackouts thanks to nuclear power. Concerning power supply, the government and the power industry are disseminating the propaganda that if nuclear reactors remain shut down demand will exceed supply, especially in KEPCO's generating region. However, with regard to KEPCO's estimated power demand, several experts have pointed out that KEPCO has underestimated both its supply estimates and the effect of power saving compared with other power companies, and that power supply compatible with demand is possible by purchase of power from other suppliers.

In any event, the implied notion that "power supply is more important than safety" is mistaken. Even though that may be so, over and above that, and with the background of the proof that there is no non-nuclear power supply shortage problem, we would like to bring about a phase-out of nuclear power through clear enshrinement in laws as the policy of the state and/or as the firm decision of the power companies. While a nuclear phase-out may be fraught with difficulties, it is not always clear exactly what those difficulties are. Once the country is determined to implement a nuclear phase-out policy, the difficulties will then become clear in a much more concrete form. It is, indeed, only in this way that appropriate countermeasures can be set up.

The government has said that it will initiate a national public discussion on energy

policy. The new energy policy, entitled the "Innovative Energy and Environmental Strategy" is due to be finalized sometime this summer. Formulation of the "Strategy" is to be coordinated by an "Energy and Environment Council" consisting of the Minister for National Strategy as chairperson, and the Ministers of Economy, Trade and Industry; Education, Culture, Sports, Science and Technology; and the Minister for the Restoration from and Prevention of Nuclear Accidents. It is said that the "Strategy" will reflect discussions on a review of the Framework for Nuclear Energy Policy and the Basic Energy Plan.

The Framework for Nuclear Energy Policy is a document drawn up and approved by the Atomic Energy Commission, and the task of drawing up a revised version began in late 2010. The Basic Energy Plan is drawn up by the Advisory Committee for Natural Resources and Energy, a consultative body of the Minister for Economy, Trade and Industry, is approved by cabinet decision and takes the form of policy drawn up by the government. The Plan was revised recently, in 2010, and since it has a very strong bias towards the promotion of nuclear power, following the Fukushima nuclear power plant earthquake disaster it is due to be reviewed "from scratch."

The review of the Basic Energy Plan will indicate options for the composition of power supply from different sources (nuclear power, thermal, renewables, etc.), and the revision of the Framework for Nuclear Energy Policy will show options for the nuclear fuel cycle (reprocessing of all used fuel, direct disposal, and storage), data such as costs and CO₂ emissions being given for each of these options. The options for the new energy policy will then be the subject of national discussion. The options themselves look as if they will present problems, since the effect of energy conservation and other efforts are likely to be underestimated for each of the options, leading to a higher estimate for total power demand. CNIC's Hideyuki Ban is participating as a committee member in both reviews and is struggling to ensure that at least some meaningful options are taken up. In the end, however, it is crucial that it is the people of the nation who decide energy policy and that the solicitation of opinions does not become a mere exercise in formality.

(Baku Nishio, CNIC Co-Director)

Labor Standards Inspection Office in Yokohama recognizes death of Fukushima nuclear worker as eligible for compensation

On February 24, the Yokohama Minami Labor Standards Inspection Office (LSIO) determined that the fatal heart attack of a worker, Nobukatsu Osumi, at the Fukushima Daiichi Nuclear Power Station in May 2011 was caused by overwork, and recognized his death as a workplace accident eligible for workers' compensation. This is the first time in which compensation has been recognized for the illness or death of a worker at the nuclear accident site.

Mr. Osumi was hired as a temporary worker by a construction company, a fourth-level subcontractor under the prime contractor Toshiba Corp., in Omaezaki City, Shizuoka Prefecture, and was dispatched to the Fukushima Nuclear Power Station. At around 2:30 a.m. on May 13, he left the workers' dormitory, quite a long distance from the nuclear accident site, and began his first three-hour shift, from 6:00 to 9:00 a.m., working on piping and other work for installing waste processing equipment in a radioactive waste disposal facility at the complex.

On the second day, at around 6:50 a.m. on May 14, he collapsed while carrying a special kind of saw. He was rushed to the plant's first-aid room, but the doctor was off duty, and at 8:10 he was transported to J Village, a sports facility about 20 kilometers away from the plant now being used as a logistical base for workers at the Fukushima nuclear accident site, which did not have sufficient medical equipment. He was then taken to a hospital in Iwaki City by ambulance, where he died at 9:33 a.m..

It took more than two hours from the time when Mr. Osumi complained of not feeling well to his arrival at the Iwaki hospital. Following his death, some experts criticized the deficiencies in the plant's emergency care system for workers. In response, plant operator Tokyo Electric Power Co. (TEPCO) has at last placed a doctor on standby 24 hours a day. While working at the plant, Mr. Osumi received only a small radiation dosage, 0.68 millisieverts (mSv). According to some media reports, when Mr. Osumi's family applied for workers' compensation TEPCO commented that the company did not believe there was a strong connection between the work and his death. Meanwhile, Toshiba said the relationship between the work and his heart attack was not clear, and that, at that stage it was difficult to judge whether or not it was a workplace accident. To date, neither Toshiba nor TEPCO have offered consolatory money or

other compensation, customary in Japan when a worker dies at the workplace, to his bereaved family.

LSIO attaches importance to the extremely severe working environment at Fukushima plant

Although Mr. Osumi only worked for a total of just under four hours on the two days, the work was carried out in a harsh environment, wearing a mask and protective clothing, and entailed traveling a long distance late at night followed by work in the early morning. LSIO concluded that the extremely severe working environment placed heavy mental and physical burdens on the worker, resulting in the heart attack, and therefore recognized his death as due to overwork for a short period of time, which is eligible for compensation.

The Ministry of Health, Labor and Welfare (MHLW) says it will recognize brain or heart disease as a 'workplace accident eligible for compensation' only when the patient was involved in one of the following three cases immediately before the development of the symptom, 1) a long period of overwork, 2) extremely hard work for a short period of time, or 3) an abnormal occurrence (e.g. an accident).

Up to now, however, it has proven very difficult for nuclear power station workers to win LSIO recognition for workplace accidents. The recent government recognition of the working environment at the nuclear power station as extremely severe is, therefore, a landmark admission, and is expected to pave the way for relief for workers who have become ill or who have been involved in an accident at the site.

Mr. Osumi is not the only worker to have died while working at the Fukushima Daiichi Nuclear Power Station. Three others have lost their lives while working there, including a male worker engaged in the management of radiation exposure doses of other workers using the resting station. He died of leukemia despite the fact that he was engaged in this work for only seven days in early August last year. His cumulative radiation exposure was 0.5 mSv, and his internal exposure is said to have been zero.

Another male worker in his 50's, who began work at the site on August 8, collapsed and died on October 6 while working on the installation



Medicare room at J-Village (Photo by TEPCO)

of a tank for storing contaminated water from the crippled reactor units. The cause of his death was shock from blood poisoning resulting from a retroperitoneal abscess. On the previous day, at around 7 a.m., he became unable to walk and complained of feeling ill as he was heading for a regular morning work meeting. His cumulative radiation exposure was 2.02 mSv.

The third worker was engaged in pouring concrete in the sludge waste storage facility, under construction at the time, on January 9, 2012 when he complained of feeling unwell. He was rushed to the emergency care room at Units 5 and 6, but he fell into a state of respiratory arrest and was taken to a hospital in Iwaki City.

As of the end of February 2012, a total of 35 applications for workers' compensation had been filed by workers at the nuclear accident site. In September 2011, MHLW Minister Yoko Komiyama stated that she intended to relax the conditions for granting workers' compensation to nuclear power station workers so that workers suffering from various types of cancer would become eligible for compensation. We hope this plan will be implemented and that more nuclear power station workers will be able to receive such compensation.

Two persons have also died in decontamination work

Decontamination work is currently being carried out in many parts of Japan, and two people have already died while engaged in such work. On December 12, 2011, a male worker participating in a model decontamination project in Shimo-oguni, Ryozen-machi, Date City, Fukushima Prefecture,

was found unconscious in a truck during lunch break. He was in a state of respiratory arrest and died in hospital about one hour later. The cause of his death is yet to be announced.

The Nuclear Disaster Countermeasures Headquarters of the Cabinet Office and the Japan Atomic Energy Agency jointly announced on January 17, 2012 that another male worker involved in

a model decontamination project in Hirono Town, Fukushima Prefecture, collapsed while working and died in hospital of a myocardial infarction.

In the short space of just two months from October last year, a new regulation on decontamination was enacted and went into full effect on January 1, 2012. This regulation applies to the whole area of Fukushima Prefecture, and to some areas of Iwate, Miyagi, Ibaraki, Tochigi, Gunma, Saitama, and Chiba Prefectures in which radiation doses are expected to exceed 0.23 microsievert per hour ($\mu\text{Sv/hr}$). These areas are designated as "special decontamination zones" where decontamination work should be carried out under direct government control, or "priority areas for contamination surveys," where the decontamination of land plots, including the removal and collection of contaminated soil, is to be carried out. The annual radiation exposure limit for decontamination workers is 50 mSv and the five-year limit 100 mSv, the same level as that for nuclear power station workers.

As for decontamination work to be conducted in other places, such as in company premises and branch offices, the government calls on volunteer workers, the self-employed, or local residents participating in the work to observe the new regulation. We will keep a close watch on the development of this problem of the radiation exposure of decontamination workers, in addition to the exposure problems of nuclear power station workers.

(Mikiko Watanabe, CNIC)

Inspections of vitrified HLW returning from Britain reveal radioactive contamination on canister surfaces

What is the cause of this and how should Japan respond?

On Aug. 3, 2011, 76 canisters of vitrified high-level waste (HLW) were shipped from Sellafield in Britain, arriving at the port of Mutsu-Ogawara, Aomori Prefecture, on Sept. 15. Japan Nuclear Fuel Ltd. (JNFL) announced on Oct. 12, 2011 that radioactive contamination was discovered on the surface of three of the 28 canisters which were contained in the No.1 transport flask. The HLW in these canisters originated from the Kyushu Electric Power Company.

Before storing the returned HLW in the high-level radioactive waste storage control center (in the Rokkasho Reprocessing Plant in Aomori Prefecture) its condition was checked for heat output, external appearance, size, weight, radiation emissions, confinement of radiation, and contamination of the surface. When a smear test revealed that the surface of some of the vitrified HLW canisters were contaminated with radioactive substances and that the contamination level was higher than the reference level, decontamination measures (wiping) were taken repeatedly. The reference level for the concentration of total alpha radiation is 0.4 Bq/cm², and that for total non-alpha radiation 4 Bq/cm². If repeated wiping of the surface reduces the contamination level to below the reference level, the canisters pass the test.

The table below shows the results of the tests that began on Sept. 21. We asked for these data in mid-November. Repeated wiping was conducted on two of the three canisters whose surface was found to be contaminated. With regard to the remaining canister (B05144), an extremely high level of concentration of non-alpha radiation, 400 Bq/cm², was detected in the initial test, a contamination level 100 times higher than the reference level. Since then, a total of 29 tests have been carried out on the canisters. Some of the tests revealed a decline in the contamination level, while other tests showed higher levels. This may indicate that radiation is leaking from the canisters.

This accident is serious. The inspection jointly conducted by JNFL, Kyushu Electric Power Co. (KEPCO) and Nuclear Fuel Transport Co. in Britain

prior to the shipment of the vitrified HLW revealed no radioactive contamination on the surface of the canisters. If the contamination emerged during the transportation period, only a matter of several weeks, this means that there must be a serious problem with the integrity of the canisters. Possible causes of this flaw are defective welding on the canister and damage to the surface of the canisters. Unless full-fledged investigations into the cause of this problem are carried out, including the re-examination of the whole process of HLW vitrification, and sufficient measures taken to prevent a recurrence of the problem, the transport of vitrified HLW must be halted.

(Reported on Nov. 19, 2011)

This is a follow-up report on the radioactive contamination on the surface of the vitrified HLW canisters returned from Britain to Japan on Sept. 15, 2011. The canister (B05144), whose surface was found to be contaminated with an extremely high level (400 Bq/cm²) of non-alpha radiation, 100 times higher than the reference level, was wiped several tens of times and was said to have cleared the reference level. On Dec. 26, the canister was stored in the storage pit at the high-level radioactive waste storage control center in the Rokkasho Reprocessing Plant in Aomori Prefecture.

Three months later, on March 23, 2012, JNFL and KEPCO, the owner of the vitrified HLW, jointly announced the suspected cause of the contamination of the canister surfaces and measures to prevent a recurrence of the problem. As to the cause, they claimed that in the production process, fine glass powder containing radioactive substances became attached to the surface of the canister where the lid fits onto the body of the canister. The worker, however, welded the lid on without removing the glass powder stuck on the surface of the canister, and as a result of this, the glass powder melted and formed a thin film of glass on part of the surface. The vitrified HLW was then shipped to Japan. According to the two companies, in the JNFL inspection conducted prior to the storage

Canister Number: B04773

Test number	1	2	3
Alpha Radiation(Bq/cm ²)	0.071	0.038	0.021
Non-Alpha Radiation(Bq/cm ²)	8.8	4.9	1.9

Canister Number: B04851

Test number	1	2	3	4	5	6	7	8	9
Alpha Radiation(Bq/cm ²)	0.17	0.11	0.034	0.022	0.017	0.013	0.011	0.009	0.027
Non-Alpha Radiation(Bq/cm ²)	22	13	4.0	2.5	1.8	1.3	1.1	0.76	2.0

Canister Number: B05144

Test number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Alpha Radiation(Bq/cm ²)	3.1	1.4	0.64	0.22	0.70	0.40	0.18	0.14	0.11	0.076	0.066	0.048	0.046	0.034	0.028
Non-Alpha Radiation(Bq/cm ²)	400	190	83	29	91	52	23	18	14	10	8.2	5.8	5.6	4.0	3.3
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
	0.073	0.040	0.042	0.043	0.045	0.039	0.040	0.039	0.034	0.029	0.026	0.026	0.026	0.025	
	9.1	4.9	5.1	5.2	5.5	4.7	4.9	4.7	4.3	3.4	3.5	3.1	3.0	2.9	

Table showing results of tests on the three contaminated HLW canisters

of the glass blocks, the crane that lifted the glass blocks came into contact with the contaminated surface, crushing the glass film into small pieces, thereby exposing the contamination.

Thus far, no detailed data on this incident have been disclosed, and no explanation has been given for the details of the contaminated canister surfaces, the vitrification process in Britain, or why (or how) the lid was the cause of the contamination.

Referring to preventive measures, it has been suggested that there will be more frequent visual inspections using cameras in Britain. Should radioactive contamination be discovered on the canister surface during physical inspections, additional bead blasting, a process for

removing surface deposits by spraying fine stainless-steel beads at a high pressure, will be carried out. However, the fact remains that beat blasting was conducted in Britain after the vitrified HLW was loaded into the canisters, and inspections did not detect contamination on the canister surface.

Under the current circumstances, the only measure that can be taken when contamination is discovered in the pre-storage inspection is to apply more bead blasting to the surface of the vitrified HLW canisters produced in Sellafield. Bead blasting,

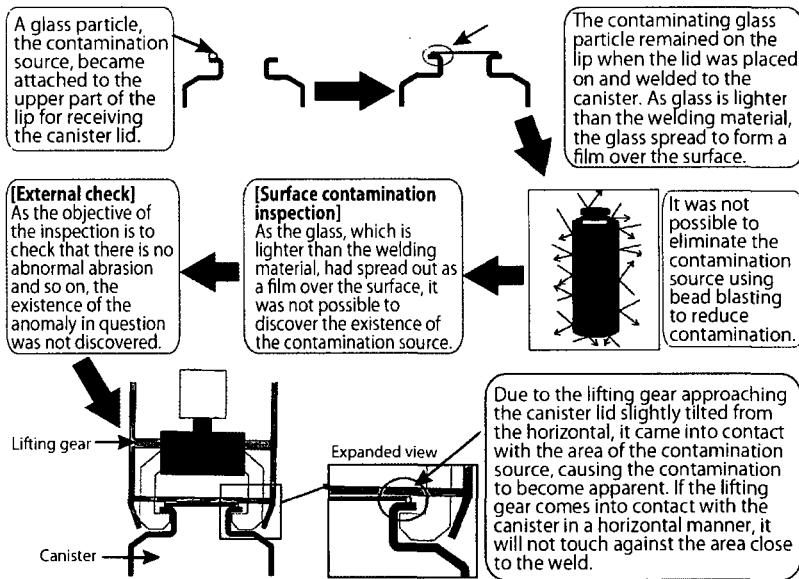


Diagram outlining inferred cause of contamination (Based on Japan Nuclear Fuel Limited website)

however, has a number of shortcomings, for example, that it will create more nuclear waste, and that it will aggravate the contamination of the canister surface if the beads themselves become contaminated. As things stand now, JNFL is considering the quite natural response of refusing to accept the return of the vitrified HLW to Japan if it is impossible to decontaminate the canisters.

(Reported on April 11, 2012)

(Masako Sawai, CNIC)

International Symposium on the Truth of the Fukushima Nuclear Accident and the Myth of Nuclear Safety

The March 11, 2011 Fukushima Daiichi nuclear disaster showed the tragic consequences that may occur when nuclear technology gets out of control.

The causes and the process by which the accident occurred have still not been determined, but some people associated with the nuclear power industry continue to promulgate the nuclear safety myth. Arguing that the Fukushima accident was the result of lax management and a larger-than-predicted tsunami, they blithely claim that as long as nuclear power plants are properly managed they can be operated safely.

From a scientific and technical perspective, and to the extent currently possible, this international symposium will attempt to get to the bottom of the Fukushima Daiichi nuclear accident. The symposium will look at Japan's nuclear energy policy and how it trivialized safety, and, by analyzing the facts, show how this led to such a massive nuclear accident.

Dates: August 30 & 31, 2012

Venue: Tokyo University Komaba Campus, Building 18, First Floor Hall (seats 200), JAPAN

Draft Program

What Happened at the Fukushima Daiichi Nuclear Power Plant

Current Status of Radioactive Contamination

Japan's Nuclear Policy and Formation of the Safety Myth

The State of Nuclear Science and Technology

Summing Up – from the Perspective of Scientists and Technologists

Speakers

Mitsuhiko Tanaka, Arnie Gundersen, Katsuhiko Ishibashi, Tetsuji Imanaka, Hitoshi Yoshioka, Philip White, Tetsuya Takahashi, Miranda Schreurs, Satoru Ikeuchi and more...

15th No Nukes Asia Forum in South Korea

“No Nukes”: Residents speak out in Samcheok and Yeongdeok, proposed sites for new nuclear power plants



Photo by A. Kobayashi

Since the Fukushima nuclear accidents, there have been moves around the world to reconsider nuclear energy policies, but, as always, there are also counter moves which ignore the fervent cries of the people. In March several pro-nuclear conferences were held in South Korea in quick succession. The Pacific Basin Nuclear Conference was held in Busan from March 18 to 23, the Nuclear Industry Summit was held in Seoul on March 23, and the Nuclear Security Summit was held on March 26 and 27. It was in this context that Energy Justice Actions and other South Korean NGOs organized the 15th No Nukes Asia Forum (NNAF) from March 19 to 24. A total of 42 people attended the forum, 32 of these from Indonesia, the Philippines, Thailand, Taiwan and Japan.

Due to the Nuclear Security Summit, the atmosphere at the airport was very tense. Without giving any reason, the South Korean Government refused entry to one of the Japanese NNAF participants. On the morning of March 19 a press conference was held in front of the Sejong Center to protest the denial of entry to Shin Kurumizawa from Osaka and the deception of the Nuclear Security Summit.

After that we attended an assembly of

Catholic priests in Samcheok, Gangwon-do. Along with Yeongdeok in Gyeongsangbuk-do, Samcheok was selected last December by Korea Hydro & Nuclear Power as the site of a new nuclear power plant. There were banners everywhere saying “No Nukes!”

One of the participants was Kenichi Hasegawa, a dairy farmer from Iitate Village in Fukushima Prefecture. He told how after the accident he was forced to destroy all his cows and how the eight members of his family were scattered. He said, “The mountains and farmland of my home town were contaminated with radioactivity. I want Fukushima to be the last place where people have to go through this kind of experience.” At a demonstration of about 1,500 people we chanted “Absolutely no nukes!” and “Recall the mayor,” while onlookers joined in the chanting.

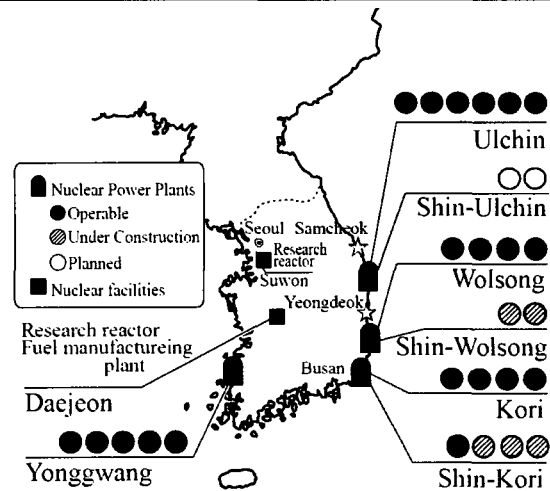
At the meeting in the evening, Mr. Hasegawa showed photos. “Iitate was a place where everyone cooperated to make the village beautiful. After the accident we had to escape, leaving behind our cows, who were like family to us.” There were sighs from the audience as we heard stories of women saying goodbye to their cows which were being led off to the slaughter, of a suicide

note from a despairing friend, and of cows dying of starvation.

Emily Dela Cruz from the Philippines gave a report on how in 1986 they prevented operation of the Bataan Nuclear Power Plant, which was built in 1984. Behind their success was a persistent movement from the mid 1970s along with citizens' education. The civil society movement reached its peak at the end of the Marcos era in the mid 1980s. I was moved once again to hear how a strong people's movement was able to prevent a nuclear power plant from being started up. I am sure it gave courage to the people of Samcheok.

The following day, after a tour of the proposed site of the Samcheok nuclear power plant we went to Yeongdeok. Lee Byeong-hwan, the leader of the Stop Yeongdeok Nuclear Power Plant Committee expressed his opposition, saying, "The proposed site is in a region of active faults. The nuclear power plant will destroy the marine ecology." Yeongdeok has on three occasions repelled nuclear-related facilities, including a radioactive waste dump.

At the forum Setsuko Kuroda from Koriyama City in Fukushima Prefecture explained the painful situation that the people of Fukushima find themselves in. Lai Fenlan from Taiwan's Green Party said, "Taiwan's anti-nuclear movement developed in close association with the fight for democracy. We learned from the renewable energy policies of Germany and grew the movement in solidarity with Green Parties throughout the world." Pan Han-Shen, who was a Green Party candidate, said, "Our national support rate is not that high, but on Orchid Island, the site of a radioactive waste dump, our support rate is 36%, making us the second strongest party." After that, Lin Shih-Lan, an indigenous person from Orchid Island, gave a report about the staggering situation on the island. "At first we were told that a canned fish factory would be built. At the disposal site people don't wear any protective clothing. The windows are left wide open, so radioactive materials and radiation are released to the outside. This is happening because there is no strict regulation of operations." He also said, "70% of the workers at the disposal site are indigenous people. There is a big pay difference between the indigenous people and the other workers," indicating that indigenous people are discriminated against in terms of wages



Nuclear Facilities in South Korea

On March 21 in Busan we carried out a protest action against the Pacific Basin Nuclear Conference. At a meeting about the Fukushima nuclear accident I reported on the situation of workers at the Fukushima Daiichi Nuclear Power Plant. Setsuko Kuroda and Saeko Uno, an evacuee from Fukushima, reported on the difficult conditions of the disaster victims.

On March 22 we participated in an international meeting at Sogang University in Seoul. The meeting was held in opposition to the Nuclear Security Summit and several NNAF participants gave presentations.

On March 23, on the way to a press conference opposing the Nuclear Industry Summit, hoards of police blocked the subway station passageways. We quickly unfurled our placards and chanted "No more Fukushimas! No more Fukushimas! No more nuclear energy in Asia!" Mass media cameras flashed, lighting up the protesters, who did not budge in spite of harassment from the police. Our subway press conference was a great success. In the afternoon, NNAF participants released a joint statement and decided that the next NNAF meeting would be held in Indonesia.

It was the first time for me to participate in NNAF. It was a very moving experience and a tremendous inspiration for me to take action and exchange opinions with the participants, who came from many countries. I hope to make the most of the experience in my future activities. I also hope that as friends united by a common goal, we can continue to deepen our solidarity.

(Mikiko Watanabe, CNIC)

Aging Nuclear Power Plants focusing in particular on irradiation embrittlement of pressure vessels

Hiromitsu Ino

Outline of Neutron Irradiation Embrittlement in Aging Nuclear Power Plants

Destruction of a reactor pressure vessel due to neutron irradiation embrittlement should be called an *extreme* severe accident. If the pressure vessel breaks, there is almost no way of preventing a runaway chain reaction. Such extreme damage must be avoided at all costs.

The benchmark for irradiation embrittlement is the ductile-brittle transition temperature (DBTT). If an extreme situation arises, such as pipe rupture due to an earthquake, it is necessary to cool the core using the emergency core cooling system (ECCS). However, if the DBTT is high, this becomes a dangerous operation. When cooled suddenly, a temperature difference arises between the inner and outer walls of the pressure vessel and strong tensile stress is brought to bear on the inner wall. If such tensile stress is applied when the temperature is below the DBTT, there is a danger that cracks could occur in the pressure vessel wall, leading to failure of the pressure vessel and a severe accident.

Table 1 shows Japanese nuclear power reactors in descending order of the DBTT of their pressure vessels. The table shows seven reactors in which DBTT exceeds 50°C. They are all old reactors that began operating in the 1970s.

Genkai-1 is the worst. The DBTT for this reactor was announced in October 2010. The figure comes from the most recent test of monitoring specimens in April 2009. The DBTT rose 42°C since the previous test result of 56°C in February 1993. This is a new record for Japan. This reactor will be discussed in detail in NIT 149.

All the reactors listed from second to fifth place in the table are located in Fukui Prefecture and are owned by Kansai Electric Power Company (KEPCO). In particular, we have been concerned about the continued operation of Mihama-1&2,

where high DBTTs have been observed since the beginning of the 1990s. KEPCO asserts that results of pressurized thermal shock (PTS) analysis show that even if the ECCS was used in the event of a pipe rupture the pressure vessel would not fail. However, the evaluation methodology for the stress arising, K_I , has not been released, so it is impossible to know whether this analysis is reliable.

PTS analysis assesses the pressurized thermal shock to the core of PWR pressure vessels in the case of accidents such as loss of coolant accidents and main steam pipe ruptures. It is necessary to confirm that the critical stress intensity factor K_{IC} does not exceed the fracture toughness K_{IC} .

The reactors listed in sixth and seventh places in Table 1 are BWRs. The inner diameter of BWR pressure vessels is large compared to PWRs and the amount (flux) of neutron irradiation received in a given time is one or two orders of magnitude less than in PWRs. From the table it can be seen that the total amount (fluence) of irradiation received by Tsuruga-1 is about one thirtieth of that of Mihama-1, even though they began operating at much the same time. (There is a slight difference in operating time and also in the date the specimens were taken.) Consequently, it was thought that neutron radiation embrittlement was not such a big problem in BWRs as it was in PWRs. (Even now many researchers and engineers are still in the grips of that "common sense.") However, after many years of operation, as we came to know the reality of irradiation embrittlement in BWRs, this "common sense" has been overturned. The total amount (fluence) of irradiation is not the only determining factor for irradiation embrittlement. It has become clear that the rate (flux) at which irradiation occurs is also a determining factor. As will be discussed in part two, this led to an amendment to the monitoring specimen method

Table 1: Reactor Pressure Vessel Ductile-Brittle Transition Temperature (DBTT) – Worst 7

Rank	Reactor Unit	Type	Startup	Classification	DBTT	Neutron fluence (10^{19} n/cm ²)	Date of experiment (removal)
1	Genkai-1	PWR	Oct. 15, 1975	Mother material	98°C	7.0	April 2009
2	Mihama-1	PWR	Nov. 28, 1970	Mother material	74°C	3.0	May 2001
				Weld material	81°C		
3	Mihama-2	PWR	July 25, 1972	Mother material	78°C	4.4	Sep. 2003
4	Oh-2	PWR	Dec. 5, 1979	Mother material	70°C	4.7	March 2000
5	Takahama-1	PWR	Nov. 19, 1974	Mother material	68°C *	1.3	Nov. 2002
6	Tsuruga-1	BWR	Mar. 14, 1970	Mother material	51°C	0.094	June 2003
				Weld material	43°C		
7	Fukushima Daichi-1	BWR	Mar. 26 1971	Mother material	50°C	0.09	Aug. 1999

Source: Prepared by the author from "Results of Monitoring Tests on Steel in Nuclear Reactor Pressure Vessels," CNIC
* As of July 2011. A DBTT of 95°C was later observed in Takahama-1.

JEAC-4201 and to the situation where two BWRs are now listed among the worst seven and other BWRs are also known to have high levels of irradiation.

Why Does Irradiation Embrittlement Occur? - Basic Concept

Metal materials become degraded for all sorts of reasons. One reason is "radiation damage." This phenomenon is investigated at the atomic level through the study of lattice defects. The Physical Society of Japan has had a section on lattice defects for over 50 years. As a personal note, I have devoted myself to this field of research since becoming interested in it as a university student. I became a tutor at Osaka University and experienced the student uprisings of the 1960s. In hindsight I can see that this field of research, which originated in the United States, developed in tandem with nuclear energy. Nevertheless, that fact did not lead me to abandon the field. I carried out materials research using radiation as a guest researcher at the Kyoto University Research Reactor Institute. However, it was difficult to see a connection between this research and the social problems associated with nuclear energy.

The reason why irradiation defects became an important research theme was because when neutrons generated by nuclear fission hit reactor vessels and pipes they damage the metal materials. This is called "neutron radiation damage." If this causes materials to become brittle, it is called "neutron irradiation embrittlement." Of particular importance is neutron irradiation embrittlement of the steel of the reactor pressure vessel, which is the heart of a nuclear power plant. If this is damaged it can lead directly to a severe and uncontrollable accident.

What type of lattice defects arise from neutron radiation? In crystals, atoms are precisely aligned in lattices, but if they are struck by a neutron they are displaced, leaving a hole. This is called a "vacancy." Displaced atoms are called "interstitial atoms." This phenomenon is called a "lattice defect." In addition, secondary defects result when vacancies and interstitial atoms move about and accumulate, creating "vacancy clusters" and "interstitial atom clusters," respectively. Impurities within the metal (copper atoms etc.) move to form "impurity clusters." These "secondary lattice defects" cause metals to lose their characteristic ductility (plasticity) and become brittle. To compare it to the human body, it is like the hardening of the arteries which makes blood vessels vulnerable to rupture.

Usually, when a force is applied to steel it simply deforms without breaking, but below a given temperature, if the slightest force is applied, rather than deforming plastically it shatters like pottery. This critical temperature is called the ductile-brittle transition temperature (DBTT). This brittleness of steel used to be the bane of shipbuilders. Many ships sank due to this

phenomenon. The Titanic, which sank exactly 100 years ago in 1912 when it struck an iceberg while crossing the North Atlantic Ocean, is a famous example. Subsequent studies showed that poor quality steel plate was used and that the DBTT was 27°C.

When reactor pressure vessels are bombarded by neutrons the DBTT rises. When designing nuclear reactors it is necessary to predict how high the DBTT will rise and whether they can survive for the period of their design lives. However, assuming a design life for nuclear reactors of 40 years, it is impossible to know what condition they will be in after 40 years until the 40 years has actually elapsed. That presents a problem, so accelerated experiments are conducted. Accelerated experiments are tests that are commonly used to assess endurance by, for example, applying forces beyond the normal load, or operating plants at greater than normal speed.

Likewise, when conducting tests for neutron irradiation embrittlement, the amount (flux) of neutron exposure in a given period of time is increased far above normal amounts. Materials test reactors can radiate materials at a rate of 10^{12} n/cm²s (neutrons/square centimeter). This rate (flux) of exposure is between 100 and 10,000 times the rate of exposure in normal reactors, given that the rate of exposure for PWRs is 10^{10} n/cm²s, while the rate for BWRs is 10^8 n/cm²s. That means the amount of irradiation a BWR would sustain in 40 years can be applied in one or two days. Using such data a formula predicting embrittlement was produced. Furthermore, besides the normal monitoring specimens, accelerated monitoring specimens are also placed in BWR reactor vessels. They are placed not on walls of the vessel itself, but closer to the core, where the rate (flux) of radiation is an order of magnitude higher. The idea is to predict the future state of the reactor. Likewise, monitoring specimens are placed deeper inside PWRs than the walls of the reactor vessel. For example, in the case of Genkai-1, discussed in part two, the rate of radiation is about double the normal rate. This is an attempt to read the future.

However, there is an assumption underlying the notion that the future can be predicted. That is, regardless of the rate (flux) of irradiation, or, to put it another way, regardless of the period of exposure, if the total amount (fluence) of radiation is the same, the result will be the same. The formula for this assumption is as follows:

$$\text{Rise in DBTT} = \text{material factor} \times F(f)$$

The material factor is determined by the type and the concentration of impurities in the steel. For example, if the steel contains a large amount of copper, the material factor will rise. $F(f)$ is the irradiation factor. It is postulated to be a function of the fluence of neutron irradiation " f " alone.

With accumulated experience of operating nuclear power plants, it became possible to obtain

long-term monitoring test data in real life conditions, and it became clear that this formula was suspect. In particular, with regard to BWRs, for which the rate of irradiation is slower, it became clear that the results for the normal monitoring specimens and the accelerated monitoring specimens placed in reactors did not agree. This trend is particularly pronounced in reactors like Tsuruga-1 and Fukushima Daiichi-1 where the steel of the reactor pressure vessels contains large amounts of copper impurity. It can be seen from this that the irradiation factor $F(f)$ is dependent not only on the fluence (total amount) of neutron irradiation " f ", but also on the flux (amount in a given time) of irradiation.

We noticed this over ten years ago and alerted researchers to the issue. However, at the time, the results of American research refuting dependence on the flux of irradiation held sway, so Japanese researchers refused to take the matter seriously and did not alter the embrittlement prediction formula. Faced with data from Tsuruga-1 showing unpredicted high levels of DBTT, METI's Aging Response Review Committee dismissed the results saying they were due to data scatter.

Thereafter, analysis of the micro-formation of copper progressed, and it became clear that when the rate of radiation is slow mainly clusters of copper atoms (obstructions) form, whereas in accelerated irradiation tests mainly clusters of vacancies form, so the cause of the hardening (embrittlement) is different. The results of this micro-analysis backed up our computer simulations. The outdated thinking described above was forced to give way and now the dependence of radiation embrittlement on the flux of irradiation is the shared academic understanding. The irradiation embrittlement prediction formula used in monitoring test methodology was changed and a new methodology (JEAC 4201-2007) was produced*. Assessment of pressure vessels shifted to the 2007 formula from mid-2011, but when the increase of DBTT using this formula is smaller than that using the previous 2004 formula, the 2004 formula is included as a reference.

However, even the 2007 formula cannot explain the high DBTT for metal welds in Tsuruga-1 that we have drawn attention to. The metal welds in Tsuruga-1 have low levels of copper impurities, unlike the parent metal, and thus should not show a high DBTT. The amended JEAC-2007 was not adequately able to explain the complex nature of the reality of the metal materials.

* Recently the author's group found that the formulation contains a fatal misunderstanding.

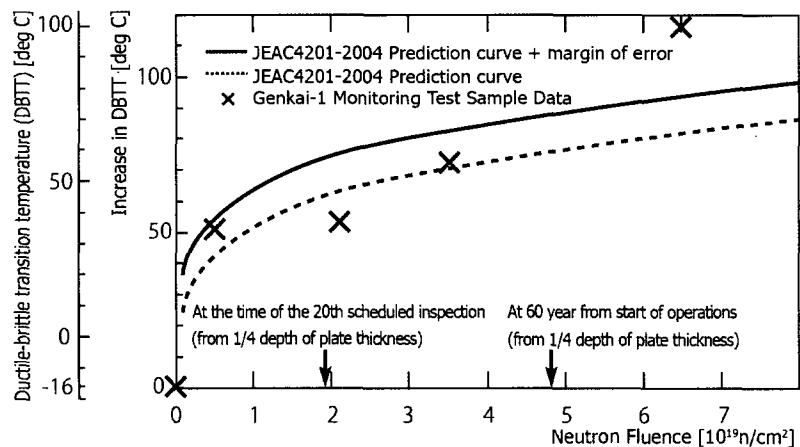


Figure 1. Genkai-1 Monitoring Test Sample Data and JEAC 4201-2004 Prediction Curve

Unpredicted Embrittlement in Genkai-1 Reactor Pressure Vessel

Further "unpredicted" monitoring specimen data were observed; these were the results from Genkai-1. At the October 25, 2010 meeting of Karatsu City Municipal Assembly's Plutermal Special Committee, Kyushu Electric Power Company announced that the DBTT observed in Genkai-1's fourth monitoring test specimen, taken during a periodic inspection in April 2009, had reached 98°C. Previously, the highest DBTT for a reactor pressure vessel had been 81°C for metal taken from a weld at Mihama-1 (see Table 1). The Genkai-1 specimen exceeded this, so it would be fair to conclude that Genkai-1 is the most dangerous reactor pressure vessel in Japan.

It is also very significant that this embrittlement was unpredicted. The DBTT observed in the previous (third) monitoring test (February 1993) was 56°C. That had increased by 42°C, which was contrary to the predicted result. Figure 1 is a diagram submitted by Kyushu Electric in its December 2003 Aging Technical Assessment, with a "x" added to the top right corner to show the result of the fourth monitoring test. Up until the third monitoring test the data points could be more or less plotted onto the predicted curve, but the latest data point is way above that curve. If you look closely at the diagram you will see that the broken line is the predicted curve and that a line is added above that showing the upper limit of the margin for error. However, actual embrittlement is way above that upper limit.

Kyushu Electric says that 98°C is the value predicted for 2060 (85 years after the start of operations), while the predicted DBTT for 2035 (60 years after the start of operations) is 91°C and for August 2010 (35 years after the start of operations) is 80°C. In part two, let us consider whether this is correct or not.

(To be continued in the next issue of Nuke Info Tokyo)

Group Introduction

Japan Occupational Safety and Health Resource Center (JOSHRC)

by Iida Katsuyasu*

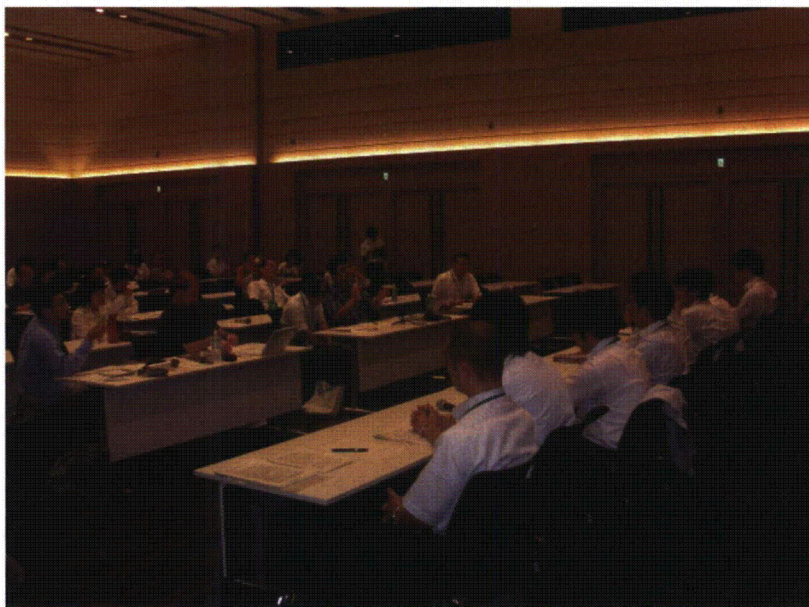
The Japan Occupational Safety and Health Resource Center (JOSHRC), which exists to protect the health and lives of workers, is an NGO network established for the sake of eradicating occupational diseases.

Until now, our friends in the network have handled the occupational problems of nuclear plant workers. Since 1976, however, there have been only ten examples of recognized cases of work-related cancer among nuclear plant workers. Nuclear plant workers suffering health damage from radiation continues to be an issue shrouded in darkness.

Since the 3/11

Fukushima Nuclear Accident occurred, TEPCO's sloppy radiation countermeasures have resulted in the appearance of a series of highly irradiated workers. Directly after the accident, the government raised radiation exposure limits from 100 mSv to 250 mSv for emergency work employees as a special exception to the regulation regarding the prevention of ionizing radiation disorders. In addition, the government also took measures to loosen the annual 50 mSv limit for workers active at some distance away from the emergency work.

Was it acceptable to simply relax worker radiation exposure regulatory limits in the name of emergency work? We believe the worker radiation exposure is a problem that can no longer be overlooked, and from May last year we began negotiations with the government. Originating with CNIC, citizens' groups as well as labor unions have called on the government to engage in negotiations seven times since March of this year. Through utilization of the freedom of information system we have also sought to elucidate the process by which the radiation exposure limits were raised within the government. These efforts have revealed that the nuclear-power promoting Nuclear and Industrial Safety Agency (NISA), fearing impediments for Japan's nuclear operations, made a special case for the Fukushima Daiichi Nuclear Power Station's emergency worker radiation exposure



JOSHRC and citizens' groups negotiating with the government regarding the worker radiation exposure problem at Fukushima Daiichi Nuclear Power Station.

limits, and changed the lifetime limit to 1 Sievert.

Meanwhile, the Tokyo Occupational Safety and Health Center is holding seminars together with the NGO Toxic Watch Network (T-Watch), and we are studying the nuclear accident and the effects of radiation. T-Watch is measuring the radiation in food, water, and soil with an NaI scintillation detector.

Last summer, in cooperation with T-Watch, we investigated radiation in Tokyo's sewage treatment and water purification facilities, and proposed risk evaluations and countermeasures for worker radiation exposure. In April, we held a gathering in Tokyo to create an activist network for considering the problems of worker radiation exposure.

We will continue to tackle the problems of radiation spread through communities and workplaces, and by developing campaign movements and negotiations with the government, we would like to work towards a change in the government and industry's position of radiation neglect.

*Japan Occupational Safety and Health Resource Center Liaison Conference Director-General of Tokyo Occupational Safety and Health Center

NEWS WATCH

Abolition of Fukushima Daiichi Reactor Units 1-4

As of April 19, TEPCO decommissioned Fukushima Daiichi reactor units 1-4 (BWRs, Unit 1: 460 MW, Unit 2-4: 784 MW each). Consequently, Japan's nuclear reactors were reduced from 54 units totaling 49,112 MW to 50 units totaling 46,300 MW.

Fiscal Year 2011 Facility Utilization Rate 23.6%

In FY2011 (April 2011 - March 2012), Japan's fifty-four nuclear reactor units set a record low utilization rate of 23.6%. Of the 54 units, 28 units did not operate at all within the year.

New Standards for Radioactive Cesium in Food

On April 1, new regulatory standards became effective for radioactive cesium contained in food. The 500 becquerel per kilogram (Bq/kg) for general foods such as vegetables, grains, meat, and fish was lowered to 100 Bq/kg, 50 Bq/kg for baby foods. The standard of 200 Bq/kg for milk was lowered to 50 Bq/kg, and likewise the drinking water standard was lowered to 10 Bq/kg. For rice and beef, interim measures were set through the end of September, and the new values are to be applied from October.

Apart from these regulation values, co-ops and retail stores have created independent standards that are more stringent, but on April 20 the Ministry of Agriculture issued a notice requesting that the use of independent standards cease. Opposition from consumers on 23rd forced the Minister of Agriculture to defend the notice by stating that "it is not compulsory and does not negate independent standards."

Tokai Mayor demands Minister of Economy decommission Tokai-2

On April 4, mayor Tatsuya Murakami, who has been requesting the decommissioning of the Tokai-2 Nuclear Power Plant (BWR, 1,100 MW) since the Fukushima Nuclear accident, handed a written statement demanding the permanent shutdown and decommissioning of the Tokai plant to the Minister of Economy, Trade and Industry, Yukio Edano.

Inaugural Meeting of Mayors for Nuclear Abolition

With Tatsuya Murakami, Mayor of Tokai Village in Ibaraki Prefecture, and Katsunobu Sakurai, Mayor of Minami Soma in Fukushima Prefecture, as organizers the founding meeting for the "Heads of Local Governments Seeking to End Japan's Reliance on Nuclear Power" was held on April 28. The Conference consisted of 69 members at its inauguration. Only Tokai Village Mayor Murakami is situated in a municipality hosting a nuclear plant (though there were two or three such observers at the inaugural meeting). However, there were many heads of municipalities located within thirty kilometers of a nuclear plant present at the meeting, as well as four or five heads of municipalities from which planned nuclear power plants or recycling factories have been forced to withdraw.

The Conference is planning to make efforts for the clarification of a road map toward a nuclear phase-out and the promotion of regional renewable energy use, as well as to put forward policy proposals to the government and Diet. Also adopted at the inaugural meeting were a "Resolution requiring consensus from local governments and municipality citizens regarding the restart of nuclear plants such as the Ohi Nuclear Power Plant," and a "Resolution demanding the determination of a new basic energy plan that will include a nuclear phase-out."

Nuke Info Tokyo is a bi-monthly newsletter that aims to provide foreign friends with up-to-date information on the Japanese nuclear industry as well as on the movements against it. It is published in html and pdf versions on CNIC's English web site: <http://cnic.jp/english/>

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Energy options proposed



"Goodbye to Nuclear Power Plants" Rally attended by 170,000 antinuclear protesters in Yoyogi Park, Tokyo. (July 16, 2012)

Due to the nuclear disaster in Fukushima in March 2011, it has become impossible for Japan to carry out its former energy policy, one that depended on nuclear power generation. The policy target was to cut the nation's carbon dioxide emissions by 25 percent from the 1990 level by the year 2020, partially by building 14 more nuclear power reactors. This target for carbon dioxide emissions was Japan's pledge to the international community. Now that Japan has suffered extremely severe radiation damage from last year's nuclear accident, it is evident to everyone that it is no longer possible for the nation to achieve this goal.

For this reason, the Japanese government has been forced to review its energy policy.

The previous Cabinet, led by Naoto Kan, attempted to revise the policy from the viewpoint of Japan's departure from nuclear power generation.

His successor Yoshihiko Noda, however, toned down Kan's policy and is set to review the former policy with the aim of reducing Japan's dependence on nuclear power. Noda claims that the

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reduction of Japan's dependence on nuclear power generation is his public pledge, but to what extent the dependence should be reduced will be decided upon by politicians after national debates are held on the issue. Although it has been the bureaucrats who have formulated policies most of the time up until recently, the current government, led by the Democratic Party of Japan (DPJ), is striving to alter this tradition, and introduction of the new decision-making system is one example of this change.

The Energy and Environment Council (EEC), which was set up within the National Policy Unit of the Cabinet, has proposed a national debate on the desirable energy-mix options.

The EEC says energy options will be presented to the public before they start the national debates. They therefore consulted the Ministry of Economy, Trade and Industry (METI) for energy options based on the share of various energy sources, the Japan Atomic Energy Commission (JAEA) for options concerning the nuclear fuel cycle, and the Environment Ministry (EM) for measures to cope with global warming.

Three options

Based on the reports from the two ministries and JAEA, the EEC formulated three options on the share of nuclear power generation in the total domestic power supply and released them on June 29. As the current basic energy plan lays out Japan's energy strategy heading towards 2030, the share of nuclear power in 2030 was proposed.

The current share of nuclear power

In Japan, the operation of all nuclear power stations was halted on or before May 5, and only one reactor at Ohi Nuclear Power Station resumed operations on July 4, despite a strong public outcry against the restart. A second reactor at the nuclear power station will probably restart operations at the end of July 2012. As for other nuclear power stations, it will not be so easy to resume operation. Japan's new nuclear regulatory commission is to establish new safety standards based on the results of the official investigations into the Fukushima nuclear disaster and will determine the propriety of resuming operations of each reactor.

As things stand now, the proposed review of the share of nuclear power should have been based on the current situation where all nuclear power stations are shut down or only two reactors are operational. The fact, however, is that the options are based on the share of nuclear power in the pre-nuclear disaster period.

One of the three options is to cut the share of nuclear power in the nation's total power supply to zero. This option calls for realizing a total departure from nuclear power generation with strong determination and at as early a date as possible, while achieving a desirable energy mix that depends mainly on renewable energy sources. This is the only option that aims at the termination of nuclear power generation.

The second option is to cut the share of

nuclear power to 15% by 2030. This figure is based on two factors. One of them is the plan to decommission nuclear reactors after 40 years of service, which was decided upon in negotiations on the establishment of the new nuclear power regulatory commission. If nuclear reactors are shut down after 40 years of service, and no new ones are built, the ratio of nuclear power will be reduced to 15 percent by 2030 (calculated on the assumption that the average operation rate stands at 80%), and to zero by around 2050. The second option will also call for reinforcement of safety and anti-disaster measures at nuclear power stations.

However, this option is to be reviewed sometime around 2030, taking into account the speed of expansion in the use of renewable energy. This may make leeway for extending the period of operation of old nuclear reactors, or for building new ones.

The third option is to maintain the current 20-25% share of nuclear power. This figure is based on the 2010 data that nuclear power generation accounted for 26% of the nation's power supply. Whether or not this option is appropriate depends on the operation rates of nuclear reactors. Should power shortages occur, this is likely to pave the way for construction of new nuclear reactors that have already been planned by electric power suppliers.

The three options do not fully reflect the views of the people who are demanding a nuclear phase-out. For example, they have proposed that more radical energy-saving measures be introduced to achieve the 25% cut in carbon dioxide emissions that Japan has pledged. But all three options estimate the cut to be achieved by the electric power generation sector at a much smaller 10%. In the meetings of the Advisory Committee for Natural Resources and Energy, where the three options were discussed, the anti-nuclear members proposed discussions on this issue many times in an attempt to expand the size of the reduction, but in vain.

Methods of national debates on energy mix options

The government says it will listen to public opinion on the three options via various means, such as public opinion polls conducted by the mass media, public hearings to be held at 11 sites across the country, the public comments system, and the nation's first deliberative poll, in which the public will submit their opinions and discuss the issue in debate sessions to be held across the nation. The government plans to grasp the trend of public opinion through these efforts. In the deliberative poll, around 3,000 people will be randomly selected, and asked to respond to questionnaires. Of these, 120 will be chosen and divided into groups of several persons each for the debate session. There are, however, some concerns about this scheme. The government plans to adopt one of the three options by the end of August, and so there is not much time left. Whether or not the deliberative poll will be held as projected remains uncertain under these circumstances. Another concern is that the

period for accepting public comments is limited to one month, and this may be too short to allow for a substantial number of public opinions to be submitted.

What about options for the nuclear fuel cycle?

It is no exaggeration to say that the nuclear fuel cycle has been left out of the options for national debates. If all nuclear power stations were to be decommissioned, it would become impossible to recycle spent nuclear fuel, and all spent fuel would then have to be disposed of directly. In this case, there would be no need to put the issue to a national debate. But if other options are selected, three different plans can be proposed; to recycle the spent fuel, to dispose of the spent fuel directly, or to do both at the same time. These plans are mentioned in the energy-option proposal, but are not proposed as "options."

Motohisa Furukawa, State Minister of National Strategy, Economic and Fiscal Policy, said in a recent press conference that the consideration of options on the recycling of spent nuclear fuel is not an issue that should be determined by vote. His position that the energy policy should be put to the vote (national debates) because it will serve as the nation's basic policy, while the policy on spent nuclear fuel does not fall within this framework is not convincing. However, a non-official study group led by Japan's Nuclear Disaster Minister Goshi Hosono, and with the participation of Tetsuya Endo, Kenji Yamaji and other lawmakers, had earlier proposed a number of plans that included the use of the Rokkasho reprocessing plant in Aomori Prefecture jointly with other nations. Furukawa probably made the above remark because he was influenced by this proposal.

There is another possibility. A secret meeting of the Japan Atomic Energy Commission (JAEC) was held on April 24, at which the government officials and people from the power industry jointly discussed Japan's nuclear fuel cycle policy. This disclosure by the media spurred public distrust of the commission's report and Furukawa may have presumed that the JAEC-proposed options on the spent nuclear fuel cycle should not be presented to the public.

Nevertheless, JAEC presented its report concerning options on the spent nuclear fuel cycle that matched with the energy mix options to the Energy and Environment Council on June 29. The report proposed that all spent nuclear fuel be directly disposed of in the case of Japan's total departure from nuclear power generation. In the case where the share of nuclear power is reduced to 15%, the report said part of the spent fuel should be recycled and the rest should be disposed of directly, and in the case where the share of nuclear power is higher, all spent fuel should be recycled or part of it disposed of directly.

Secret meetings disclosed

The Mainichi Shimbun disclosed the existence of the secret meetings in its May 24 issue.

According to media reports, the secret meetings, dubbed 'study meetings,' were held 23 times at a conference room on the seventh floor of the Central Government Building No. 4, in which JAEC has its office. Each time, more than 30 people participated in the meeting, including officials from electric power suppliers, Japan Nuclear Fuel Ltd., JAEC, the Ministry of Education, Culture, Sports, Science and Technology, and the Ministry of Economy, Trade and Industry. The fact that the electric power suppliers attended all of the 23 meetings became the target of public criticism. In the meetings, the contents of the JAEC report were reportedly revised in line with the intentions of the electric power suppliers.

Although JAEC admitted that it held meetings attended by electric power suppliers, it insisted that the purpose of the meetings was limited to contacting the parties concerned in preparation for compiling the report that was to be presented to the JAEC subcommittee. Moreover, JAEC denied the allegation that the commission revised the report to reflect the views of electric power suppliers.

The conference materials that were later made public indicate that the organizer allotted the work of drafting responses to the proposals presented by the technical sub-committee members. This means that the secret meetings virtually served as occasions to discuss the contents of the report.

Among others, Chairman Shunsuke Kondo promised to take the following measures:

- 1) to not hold secret meetings again,
- 2) to make public the materials which were discussed at the meeting,
- 3) to return all officials dispatched to JAEC from electric power suppliers by around the end of June, and
- 4) to present plans for the reform of JAEC and its deliberation councils.

When this writer met Chairman Kondo on July 3, he said the return of the officials of electric power suppliers to their offices at the end of June had made it difficult for JAEC to carry out desk work without delay. His remark indicates that JAEC was taking advantage of its cozy relationship with electric power suppliers in order to draft its policies. With regard to the reform of JAEC, rules for handling information and for creating the minutes of its meetings were decided upon, but no proposals have been presented yet on the appropriate role of JAEC in the future. The commission says it will discuss this issue from now on.

Because of the mass media's revelations regarding JAEC's secret meetings, deliberations on nuclear power policy by JAEC's New Nuclear Policy Planning Council, previously held in parallel with the discussions on the energy-mix options, were suspended.

Hideyuki BAN (Co-Director of CNIC)
Reported on July 4, 2012

The Koodankulam Struggle

S. P. Udayakumar *

Ph. D. in Political Science

* People's Movement Against Nuclear Energy (PMANE)

* National Alliance of Anti-nuclear Movements (NAAM)

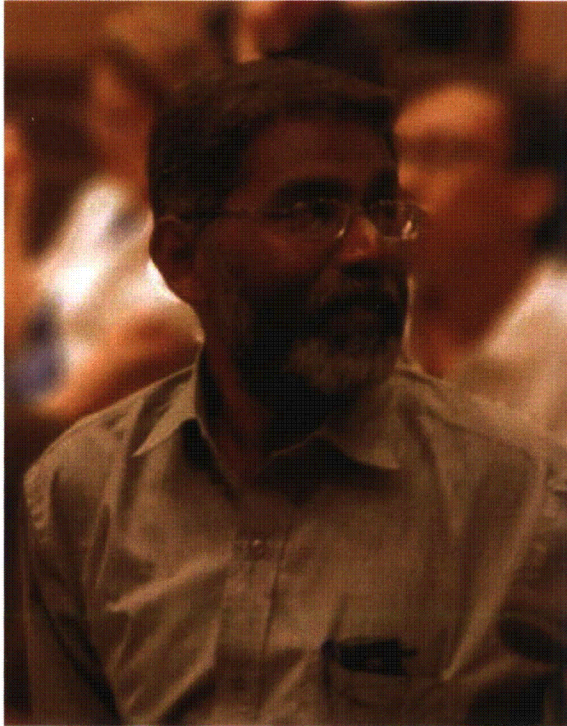


Photo of Mr. S. P. Udayakumar

We have been fighting against the Koodankulam Nuclear power Project (KKNPP) since the late 1980s. This Russian project was shelved right after the Soviet Union's collapse and taken up again in 1997. The Indian government and Russians have constructed two huge reactors of 1,000 MW each without any consent of or consultation with the local people. We have just obtained the outdated Environmental Impact Assessment (EIA) report after 23 years of long and hard struggle. The Indian nuclear authorities have not shared any basic information about the project with the public. They do not give complete and truthful answers for our questions on the 'daily routine emissions' from these reactors, the amount and management of nuclear waste, fresh water needs, impact of the coolant water on our sea and seafood, decommissioning costs and effects, Russian liability and so forth. We are deeply disturbed by all this.

Our people watched the Fukushima accident of March 11, 2011 on TV at their homes and understood the magnitude and repercussions of a nuclear accident. Right after that on July 1, 2011, the KKNPP announced the 'hot run' of the first reactor that made so much noise and smoke. Furthermore, the authorities asked the people, in a mock drill notice, to cover their nose and mouth and run for their life in case of an emergency. As a result of all these, our people in Koodankulam and Idinthakarai villages

made up their minds and took to the streets on their own on August 11, 2011. Then we all together decided to host a day-long hunger strike on August 16 at Idinthakarai and a three-day fast on August 17-19 at Koodankulam. On the 17th itself authorities invited us for talks and asked us to postpone our struggle to the first week of September because of the upcoming Hindu and Muslim festivals. In a few days' time, the chief of the Department of Atomic Energy (DAE) announced that the first reactor would go critical in September 2011.

So we embarked upon an indefinite hunger strike on September 11, 2011 and our women blocked a state road on September 13 for a few hours when the state and central governments continued to ignore us. The state Chief Minister invited us for talks on September 21 and passed a cabinet resolution the next day asking the central government to halt all the work until the fears and concerns of the local people were allayed. We ended our hunger strike on the 22nd but went on another round of indefinite hunger strike from October 9 to 16 when the talks with the Indian Prime Minister failed. We laid siege in front of the KKNPP on October 13-16, 2011 when the KKNPP authorities did not halt work at the site as per the Tamil Nadu state cabinet resolution. We ended both the indefinite hunger strike and the siege on October 16 in order for our people to participate in the local body elections on the 17th. From October 18, 2011, we have been on a relay hunger strike continuously. We have been carrying out massive rallies, village campaigns, public meetings, seminars, conferences, and other demonstrations such as shaving our heads, cooking on the street, burning models of the nuclear plants, etc. When the state government of Tamil Nadu arrested some 200 of our comrades on March 19, 2012, 15 of us embarked on an indefinite hunger strike until March 27. This struggle has been going on for more than 260 days and the morale of the people is still very, very high.

There is no foreign country or agency or money involved in this classic people's struggle to defend our right to life and livelihood. Our fishermen, farmers, workers and women make small voluntary donations in cash and kind to sustain our simple Gandhian struggle. Our needs are very few and expenses much less. We only provide safe drinking water to the hunger strikers and visitors. People from all over Tamil Nadu (and sometimes from other parts of India) come on their own arranging their own transportation. For our own occasional travel, we hire local taxis.

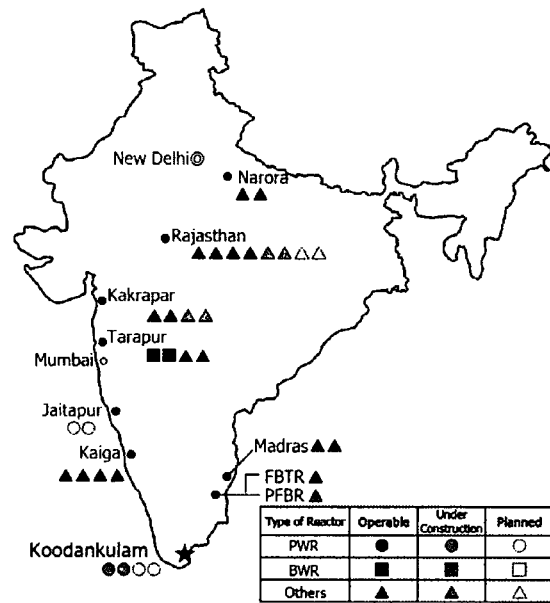
Instead of understanding the people's genuine feelings and fulfilling our demands, the government has foisted serious cases of 'sedition' and 'waging war on the Indian state' on the leaders of our movement. There

are more than 200 criminal cases on us. There have been police harassment, intelligence officers' stalking, concocted news reports in the pro-government media, abuse of our family members, hate mail, death threats and even physical attack.

Although India is a democracy, our Delhi government has been keen on safeguarding the interests of the multinational corporations (MNCs) and pleasing some powerful countries such as the United States, Russia, France, etc. The welfare of the 'ordinary citizens' of India does not figure on their list of priorities. The central government and the ruling Congress party stand by the secretive nuclear agreements they have made with all different countries and consider us as stumbling blocks on their road to development. The main opposition party, Bharatiya Janata Party (Hindu nationalist party) is interested in the nuclear weapons program and making India a superpower and hence loves everything nuclear. It is ironic that these two corrupt and communal forces join hands with each other against their own people. They bend backwards to please their American and other bosses but question our integrity and nationalist credentials.

Our leaders and the group of 15 women were physically attacked on January 31, 2012 at Tirunelveli by the Congress thugs and Hindutva Fascists when we had gone for talks with the central government expert team. Now the government cuts the electricity supply so often and so indiscriminately in order to drive home the message that nuclear power plant is needed for additional power. They try to create resentment and opposition among the public against our anti-nuclear struggle.

To put it all in a nutshell, this is a classic David-Goliath fight between the 'ordinary citizens' of India and the powerful Indian government supported by the rich Indian capitalists, MNCs, imperial powers and the global nuclear mafia. They promise foreign direct investment, nuclear power, development, atom bombs, security and superpower status. We demand risk-free electricity, disease-free life, unpolluted natural resources, sustainable development and a harmless future. They say the Russian nuclear power plants are safe and can withstand earthquakes and tsunamis. But we worry about their side-effects and after-effects. They speak for their scientist



friends and business partners and have their eyes on commissions and kickbacks. But we fight for our children and grandchildren, our progeny, our animals and birds, our land, water, sea, air and the skies.

Right now, the Indian government is trying to commission the KKNPP reactors without conducting the mandatory disaster training and evacuation exercises to the people in the 30-km radius. The government and the Department of Atomic Energy have not told the people anything about the Koodankulam nuclear waste and its management, the secretive liability agreement between New Delhi and Moscow, and the geology, hydrology, oceanography and seismology issues with regards to the Koodankulam reactors.

Since May 1, some 300 women and 35 men have been on an indefinite hunger strike with 11 demands. Neither the Indian government nor the state government has come forward to talk to the people on our demands. Instead, they have embarked upon an intimidating campaign. And the struggle continues.

Continued from page 15

Of the seven nuclear power plants identified in this paper as having striking irradiation embrittlement, the Fukushima Daiichi Unit 1 reactor has been transformed into a hideous mess and will not operate again. We believe the other six aging reactors should be permanently shut down forthwith.

A bill to wind up NISA and NSC and establish a new Nuclear Regulatory Commission is now being debated in the Diet. The bill proposed by the government contains a clause saying, "The life of nuclear power plants will in principle be 40 years." This condition allows a life extension of 20 years in exceptional circumstances, so there is the possibility that the 40-year condition will be gutted of meaning. It should state that nuclear power plants will, without exception, be decommissioned after 40 years.

All nuclear power plants that began operations in the 1970s will be over 40 years old by 2019. All these early reactors have numerous problems with manufacturing technology and quality of materials, and they are deteriorating. Of course Tsuruga-1 and Mihama-1&2, which are already over 40 years old, should be closed down, and Genkai-1 and Takahama-1, which have extreme irradiation embrittlement, should be closed down without waiting for them to turn 40.

Acknowledgement: Much of this paper is based on discussions of the Nuclear Aging Research Team. I express my thanks to Chihiro Kamisawa, Yuuta Aono and all the members of the Team.

We oppose the restart of Ohi Nuclear Power Plant

From 5th May this year, all of Japan's 50 nuclear reactors were shut down. However, stating that Japan's economy would not be able to survive without nuclear power, and that he would personally take the responsibility for ordering the restart of nuclear power plants, PM Noda agreed to the restart of Ohi NPP Units 3 and 4, which was officially decided at a meeting of the four relevant cabinet ministers on 16th June. On 2nd July it was reported that Ohi-3 had reached criticality. Despite the fact that the Fukushima accident it is not yet over no matter how you look at it, PM Noda and the government, who proclaimed in December 2011 that the accident was over, have made yet another blunder. We at CNIC believe that PM Noda and the government's judgment is fundamentally flawed.

What should we have learned from the accident at the Tokyo Electric Power Company (TEPCO) Fukushima Daiichi nuclear plant? It is that if we see some sign of possible danger in a nuclear power plant it should be thoroughly investigated and all appropriate measures taken to ensure safety. It is totally unacceptable to say things such as, "I don't understand the science, but from the engineering assessment it looks as if it's probably OK." Even having taken every possible precaution, a catastrophic accident might still occur.

The Diet Fukushima Nuclear Accident Independent Investigation Commission will soon be releasing its report. However, it is unlikely that the degree of damage to the nuclear power plant and its causal relation to the accident will all be revealed. The problem of 'how to ensure the safety of nuclear plants' is one that has no 'right answers.'

'Safety' cannot be assured by stress tests

All of this began on 11th July 2011, with the three cabinet ministers at the time, Edano, Kaieda and Hosono, declaring that "the condition for restarts will be the primary assessment of the stress test." Four days before that, the then PM Kan had stated in the budget committee of the House of Councilors that "all nuclear power plants will be subject to a stress test." In contrast to the stress tests that originated in Europe, the Japanese version divides the test into a primary and secondary evaluation, and moreover it was decided that the primary evaluation would be the condition for restarting nuclear plants down for regular maintenance. It is hard to believe that at this stage the politicians understood what a stress test is. They probably just had the idea planted in their heads by the bureaucrats, nuclear industry people and their friendly academics in the infamous 'nuclear village.'

The formal name of the so-called "Stress Test

Hearing" that began on 14th November 2011 was "The Hearing on the Comprehensive Evaluation of Safety in Power Generating Nuclear Reactor Facilities." A total of 11 members sat on the Hearing panel. It was not the kind of event where citizens who live near or who might be affected by a nuclear plant come and listen to the opinions of experts. The process of the Hearing was that the Nuclear and Industrial Safety Agency (NISA) would first hear the opinions of the members. NISA would then make a judgment on the appropriateness of the report submitted by Kansai Electrical Power Company (KEPCO), which would then be passed up to the Nuclear Safety Commission (NSC) for a final check.

The aim of the primary evaluation is to identify a nuclear plant's weak points. It is not a set of evaluation criteria for judging the safety of a nuclear plant. The test is simply a computer simulation to assess the tolerance of a number of selected crucial pieces of equipment in the case that a large earthquake or tsunami should occur. That is not a "Comprehensive Evaluation of Safety." KEPCO itself has still not carried out the secondary evaluation. The NSC approved NISA's judgment on Ohi-3 and 4, but the NSC Chairman Madarame is reported to have said that "this is not something that can be used to judge safety."

It has been confirmed recently by Professors Mitsuhiro Watanabe and Yasuhiro Suzuki that there is a fracture zone (i.e. an active fault) beneath Ohi NPP. New discoveries should, of course, be taken into account immediately. The reality is that it is inconceivable that a nuclear power plant should exist in the current location.

The former establishment must take responsibility for the Fukushima nuclear accident

Those officials who continued to push the safety myth and the agencies they worked for should take responsibility by resigning or by being dismantled. In spite of this, the fact that the same old people in the same positions as they were in previously are screening and passing judgment on the safety of Ohi NPP with no evaluation criteria in place is truly outlandish and farcical. At each meeting of the Stress Test Hearing, the members Masashi Goto and Hiromitsu Ino submitted question papers and uncovered doubts concerning KEPCO's report, but in this totally abnormal Hearing, having three members with conflicting interests, one of whom was the chair and facilitator of the Hearing, these crucial matters were simply ignored.

Incomprehensible events have been taking place one after the other. Two examples are, 1) NISA, responsible for enforcing safety standards at nuclear power plants, rejecting instructions from its

superior organization, the NSC, which is responsible for approval of the safety standards, and 2) the Japan Atomic Energy Commission continuing to hold secret meetings consisting only of nuclear proponents to chew over the contents of discussions in the drafting committee for the new Nuclear Policy Planning Council of the Japan Atomic Energy Commission, selecting the agenda items and rewriting the report.

In the current session of the Diet, it has been decided to establish a Nuclear Regulatory Commission (with five members) and a Nuclear Regulatory Agency as its secretariat. The independence of these bodies is expounded on as "Article 3 commissions."* NISA will slide laterally into the Nuclear Regulatory Agency, and it is being said that the 'no return' rule will be observed. But how will the selection for the five members of the Commission be possible? Moreover, we also doubt

that the people who have made the lateral slide (from NISA to the Agency) will now suddenly be capable of carrying out robust regulatory activities.

With these concerns in mind, we believe that discussions on the issue of Ohi NPP restart should at least wait for the publication of the Diet Investigation Commission's report and the launch of the new nuclear regulatory arrangements.

Yukio YAMAGUCHI (Co-Director of CNIC)
Reported on July 2, 2012

* Article 3 commissions: Commissions established under Article 3 of the National Government Organization Act. Since impartiality is essential and since the issues deliberated upon require specialized knowledge, these commissions are given a certain degree of independence from the Cabinet while existing as external organs of the Cabinet Office.

International Symposium on the Truth of the Fukushima Nuclear Accident and the Myth of Nuclear Safety

Dates: August 30 & 31, 2012. 9:30 ~ 18:00
Venue: Tokyo University Komaba Campus, JAPAN

Opening remarks

Steering Committee: Kotaro Kuroda (Chair)

Session 1: What Happened at the Fukushima Daiichi Nuclear Power Plant

August 30, 9:40 ~ 12:00

Speakers

Mitsuhiro Tanaka (Former nuclear power plant designer, member of the Diet Investigation Commission on the Accident at the Fukushima Nuclear Plants)

Arnie Gundersen (Chief engineer of Fairewinds Associates)

Coordinator ; Hiromitsu Ino

August 30, 13:00 ~ 15:00

Speaker

Katsuhiko Ishibashi (Seismologist, member of the Diet Investigation Commission on the Accident at the Fukushima Nuclear Plants)

Coordinator ; Yukio Yamaguchi

Session 2: Current Status of Radioactive Contamination

August 30, 15:30 ~ 18:00

Speaker

Tetsuji Imanaka (Kyoto University Research Reactor Institute)

Coordinator ; Komei Hosokawa

18:30 ~ : Social gathering

Session 3: Japan's Nuclear Policy and Formation of the Safety Myth

August 31, 9:30 ~ 12:30

Speakers

Hitoshi Yoshioka (Science historian, member of government Investigation Committee on the Accident at the Fukushima Nuclear Power Station of Tokyo Electric Power Company)

Philip White (PhD student at Adelaide University (Australia), former International Liaison Officer of Citizens' Nuclear Information Center)

Coordinator ; Harutoshi Funabashi

Session 4: The State of Nuclear Science and Technology

August 31, 13:30 ~ 16:30

Speakers

Tetsuya Takahashi (Philosopher)

Miranda Schreurs (Professor of Freie Universität Berlin)

Satoru Ikeuchi (Physicist)

Coordinator ; Makoto Maruyama

Session 5: Summing Up – from the Perspective of Scientists and Technologists

August 31, 17:00 ~ 18:00

Steering Committee: Kotaro Kuroda (Chair).

Tamotsu Sugunami (Secretary General)

Organizer

Steering Committee of "International Symposium on the Truth of the Fukushima Nuclear Accident and the Myth of Nuclear Safety"

Cooperating Groups

Group of Concerned Scientists and Engineers Calling for the Closure of the Kashiwazaki-Kariwa Nuclear Power Plant, Citizens' Nuclear Information Center (CNIC).

Center for Sustainable Development Research, Graduate Program on Human Security, University of Tokyo, Union for Alternative Pathways in Science & Technology (APAST), The Takagi Fund for Citizen Science

Contact information: symposium@takagifund.org

Clean-up operation at the nuclear accident site at Fukushima Daiichi Nuclear Power Station.

Presence of subcontractors affiliated with crime syndicates and their employees

Two local newspapers in Fukushima Prefecture have recently reported that businesses affiliated with crime syndicates are involved in the clean-up operation at the crippled Fukushima Daiichi Nuclear Power Station. One of them is the Fukushima Min-yu Shimbun, which reported in its May 23 issue that on May 22 the Koriyama City police and the Futaba Gun (County) police arrested leading members of a gangster group affiliated with the Sumiyoshi-kai crime syndicate based in Nihonmatsu, Fukushima Prefecture. According to the newspaper, they were charged with violation of the Temporary Staffing Services Law by dispatching five to six members of the group to the nuclear power station for the clean-up operation.

Prior to this, another local newspaper, the Fukushima Mimpo, reported on May 15 that the president of Watanabe Kogyo Ltd. in Naraha Town was arrested on suspicion of illegally possessing a gun. He was deeply involved in the staffing of the nuclear power station and was the president of the local chamber of commerce and industry, as well as a member of the Fukushima Prefecture Nuclear Power Plant Town Information Council⁽¹⁾, the newspaper said.

These incidents indicate that the businesses based near the nuclear power station and run by people linked to the *yakuza* (crime syndicate gangs) are deeply involved in the staffing of the nuclear

power plant for the purpose of making profits for their executives and employees. At the same time, Tokyo Electric Power Co. (TEPCO) is also making the most of such people, despite its position as a public utility company. In other words, TEPCO and the *yakuza* have built up a structure of mutual interdependence. In Japanese workplaces where dangerous, tough and demeaning jobs have to be done, there is a tradition that crime syndicates are involved in the recruitment of workers. Nuclear power stations are no exception. In the extremely difficult clean-up operation at the Fukushima Daiichi Nuclear Power Station, it is highly probable that businesses affiliated with crime syndicates and their employees will increase their presence.

As Table 1 shows, approximately 350 businesses are participating in the clean-up operations at the Fukushima Daiichi plant. They form a pyramid-shaped, multi-layered subcontractor system with TEPCO at the top of the pyramid. Under the utility, there are plant makers, subsidiaries of TEPCO and the plant makers, large, medium- and small-sized construction and repair companies, independent master carpenters and plumbers, and so on.

Japanese nuclear power stations are required to conduct a regular inspection once every 13 months. Originally, it took around three months to carry out the inspection, which included changing the nuclear fuel rods, thorough checks of facilities and equipment, replacement of old parts and consumables with new ones, remodeling of some facilities, and inspection by the government. Three plant makers, Hitachi Ltd., Toshiba Corp. and Mitsubishi Heavy Industries Ltd., received orders from TEPCO, and then allocated the orders to their subcontractors. However, the partial liberalization of the Japanese electric power generation market in 1997 brought a number of changes to this practice.

Taking advantage of the occasion, TEPCO designated its subsidiaries as the principal subcontractors and slashed repair and other costs as much as possible. At the same time, the company pressed the subcontractor to shorten the time required for a regular inspection, triggering competition within the market. It is said that the smaller and weaker companies dropped out of the race in this process, and the pyramid-shaped system of subcontractors was reduced by several layers. The result of this was that workers hired by higher-level subcontractors enjoyed favorable conditions concerning the type of employment, working conditions, working period, and type of

Tokyo Electric Power Company (TEPCO)	
▼	
A (Main Contractor)	30,000 – 40,000 yen
Hitachi Ltd., Toshiba Corp, Mitsubishi Heavy Industries Ltd., General Electric, Mitsui & Co., Ltd., Ishikawajima-Harima Heavy Industries Co., Ltd.	
▼	
B (Principal Subcontractor)	20,000 – 30,000 yen
Hitachi Plant Ltd., Toshiba Plant Ltd., Kandenko Ltd., Tokyo Denki Komuten Ltd., Toden Kogyo Ltd., Toden Kankyo EN Ltd., Toso Real Estate Ltd.	
▼	
C	10,000 – 20,000 yen
D	9,000 – 12,000 yen
E	8,000 – 10,000 yen
F	7,000 – 9,000 yen
G	6,000 – 8,000 yen
H	5,000 – 7,000 yen
I	4,000 – 6,000 yen
J	5,000 yen -

Converted to daily wages. Prepared by Ishimaru based on evidence from an F rank company president

Table 1. Multi-layered structure within the nuclear power station and wages in 2000
350 companies were involved in Fukushima Daiichi Nuclear Power Station

1) The scandal over falsified inspection records and concealed problems by TEPCO at its nuclear power plants came to light in 2002. This 23-member conference, set up in the wake of this incident, was composed of five residents each from four towns where nuclear power plants are located, one intellectual, and the managers of the No.1 and No.2 nuclear power stations in Fukushima Prefecture. The Nuclear and Industrial Safety Agency, the Agency for Natural Resources and Energy, and the Fukushima Prefectural government joined the organization as observers. The first meeting was held on February 1, 2005, subsequent meetings being held continuously until immediately before the nuclear accident in Fukushima in March, 2011.

work, while those working for the lowest-level subcontractors were forced to accept the worst working conditions. Workers hired by the lowest-level subcontractors were paid only around 5,000 yen per day, and were not covered by social insurance or employment insurance.

In the case of the workers currently employed by the lowest-level subcontractor and engaged in the clean-up operation at the Fukushima nuclear power station, the current average daily wage is said to be 8,000 yen, although TEPCO pays 60,000-70,000 yen per capita to the principal subcontractor. This is because each of the subcontractors from the top to the bottom of the subcontracting pyramid takes a cut from the workers' wages.

Koshiro Ishimaru has been participating in the Futaba Region Anti-Nuclear Power Plant Federation since the 1970's, supporting the nuclear power plant workers' efforts to win workers' compensation. "Because I couldn't bear the situation where workers could not stand up against the power of the companies and openly tell the truth, I established the Anti-Nuke Information Center in 1979," he said. Mr. Ishimaru launched activities to support nuclear power plant workers' attempts to win official recognition for their injuries and sicknesses as those eligible for official compensation, and conducted surveys on radiation damage to their health.

Although he himself was affected by the severe accident at the Fukushima Daiichi Nuclear Power Station in March 2011 and is currently evacuated to Iwaki, Fukushima Prefecture, he is serving as the representative of the organization. We have learned a lot from Mr. Ishimaru's activities and surveys. The following are noteworthy comments he has made in negotiations with TEPCO, and the pledges he and his group have obtained from TEPCO.

The late Nobuhiro Sato, who worked at the nuclear power plant for a long time said the severe, dangerous and demeaning working conditions at the plant are a magnet for the increased presence of crime syndicates and their front companies. According to Mr. Sato, there are no other workplaces better fitted to the *yakuza* than nuclear power plants. Their strict hierarchical relationship between the group leader and the members works effectively for getting jobs done at the plant. The plant workers change into protective garments before they enter the radiation-controlled areas, and this is the time when gangster group members show off their tattoos to the other workers. Thus, troubles in workplaces can be suppressed by force, said Mr. Sato.

Mr. Ishimaru and his group, together with Mr. Sato, complained to TEPCO in October 2005. They claimed that the multi-layered subcontractor system was causing a great deal of trouble at the nuclear power plant. According to them, some of the workers were *yakuza* group members and had tattoos, which was an abnormal situation for a public utility.

"Illegal acts, such as the forgery of health reports and registered seal impressions (the equivalent of forging a signature or an official rubber stamp), and not allowing workers to subscribe to health insurance and employees' pension plans, are rampant," they said. In response, TEPCO said the work contract refers to quality control, methods of construction, completion of the work, etc., and that the problems with the worker's body or personality are not mentioned.

TEPCO also said the company summoned the deputy chief of the Tomioka Town Police and asked him to give the subcontractors a lecture on how to deal with crime syndicates in staffing the Fukushima Daiichi nuclear plant in an attempt to raise their awareness of such problems. This remark indicates that TEPCO implicitly admitted the presence of crime syndicates in the plant, but used the work contract as an excuse for evading a direct response to the workers' demands.

Furthermore, Mr. Sato accused TEPCO of poor management of the plant workers. "Worker accidents are usually covered up inside the nuclear plant. Even if workers suddenly fall ill, they are not allowed to call an ambulance. In my case, after having been left unattended for three hours, I was taken to hospital in a colleague's car. I therefore suffered aftereffects later and became physically handicapped. Of all accidents occurring in the nuclear power station, 90% were concealed."

Referring to the presence of *yakuza* in the plant, he asked TEPCO, "Do you know that gangsters and their affiliated-company employees are working at the plant with impunity, betting on baseball games and gambling with *Hanafuda* (Japanese playing cards) in the workplaces? TEPCO is responsible for the management of the plant workers." TEPCO officials tend to fall silent when something disadvantageous to their position and hard to respond to is mentioned. That is the attitude they took in this case.

One year later, in 2006, TEPCO reportedly attempted to drive the gangsters and their affiliated companies out of the plant, but gave up because these people took a defiant attitude and threatened TEPCO by saying, "Do it if you think you can." Asked about the truth of this incident in further negotiations TEPCO refused to admit that the incident had occurred.

Apparently, TEPCO had a great deal of trouble dealing with two major problems. One of them was illegal conduct and the cover-up of worker accidents, and the other was crime syndicates and their affiliated companies. As for the former problem, the situation has improved considerably. Currently, ambulances are allowed to come into the nuclear power station and there is a doctor onsite 24 hrs a day. However, the latter problem is still beyond TEPCO's control because the subcontractor system is deeply multi-layered and complex, and because the *yakuza* are so deeply entrenched in the system.

(Mikiko WATANABE, CNIC)

- Continued from p.10, Nuke Info Tokyo No. 148-

Aging Nuclear Power Plants focusing in particular on irradiation embrittlement of pressure vessels

Hiromitsu Ino

We must first understand the data on which this is based. Table 2 shows the results for the first to fourth monitoring tests. The amount of neutron irradiation is the amount for the specimens, not for the pressure vessel itself. The specimens were placed deeper inside the reactor than the reactor walls, so they were irradiated by more neutrons. Since the specimens have been irradiated by more neutrons than the reactor walls in the same time, operating years are converted to "effective operating years".

Effective operating years for the fourth monitoring test specimen was 66 years, meaning the reactor walls would be irradiated by the same amount of neutrons after 66 years. Since the reactors do not operate continuously, this amount of irradiation would not actually be reached until 85 years after the reactor began operating. How then are the present ductile-brittle transition temperature (DBTT) and the DBTT after 60-years estimated? Since DBTT is 98°C after 85 years, bringing it back to 35 years and 60 years Kyushu Electric comes up with the lower temperatures of 80°C and 91°C respectively.

The method used to derive this estimate is to redraw the prediction curve, adding a margin of error so that it passes through data point "x" in the top right corner of Figure 1 (see Nuke Info Tokyo No. 148), then to read off the DBTT corresponding to the amount of irradiation after 35 years and 60 years respectively. But for such a method to have a basis, the embrittlement prediction curve in Figure 1 must have some legitimacy.

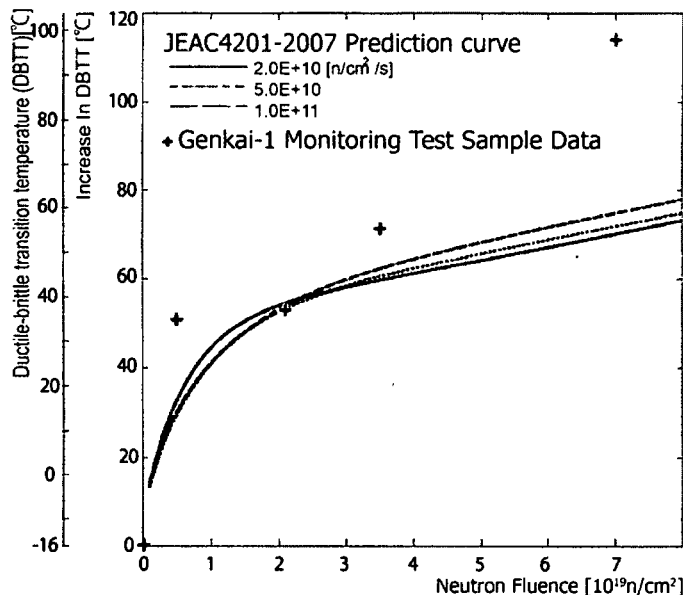


Figure 2: Genkai-1 Monitoring Data and JEAC-2007 Prediction

Monitoring test	Sample taken	DBTT* (°C)	Neutron fluence ($\times 10^{19}\text{n/cm}^2$)	Effective years of operation
Initial value prior to irradiation	Operation began in October 1975	-16	0	0
#1	Nov-76	35	0.5	Approx. 5 years
#2	Apr-80	37	2.1	Approx. 20 years
#3	Feb-93	56	3.5	Approx. 33 years
#4	Apr-09	98	7.0**	Approx. 66 years

Source: Prepared from Technological Assessment of Aging in Nuclear Reactors 2003 (December 2003) p.15, Table 2.3-1, and materials distributed at the Karatsu City Conference (25 October 2010).

* Ductile-brittle transition temperature ** Authors' estimation.

Table 2: Results of monitoring tests on mother material of Genkai-1 reactor pressure vessel

However, as discussed above, the formula used in the past has been pronounced invalid.

So can the new 2007 prediction formula explain the DBTT of Genkai-1? The answer is no.

Figure 2 shows the irradiation embrittlement prediction curve drawn by us on the basis of the 2007 prediction formula, and the observed DBTT. Like Figure 1, this diagram shows both the scale for DBTT and also for the increase in DBTT, the difference from the initial DBTT of minus 16°C.

It can be seen that the observed data of 98°C is 42°C above the predicted curve. This cannot be explained in terms of margin of error. Compared to Figure 1, if anything the deviation is greater. Thus the 2007 prediction formula fails completely to reproduce the irradiation embrittlement behavior of Genkai-1. Hence, there is no explanation why a high DBTT was observed in Genkai-1. Given that such high DBTTs are observed when there is a high amount of copper impurity, or there is phosphorous grain boundary segregation, we cannot rule out the possibility that the Genkai-1 pressure vessel contains, depending on the

location of the monitoring specimens, low quality steel with high levels of impurities. In regard to Genkai-1, both the 2004 formula (Figure 1) and the 2007 formula (Figure 2) have lost their predictive power. It is meaningless to estimate based on these formulas that the current DBTT is 80°C, or that after 60 years operation it will be 91°C.

So what should we suppose the DBTT to be now? There is no sound method of estimating it. In that case, Kyushu Electric should respect the observed data of 98°C, assume that the pressure vessel itself has already reached this high DBTT (that being a true safety margin) and consider what response should be taken. The response should be to carry out the abovementioned PTS assessment based on a DBTT of 98°C, reconsider the operating sequence based on the 98°C figure, and also carry out pressure tests based on 98°C.

NISA's Response and Public Comments

We were surprised at the observed high DBTT for Genkai-1. As soon as we

found out about it we requested Social Democratic Party leader Mizuho Fukushima to arrange a hearing with officers of Nuclear Industrial and Safety Agency (NISA) to find out about the monitoring test methodology, etc. To our amazement, at that point in time (December 15, 2010) NISA had received no information about the results of the fourth monitoring test for Genkai-1. The first they heard of it was from the questions in our letter. Kyushu Electric had not informed NISA of the strikingly high DBTT and NISA said they did not know because they had no obligation to inquire. What a careless and lax safety monitoring system. At the hearing we demanded that NISA pay great attention to Genkai-1's DBTT, and that it publish raw data for the Charpy test.

It is a matter of great significance that the results of the fourth monitoring test for Genkai-1 cannot be accounted for by either the former prediction formula (JEAC 4201-1991), or the current formula (JEAC 4201-2007), and that the high DBTT is totally unpredictable. NISA called for opinions regarding the 2010 supplement to JEAC 4201-2007, so, in light of this serious situation, the Nuclear Aging Research Team submitted a public comment to NISA articulating fundamental questions about the monitoring test methodology.

The essence of our public comment was as follows (abbreviated):

- The 2007 prediction formula is totally unable to reproduce the results of the monitoring test on mother material in the Genkai-1 reactor and metal welds in the Tsuruga-1 reactor, so the monitoring test system cannot be implemented based on the 2007 prediction formula.
- It is necessary to make a decision to permanently shut down nuclear reactors in which a high DBTT that cannot be explained by the prediction formula is observed.
- A fundamental review of JEAC-4201 is necessary, including whether prediction is possible.

This public comment calls for a fundamental review of JEAC-4201, which stipulates the monitoring test methodology for steel in pressure vessels, and for an explicit statement in the rule that there are cases where the option of permanent shutdown should be selected.

NISA's response to our public comment was published on its web site on May 6, 2011. There was no direct response to the points we made. The response made no reference to the striking deviation in the Genkai-1 data. It simply stated that where there is a deviation the margin for error should be reset and that there was no problem. NISA's reply was an insult to our intelligence. What needs to be corrected is the thinking behind the monitoring test methodology that uses margin for error to paper over problems.

Discussion and Issues in the "NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors"

Launch of the "NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors"

Last November the Nuclear Industrial and Safety Agency (NISA) initiated the NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors. As it turned out, I was invited to become a member of the committee. Hitherto, NISA

has ignored our ideas. I decided to participate in the Hearings because I believed it was necessary to have a forum in which to communicate our thoughts about the issue of aging nuclear power plants, in particular concerning the extraordinary embrittlement of the Genkai-1 plant. However, these Hearings are, as their name implies, a forum in which committee members' views are heard and debate takes place, but in the end NISA takes responsibility for writing the report. I was aware of this limitation when I decided to become a committee member.

The following three issues have been considered during the Hearings:

- (1) Assessment of the aging of individual plants:
- (2) Relation between aging and the Fukushima Daiichi accident:
- (3) Cause of the greater than predicted embrittlement of Genkai-1:

Consideration of how to interpret the results of the monitoring tests of the Genkai-1 DBTT, which exceeded the predicted 98°C, and whether the equation for predicting embrittlement is appropriate.

Theme (3), which relates to irradiation embrittlement in Genkai-1 and whether the existing prediction equation is appropriate, is the issue that interests me most. Debate about the cause of the high DBTT (98°C) observed in the Genkai-1 pressure vessel monitoring tests revolved around two theories: [i] was it caused by poor quality pressure vessel material or a bad manufacturing method, or [ii] was it because the embrittlement prediction equation does not accurately reflect reality in the high irradiation range?

Kyushu Electric claimed that the results of a chemical analysis of the steel materials showed that there were no irregularities and that uniformity was maintained. They also claimed that examinations carried out by the Central Research Institute of Electric Power Industry (CRIEPI) and others into micro-organization in the monitoring samples showed a good correlation between embrittlement and the formation of impurity clusters, so there was no abnormal embrittlement. However, to confirm the accuracy of this judgment and form a conclusion about whether or not the material of the pressure vessel is sound, instead of getting a research organization like CRIEPI, which is part of the nuclear industry, to assess the samples, they should be given to fair and trustworthy university researchers to examine their micro-organization.

To support Kyushu Electric's claim, a report entitled "Preliminary Consideration towards Improvement of the Accuracy of the Embrittlement Prediction Method" jointly produced by CRIEPI and the Federation of Electric Power Companies (FEPC) was submitted to the eighth meeting (February 22, 2012, document 10). It concluded that it is not necessary to change the thinking behind the embrittlement model and the reaction rate equation, which form the basis of the current prediction equation, and that the variation from reality arose due to the lack of data in the high irradiation range. Further, by giving importance to the high irradiation range data (applying a weighting) and resetting the parameters of the equation (impurity cluster formation rate equation coefficient) the Genkai-1 data fit was improved. In fact, however, the fourth data point of 98°C is still above the standard deviation margin and the second and third data points drop below, making the curve look very suspicious. In other words, they were

unable to draw a meaningful curve connecting the third (56°C) and fourth (98°C) data points.

It is problematic that in order to improve the fit in the high irradiation range the coefficients for the reaction rate equation, etc. were greatly changed. These reaction rate equations are the master equations that determine the whole method, so for the parameters to change greatly depending on the data sets that are used indicates the brittleness of the model itself. The reliability of the embrittlement prediction equation model, which is the basis of JEAC4201-2007, is therefore called into question. The problem goes beyond the Genkai Nuclear Power Plant. It extends to all aging nuclear power plants.

Looking at the diagram in which NISA compared the prediction equation for aging nuclear power plants with the observed data (Hearing number 5, 23 January 2012, document 2), a large gap between the predicted figure and the observed figure can be seen in the high irradiation region. It is a fact that the prediction equation is unable to predict reality. However, the inaccuracy for Genkai-1 is particularly striking. The inaccuracy for other reactors is within 20°C, but the data from the fourth monitoring sample for Genkai-1 is out by 42°C. Besides the fact that the embrittlement prediction equation does not match the pressure vessel of Genkai-1 (see [ij] above), we must consider that the extraordinary embrittlement is due to the materials or the manufacturing method ([ij]).

Another surprising thing was that when we investigated CRIEPI's embrittlement prediction equation, we discovered an elementary but important error in the equation itself. This prediction equation expresses changes in the micro-organization, namely the formation of impurity clusters and lattice defect clusters, which are the cause of irradiation embrittlement, as a reaction equation set, by tracing impurity atoms (copper atoms, etc.) and point flaw reaction (combination and disappearance) processes, and relating this to the rise in DBTT. This can be said to be an epoch-making change, compared to the rough and ready 2004 equation that just tried to fit the data, ignoring the rate of irradiation. However, there was a vital error in the reaction rate equation.

The main cause of irradiation embrittlement is the formation of copper clusters (or impurity clusters in general). In the model there are two types, irradiation induced clusters and irradiation promoted clusters. Irradiation induced clusters are accumulations of copper atoms in lattice defects caused by neutron irradiation. The rate of formation is proportional to the concentration of copper atoms and the rate of diffusion of copper atoms (the speed at which they move). Physically this is an appropriate assumption. However, CRIEPI's report says, "Because the formation of irradiation-enhanced clusters is a process in which copper atoms that exceed the solid solubility limit form a nucleus together, it is described by the square of the quantity of copper above the solid

solubility limit and also the square of the diffusion coefficient." It must be said that this is a mistake. Because two (or more) copper atoms come together to form a cluster, it is appropriate to think that it is proportional to the square of the concentration of copper atoms, but it is a mistake to say that it is proportional to the square of the diffusion coefficient*. Because two atoms move, at first sight it might seem that it would be proportional to the square of the speed, but that is not the case. Whether one atom is moving or stationary at one point, the rate at which they come together is the same. This can be proved mathematically. For example, the chance of two people meeting in a crowd in a stadium is the same whether one of the two is moving or stationary.

As stated above, there is an error in the basic model of CRIEPI's prediction equation. Naturally, any arithmetical calculation using this equation will produce the wrong result. Since the JEAC4201-2007 embrittlement prediction equation includes this fundamental error, it is a useless equation for predictions.

In addition to the abovementioned brittleness of the embrittlement prediction equation, a mistake in the derivation of the equation itself was discovered. The JEAC4201-2007 embrittlement prediction equation must be discarded. The current situation is that there is no reliable prediction equation.

Is Genkai-1 Pressure Vessel Sound? NISA's Predictable Assessment

At the 12th Hearing, held on March 29, NISA submitted a draft report entitled "Concerning Neutron Irradiation Embrittlement of Reactor Pressure Vessels (Draft)" (referred to hereon as "Draft Report"). The purpose was to bring to a close the debate since January this year about "the cause of embrittlement in excess of predictions in the Genkai-1 reactor." I strongly opposed the Draft Report and listed the problems. In the end the report was not finalized in March as planned and debate continued.

Kyushu Electric Power Company's PTS Assessment

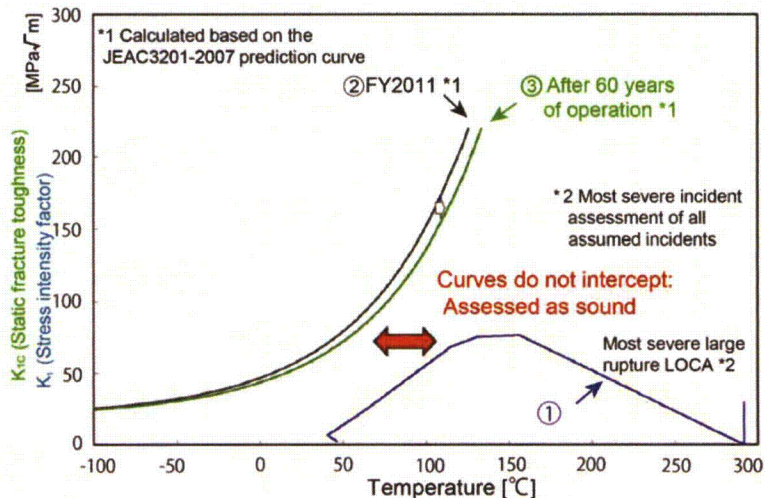


Figure 3: Kyushu Electric's Pressurized Thermal Shock (PTS) Assessment for Genkai-1 Pressure Vessel.

* The equation is: Formation rate of irradiation-enhanced clusters = $A \times (\text{quantity of copper above the solid solubility limit} \times \text{its diffusion coefficient})^2$

I strongly opposed the report because even though the reason why a high DBTT of 98°C was observed was hardly explained, the conclusion was drawn that the pressure vessel of Genkai-1 was sound, and the fact that the DBTT failed to agree with predictions was blamed on flaws in the prediction equation. Furthermore, NISA concluded that the pressurized thermal shock (PTS) assessment carried out by Kyushu Electric was appropriate and that the pressure vessel was in sound condition. However this type of assessment is totally inappropriate.

Figure 3 shows the results of Kyushu Electric's PTS assessment. The curve that looks like a mountain in the bottom right hand corner is called the PTS state transition curve (K_I curve). In the case of a sudden large loss of coolant (Loss of Coolant Accident = LOCA), the Emergency Core Cooling System (ECCS) kicks in and coolant is fed

into the reactor. The K_I curve shows the change over time in the force (strictly speaking the stress intensity factor K_I) applied under those circumstances to the leading end of cracks that are presumed to exist in the inner surface of the pressure vessel. As a result of inserting cooling water, the temperature of the internal surface drops. At the same time, a temperature difference arises across the thickness of the pressure vessel and tensile stress is applied to the inner wall. Eventually the temperature difference of the pressure vessel becomes smaller and the value of the K_I curve decreases towards the bottom left.

On the other hand, the curve rising to the right from the bottom left of Figure 3 is called the fracture toughness transition curve (K_{IC} curve). It shows how the fracture toughness K_{IC} changes depending on the temperature. If the material becomes brittle the curve shifts to the right. How is this curve derived? Besides Charpy shock test specimens, specimens are placed inside the pressure vessel to measure fracture toughness. These are extracted and the fracture toughness is measured at various temperatures. A curve is drawn as an envelope around the bottom limit of the measurements, in other words below which there is no data. In the Japan Electric Association's standard JEAC4206-2007 this curve is derived using the following equation:

$$K_{IC} = 20.16 + 129.9 \exp[0.0161 (T - T_p)] \dots (C8)$$

Parameter T_p is determined so as to draw an envelope around the measured data (i.e. so that all the data falls above the curve).

As the amount of neutron irradiation increases, the fracture toughness is reduced and breakage due to embrittlement occurs at higher temperatures. In order to derive a fracture toughness transition curve that

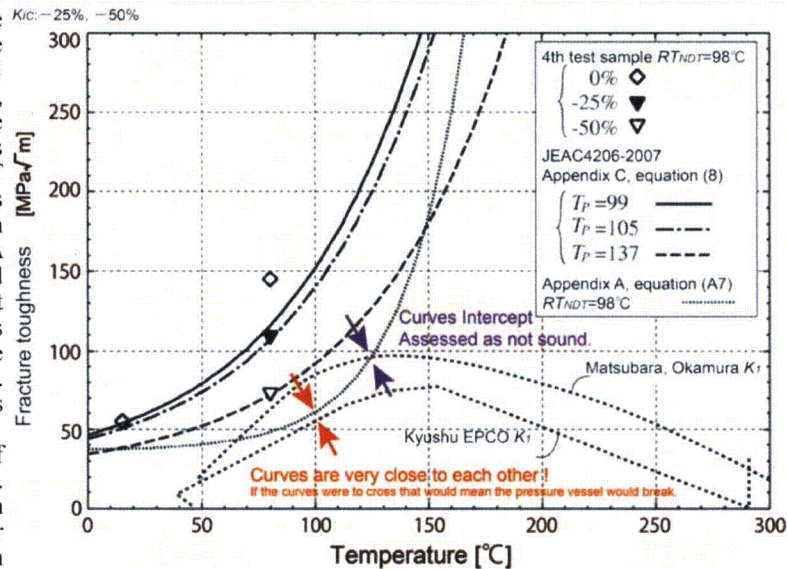


Figure 4: Results of Authors' Examination of Genkai-1 Pressurized Thermal Shock (PTS) Assessment. JEAC4206-2007 Appendix C and Appendix A, using references (a) and (b).

corresponds to amounts of irradiation embrittlement other than those given by the measurement test specimens, with the measurement data on the horizontal axis the curve is shifted an amount $\Delta T_{K_{IC}}$ parallel to this axis in the higher temperature direction. In that case, $\Delta T_{K_{IC}}$ is said to hold. ΔRT_{NDT} is the difference in the DBTT (the amount by which DBTT shifts). In other words, it is assumed that if the temperature at which the fracture toughness value was measured is shifted by the same amount that the DBTT increased, the same fracture toughness value will be obtained. There is no theoretical basis for this relationship, but since it more or less works experimentally, JEAC4206 used this assumption.

Theoretically, an enveloping curve can therefore be drawn using all the observed test data from the first to the fourth test at Genkai-1, as well as data measured before irradiation. Also, for an arbitrary amount of neutron irradiation, a fracture toughness transition curve (C8) can be drawn. In this way the two curves in Figure 3 show the current K_{IC} curve and the K_{IC} curve 60 years after commencement of operation for estimated amounts of irradiation of the inner surface of the pressure vessel.

According to NISA's draft, "The fracture toughness measurement for accumulated irradiation equivalent to that in 22 years from now (60 years from commencement of operations) was approximately double (over 50°C in terms of temperature) the critical stress intensity factor. This fracture toughness measurement is a directly measured value not related to the accuracy and correlation equations of the prediction method. Even bearing in mind that in general there is a variation of $\pm 25\%$ in fracture toughness for materials within the transition temperature range, it was confirmed that at this point in time there is sufficient margin for operation of Genkai-1." (p. 11)

(a) Nuclear Industrial and Safety Agency. "Concerning Neutron Irradiation Embrittlement of Reactor Pressure Vessels (Draft)." *Hearings on Technological Assessment of the Aging meeting 12 document 5*, March 29, 2012.

(b) Kyushu Electric Power Company. "Responses to Committee Member Comments". *Hearings on Technological Assessment of the Aging meeting 8 document 6*, February 22, 2012, pp. 3-5.

Is this true?

The first problem is the qualification, "Even bearing in mind that ... there is a variation of $\pm 25\%$ in fracture toughness." Is not the variation in the fracture toughness larger within the transition temperature range? Is it not said that it is from double to half? If there is a variation of 50% in the 80°C measurement of the fourth monitoring test, what will happen to the K_{IC} curve? I drew this in Figure 4. The result is that the K_{IC} curve approaches much closer to the K_I curve.

The second problem follows on from the above quote, "In regard to the variation in the monitoring measurement values, although the measurements each time are few in number, they are carried out continuously for fracture toughness for temperatures which take into account the increase in temperature (which can be thought of as the DBTT) for each monitoring test and it is considered rational to take the overall lower limit." This is also on p. 11 of NISA's draft report. This sentence refers to a shift in the fracture toughness ΔRT_{NDT} based on the abovementioned assumption that $\Delta T_{K_{IC}} = \Delta RT_{NDT}$. However, I submitted an opinion to the Hearings with an analysis that specifically showed that for Genkai-1, at least, this assumption does not hold. It is unacceptable that NISA compiled this draft with no reference to my analysis.

If this assumption does not hold, the shifted data point is not valid and the only two data points that can be used to draw the K_{IC} curve are those from the fourth monitoring test. With such limited data it is hard to claim that a reliable value for fracture toughness can be derived. I therefore presented the curve in Figure 4 taking into account a variation of 50%.

However, in appendix A to JEAC4206-2007 there is a rule about what should be done "in the case where the value for fracture toughness is not derived." This is an instruction to use the following equation to derive the K_{IC} curve from the DBTT values.

$$K_{IC} = 36.48 + 22.78 \exp[0.036(T - RT_{NDT})] \dots (A7)$$

Figure 4 shows the curve derived by inserting the fourth monitoring test values for DBTT $RT_{NDT} = 98^\circ\text{C}$ into equation A7. This curve approaches almost to the point of touching the stress curve K_I . If the curves were to cross that would mean the pressure vessel would break.

Next I would like to consider the PTS state transition curve (K_I curve), which shows the size of the stress arising. Are Kyushu Electric's calculations sufficiently conservative? The assumption in JEAC4206 is for a semi-elliptical 10mm deep and 60mm long crack in the inner surface. It calculates the stress applied to the leading edge of this crack (stress intensity factor K_I). Figure 3 shows the PTS state transition curve derived by Kyushu Electric for Genkai-1. According to document 20 presented to the Hearings by Kyushu Electric, for the PTS assessment the most severe large rupture LOCA (loss of coolant accident) is assumed. Kyushu Electric said that it is a conservative assessment in which, without considering the temperature conditions of the inner surface or mixing with cooling water, the temperature would fall in steps from 291°C to 27°C. (Kyushu Electric gave a confusing explanation implying that the temperature of the inner surface also falls in steps.)

On the other hand, in Figure 4 the K_I curve

referred to as 'Matsubara and Okamura' shows the results of a PTS assessment for a pressure vessel of the same dimensions as Genkai-1 (plate thickness 168mm, diameter 3.37). It is a diagram showing the case of a 10mm deep crack (a ratio of crack depth to plate thickness of 0.06). This curve gives a much larger K_I curve than the curve in Kyushu Electric's assessment. Matsubara and Okamura's paper assumes a sufficiently long crack, so compared to assuming a crack of 60mm length the values are rather large, but that variation is about 15% based on stress calculations (personal correspondence from Dr. Aono). Even if that amount is subtracted it is above Kyushu Electric's K_I curve. There is therefore a possibility that Kyushu Electric's assessment is not sufficiently conservative in regard to pressure conditions, etc.

On this point, committee member Meshii said that the K_I curve changes greatly depending on the heat transfer coefficient h of the inner surface. If the equation is taken as $h = 1 \text{ kW/m}^2\text{K}$ the result is close to Kyushu Electric's analysis, but if it is taken as $h = 2 \text{ kW/m}^2\text{K}$ the result is about the same as the Matsubara and Okamura analysis, and for $h = \infty$ it crosses the K_{IC} curve. From this result, Meshii concluded, "The PTS assessment carried out by Kyushu Electric was judged to be close to realistic, but not so conservative that it was not necessary for variation in the fracture toughness value to be taken into account." He is saying that the curve in the assessment is at the limit and that Kyushu Electric's analysis does not have sufficient leeway.

Seen in this light, the conclusion in NISA's draft report that it has been confirmed that Genkai-1 is "sound enough" in regard to pressurized thermal shock must be seen as lacking foundation. At the sixteenth meeting of the Hearings NISA submitted a new draft which to some extent took into account the various critical views expressed. Debate on this draft is set to begin. However, even though the wording is slightly changed and the data reinforced, the arguments and the conclusion in this draft are the same as before. The conclusion that the Genkai-1 pressure vessel is sound was there from the beginning. The new draft does no more than add all sorts of considerations.

For reactors with such extreme irradiation embrittlement that the conclusion concerning whether or not they are safe varies depending on the analytical method and point of view, there is no other way to ensure people's sense of security than to make a decision to shut these reactors down.

The dangers of nuclear power plants are not limited to earthquakes and tsunamis. Aging is another big problem. In this context, the irradiation embrittlement discussed in this paper is the most fundamental problem requiring attention. Operating for 60 years nuclear power plants which were assumed to have a life expectancy of 40 years is just increasing the danger.

Destruction of the pressure vessel due to embrittlement is an accident that must not be allowed to happen. If the pressure vessel is destroyed the nuclear fuel will be spread over a wide area and there will be no way of cooling the nuclear fuel to remove the decay heat. Emergency response fire trucks and power supply trucks will all become ineffective. Reactors with even a small risk of being destroyed due to embrittlement should be shut down.

Continued on page 5

Anti-Nuke Who's Who

Hiraku Yamami of the Hinodeya Institute for Ecological Lifestyle

by Haruka Ozeki*

In spring 2002, Hiraku Yamami, at the age of 22, had his first direct contact with three organizations—the Takagi School, the Citizens' Nuclear Information Center, and the Society for Studies on Entropy—almost simultaneously. More specifically, he began to participate in the seminars and lectures held by these organizations in order to meet with the authors of the books he had read. He made many long day trips to the eastern or central regions of Japan, where such gatherings were organized, from his hometown of Nara City, located in western Japan. The frequent participation of the young man from a distant region must have been welcomed. Today, Mr. Yamami works for the Hinodeya Institute for Ecological Lifestyle in Kyoto as a researcher, while engaging in his lifelong commitment to social action.

Mr. Yamami's main work at the institute is to promote energy conservation to small businesses and shops. "Even if a piece of machinery saves energy, people can increase energy consumption and 'trade-off' the reduction if neither society nor citizens understand the significance of energy conservation," he says. "For example, suppose nuclear power is completely replaced with natural energy. Will society be better in a real sense? If humans continue to consume prolific amounts of energy, as we do today, our society will eventually collapse. Unless people's attitudes change along with changes in energy, the problems we have today will emerge again."

Regarding the March 11, 2011 disaster, Mr. Yamami says firmly: "Our society will break down unless we steer it in a different direction now. We must change."

As a schoolchild, Mr. Yamami loved science. "Technology is really wonderful!" He hoped to find a job related to technology in the future. As a senior high school student, he had an experience that swayed his trust in technology. In class, he participated in a debate about whether recycling PET bottles was good or bad. "If it is technically possible to recycle the bottles, it should be promoted positively," he argued. He was met by counterarguments such as: "Who will pay the recycling cost?" and "If we can recycle the bottles, can we use PET bottles limitlessly?"



The pedal-power bicycle generator is lighting the lamp. Mr. Yamami is involved in the development of pedal power generators.

After this experience, he became able to examine issues from many angles, including social viewpoints, not only technological ones.

"Technology may not be the universal solution." About the time he had this experience, Mr. Yamami started to think of technology from a critical point of view. In response to his questions, his father recommended books by Jinzaburo Takagi. The process of trying to find something that might undermine the values of science and technology he loved, such as learning about the negative aspects of nuclear power generation, must have been a tough task that consumed a great deal of physical and mental power for a susceptible youth, who was lost, confused and puzzled.

Since then, Mr. Yamami has been placing importance on the point of view of citizens and on fostering approaches that are accessible to all. "I believe we can make our lives richer and even more joyful by using less energy than we do today. In the future, I'd like to see more people getting involved with energy-saving opportunities," he says firmly.

* Staff of the Hinodeya Institute for Ecological Lifestyle

NEWS WATCH

Hitachi-GE to Accept Order for Lithuanian Nuclear Plant

On June 21, the Lithuanian Parliament approved a construction contract between its government and Hitachi-GE for an ABWR (1,384 MW).

Construction plans for the Visaginas Nuclear Plant, close to the border of Latvia and Belarus, aim for completion in 2021. Latvia and Estonia will also receive electricity and are being requested to bear a part of the cost burden. It is planned to conclude the official contract after the investment amounts are approved. Hitachi, the nuclear plant's operating company has also become an investor, and should the investment figure for the three countries decrease then Hitachi's burden will increase. Some of the surrounding countries also have anti-construction movements, and thus this is a major risk for Hitachi.

Demands for Nuclear Plant Decommissioning: A Succession of Lawsuits

Following the Fukushima nuclear accident, new lawsuits demanding nuclear plant decommissioning are being filed in various areas.

Lawsuits filed this year include: Kyushu Electric's Genkai Nuclear Plant on January 31, Tokyo Electric's Kashiwazaki-Kariwa Nuclear Plant on April 23, Kyushu Electric's Sendai Nuclear Plant on May 30, and Hokuriku Electric's Shika Nuclear Plant on June 26. It seems as though lawsuits are about to be filed against all of Japan's nuclear plants.

Around 7.5 Million Signatures for Nuclear Phase-out Submitted to Government and Diet

Eminent writers and critics such as Kenzaburo Oe have called for a petition named "Goodbye to Nuclear Power Plants", and have

obtained around 7.5 million signatures. The petition was submitted to both the Chairman of the Lower House on July 12th, and to the Chief Cabinet Secretary on July 15th. On July 12th, eighty Diet members participated in a report meeting in the Diet Member's building to listen to Mr. Oe's appeal.

New Law Establishes Nuclear Regulatory Commission

In NIT Issue 147, News Watch reported that a bill for restructuring Japan's nuclear regulatory organizations had been submitted to the Diet. In the bill, the Nuclear Regulatory Agency was to be created under the Ministry of the Environment, but the LDP and Komeito parties submitted a counterproposal stating that there should be a Nuclear Regulatory Commission. The ruling DPJ party met the opposition parties halfway and withdrew its first plan. The three parties submitted to the Diet a revised plan based on a new agreement, which was enacted on June 20. Accompanying this enactment, the provision "contribute to Japan's national security" was added to the three laws, the Nuclear Regulatory Commission Establishment Act, the Nuclear Reactor Regulation Law and the Basic Law on Atomic Energy, raising concerns that this may lead to the abrogation of the principle of peaceful use of nuclear power.

Demand for a Citizens' Referendum Ordinance Fails to Pass

The demand in Osaka City and the Tokyo metropolis for a citizens' referendum ordinance for a vote on the restart of nuclear plants was rejected both in the Osaka Assembly on March 27 and in the Tokyo Assembly on June 20. At the same time, movements with a similar claim have started in Shizuoka and Niigata Prefectures.

Nuke Info Tokyo is a bi-monthly newsletter that aims to provide foreign friends with up-to-date information on the Japanese nuclear industry as well as on the movements against it. It is published in html and pdf versions on CNIC's English web site: <http://cnic.jp/english/>

Please write to us if you would like to receive email notices when new editions are published.

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March 9, 2012

Dear U.S. Senators Levin and Stabenow,

This week marks the sixth anniversary of a U.S. Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board's (ASLB) decision to steamroll our opposition, and rubberstamp a 20 year license extension (2011 to 2031) at the problem-plagued Palisades atomic reactor in Covert, Michigan. Our protest of the NRC's finalization of its license extension approval on January 17, 2007 is attached.

Given the then-dilapidated status of Palisades, it was profoundly disturbing that there was a license extension granted. In light of recent developments, it is inexcusable that Palisades is allowed to continue operations. **Palisades has now been identified by the NRC as one of the four worst plants in the US and is now the very most embrittled plant in the country.**

Palisades, located on the Lake Michigan shoreline five miles south of South Haven, has a rich history of trouble. Our concerns are manifold, from radioactive waste risks to multiple reactor safety risks, but we focus now on the serious matter of reactor pressure vessel (RPV) embrittlement.

RPV embrittlement is caused by neutron radiation bombardment of the RPV's metal walls over time, resulting in a significant loss of ductility. In pressurized water reactors like Palisades, embrittlement risks causing Pressurized Thermal Shock (PTS). For example, if overheating occurs in the operating reactor core, the Emergency Core Cooling System (ECCS) is designed to inject cooling water, in order to prevent a meltdown. But such sudden temperature change, combined with such high pressure, could fracture an embrittled RPV like a hot glass under cold water. A fractured RPV would lead to a Loss of Coolant Accident (LOCA) which in turn can lead directly to a reactor core meltdown. The pressurized primary core cooling water would instantly turn to steam and escape the RPV through the break in the vessel and fill the containment with radioactive steam and other escaping radioactive gases and particles, all at deadly levels. If the meltdown burned its way through the containment structures, or if the large, concentrated quantity of hazardous radioactivity found other escape pathways out of containment, a catastrophic radioactivity release to the environment could occur.

The ongoing Fukushima Daiichi Nuclear Catastrophe, which began one year ago on March 11th, demonstrates that catastrophic radioactivity releases are not confined to Soviet designed reactors as at Chernobyl but also can befall Western designed reactors. Fukushima shows that we can no longer abide such risks in our midst.

Palisades is an accident waiting to happen. It must be shut down, before it melts down.

What kind of risks are we talking about? A 1982 study by Sandia National Laboratory predicted that catastrophic radioactivity releases could cause casualties and property damage downwind and downstream. For Palisades, the predictions are shocking: 1,000 "peak early fatalities," 7,000 "peak early injuries," 10,000 "peak cancer deaths," and \$52.6 billion in property damage. Populations have grown significantly in the past several decades, so casualties would be much worse now. When adjusted for inflation alone (not accounting for the economic development in the ensuing decades), the property damage figure would top \$117 billion in 2010 dollars.

The NRC admitted just February 29, 2012 at a public meeting in South Haven that "Palisades'

vessel is the most embrittled vessel at an operating nuclear power plant” in the U.S. (Jennifer Uhle, Ph.D., NRC Office of Regulatory Research). We had long suspected as much, as the main basis of our intervention against the Palisades license extension was RPV embrittlement risk. But six years ago, the NRC ASLB steamrolled us and rubberstamped the 20 year license extension. Perhaps no reactor in the U.S. is as old and degraded as Palisades.

The NRC also admitted that night that Palisades' ECCS actually activated in the chaotic, high-risk aftermath of the September 25, 2011 accident cutting power to half the control room. Fortunately, the ECCS did not actually inject coolant into the core. This would have tested NRC's highly questionable assurances and regulatory rollbacks on PTS, in the real world.

The public is being forced to bear the risk of Entergy's game of radioactive Russian roulette on the Lake Michigan shoreline. What are you going to do to help us? You and your staffs never even acknowledged receipt of, let alone acted upon, the letter we sent you six years ago this month, demanding a GAO investigation of the progressive weakening of embrittlement requirements at Palisades. It was signed by 16 of Michigan's leading environmental groups, including the Sierra Club and the Michigan Environmental Council, a coalition of 70+ constituent groups. The combined memberships of these organizations represented the views of hundreds of thousands of Michiganders. Additionally, organizations from Indiana, Illinois, Wisconsin, and Ontario also signed the letters, as well as Great Lakes United, itself a coalition of 150 groups in the U.S. and Canada, from 8 states and 2 Canadian provinces. Certainly, the concern about Palisades' RPV embrittlement risks is widespread – and the deafening silence from your offices has left us feeling that the public has no voice in the critical issue of whether Palisades should be allowed to continue operating in such dangerous circumstances.

It is now 2012, 45 years since Palisades got its operating license. NRC has rubberstamped a risky license extension for 20 more years. It is our moral duty to plead that you address the matter of the RPV embrittlement danger. We repeat our modest request that you launch a GAO investigation, albeit six years late. We also request meetings with you, personally, by mid-April, or even sooner. We want to know what you are going to do to protect us against the overt, out-of-control, worsening risks at Palisades, starting with its embrittled RPV, the worst in the country. Please work with us to meet at your Grand Rapids offices, either separately on the same day, or jointly. Please plan on booking a room big enough to accommodate a large number of concerned citizens who will want to come.

Entergy is making a killing, while getting away with murder. We must not let the figurative become literal.

Our point of contact is Kevin Kamps with Beyond Nuclear. Please contact him at (240) 462-3216. Thank you.

Sincerely,

/s/ Corinne Carey, Don't Waste Michigan, Grand Rapids chapter
/s/ Alice Hirt, Don't Waste Michigan, Holland chapter
/s/ Kevin Kamps, Don't Waste Michigan, Kalamazoo chapter
/s/ Michael Keegan, Don't Waste Michigan, Monroe chapter
/s/ Kathryn Barnes, Don't Waste Michigan, Sherwood chapter
/s/ Terry Lodge, Legal Counsel for Environmental Intervenors

U.S. Nuclear Regulatory Commission document:

Generalization of Plant-Specific Pressurized Thermal Shock (PTS) Risk Results to Additional Plants

Date Submitted: October 26, 2004 Revised: December 14, 2004

Table 1. Plants with highest *RTNDT*.

Tolerance to a PTS Challenge

Plant Name NSSS Vendor

Most Embrittled

Material

*RTNDT*_(u) + Irradiation

Shift at 40 years [° F]

Vessel Manufacturer

The estimated tolerance to a **PTS** challenge increases as the number in the next column increases (i.e., plants with the lowest ranking have the most embrittled materials).

- 1 Salem 1 Westinghouse Plate 204 Combustion Engineering
- 2 Beaver Valley 1 Westinghouse Plate 194 Combustion Engineering
- 3 TMI-1 Babcock & Wilcox Axial Weld 186 Babcock & Wilcox
- 4 Fort Calhoun Combustion Engineering Axial Weld 181 Combustion Engineering
- 5 **Palisades** Combustion Engineering Axial Weld 179 Combustion Engineering
- 6 Calvert Cliffs 1 Combustion Engineering Axial Weld 178 Combustion Engineering
- 7 Diablo Canyon 1 Westinghouse Axial Weld 171 Combustion Engineering
- 8 Diablo Canyon 2 Westinghouse Plate 170 Combustion Engineering
- 9 Sequoyah 1 Westinghouse Forging 167 Rotterdam Dockyard
- 10 Watts Bar 1 Westinghouse Forging 164 Rotterdam Dockyard
- 11 St. Lucie 1 Combustion Engineering Axial Weld 164 Combustion Engineering
- 12 Surry 1 Westinghouse Axial Weld 163 Babcock & Wilcox
- 13 Indian Point 2 Westinghouse Plate 162 Combustion Engineering
- 14 Ginna Westinghouse Forging 161 Babcock & Wilcox
- 15 Point Beach 1 Westinghouse Axial Weld 159 Babcock & Wilcox
- 16 Farley 2 Westinghouse Plate 158 Combustion Engineering
- 17 Mcguire 1 Westinghouse Axial Weld 158 Combustion Engineering
- 18 Oconee 1 Babcock & Wilcox Axial Weld 157 Babcock & Wilcox
- 19 North Anna 2 Westinghouse Forging 155 Rotterdam Dockyard
- 20 Shearon Harris Westinghouse Plate 153 Chicago Bridge & Iron
- 21 North Anna 1 Westinghouse Forging 153 Rotterdam Dockyard
- 22 Cook 2 Westinghouse Plate 152 Chicago Bridge & Iron
- 23 Salem 2 Westinghouse Axial Weld 148 Combustion Engineering
- 24 Crystal River 3 Babcock & Wilcox Axial Weld 141 Babcock & Wilcox
- 25 Calvert Cliffs 2 Combustion Engineering Plate 139 Combustion Engineering

26 Robinson 2 Westinghouse Plate 138 Combustion Engineering
27 Cook 1 Westinghouse Axial Weld 138 Combustion Engineering
28 Farley 2 Westinghouse Plate 133 Combustion Engineering
29 Farley 1 Westinghouse Plate 133 Combustion Engineering
30 Arkansas Nuclear 1 Babcock & Wilcox Axial Weld 129 Babcock & Wilcox

Notes:

Plants analyzed in the **PTS** re-evaluation effort.

Plants compared in the Generalization activity.

**UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION**

Before the Atomic Safety and Licensing Board

_____)	
In the Matter of	)	Docket No. 50-255-LR
NUCLEAR MANAGEMENT COMPANY	)	ASLBP No. 05-842-03-LR
PALISADES NUCLEAR GENERATING)	
STATION)	
Regarding the Renewal of Facility Operating)	
License No. DPR-20 for a 20-Year Period	)	March 17, 2006
_____)	

**PETITIONERS' NOTICE OF APPEAL FROM ASLB DENIAL
OF HEARING, AND SUPPORTING BRIEF**

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<i>Philadelphia Elec. Co.</i> (Peach Bottom Atomic Power Station, Units 2 and 3), ALAB-216, 8 AEC 13, 21 (1974)	4
<i>Private Fuel Storage, L.L.C.</i> (Independent Spent Fuel Storage Installation), LBP-98-7, 47 NRC 142, <i>aff'd</i> , CLI-98-13, 48 NRC 26 (1998)	4
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NOTICE OF APPEAL

Now come the Nuclear Information and Resource Service, *et al.*, Petitioners-Intervenors herein (and hereinafter referred to as "Petitioners"), by and through counsel, and pursuant to 10 CFR § 2.311, give notice of their appeal from the March 7 "Memorandum and Order" (hereinafter "Order") issued by the Atomic Safety and Licensing Board panel in this matter, by which the ASLB denied Petitioners a hearing on their sundry contentions.

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BRIEF IN SUPPORT OF NOTICE OF APPEAL

I. INTRODUCTION

This proceeding involves the application of Nuclear Management Company, LLC ("NMC") to renew the operating license for its Palisades Nuclear Plant for an additional twenty-year period commencing in 2011. A number of groups and individuals jointly petitioned for standing as intervenors and submitted contentions challenging various safety and environmental aspects of the proposed license renewal.

There was no genuine controversy raised over the standing of the Petitioners, all of whom were granted status to intervene. The matter proceeded to a prehearing conference in November 2005, and in its March 7, 2006 "Memorandum and Order," the ASLB reviewed the

contentions and denied Petitioners a hearing on any of them, terminating the adjudication, “despite [Petitioners] having in some instances touched upon some serious topics.” Order p. 2.

From the order ending the adjudication, Petitioners have timely taken this appeal, challenging the ASLB’s rulings on Contentions.1, 3 and 5.

II. ARGUMENT

Status of Demetrios Basdekas as Petitioners’ Expert on Embrittlement

After being presented extensive evidence of Demetrios’ Basdekas involvement with Petitioners in the drafting of Contention 1 on reactor pressure vessel embrittlement, the ASLB denigrated the value of Basdekas’ involvement by relegating him (Order p. 17) to the role of having “assisted Petitioners in drafting Contention 1, not that he would be relied upon or available to assist them at any hearing.” Petitioners have proven that Basdekas framed his statement to the press, that he actively co-wrote Contention No. 1, and that in his press statement, he stated that the best indicators of embrittlement at Palisades were NMC’s own records. Basdekas’ assertions about embrittlement were not simply “obvious” or generic, but were made with specific reference to Palisades. Mr. Basdekas was Petitioners’ expert at the time of submission of Contention No. 1 on August 8, 2005. He was not merely a co-drafter of the contention.

The ASLB has exalted form over substance, letting slavish adherence to rules work to bar the litigation on its merits of matters which the Board has itself termed “very serious.” As the below discussion reveals, *infra*, Petitioners timely submitted their contentions in this intervention, and then followed up with a supplemental filing some five (5) weeks later which the Board has declined to consider, calling the supplemental filing untimely. This license extension proceeding has seen several major delays for accommodation of other parties or

incurred on the Board's own motion, which in the aggregate amount to more lost time from "delay" than the "delay" of the five weeks supposedly caused by Petitioners between contention submission and supplemental filing. However, the perceived damage to the relatively slow progress of the proceedings is laid only at the feet of the Petitioners.

Appeal of dismissal of Contention No. 1 (The license renewal application is untimely and incomplete for failure to address the continuing crisis of embrittlement)

Despite giving lip service (Order p. 23) to the adages that "technical perfection is not an essential element of contention pleading"¹ and that the "[s]ounder practice is to decide issues on their merits, not to avoid them on technicalities,"² the ASLB nonetheless contrived to deny admission of the embrittlement contention. The licensing panel notes (Order p. 34) that in "Petitioners' Combined Reply to NRC Staff and Nuclear Management Company Answers" filed on September 16, 2005 - 5 weeks after Petitioners' submission of their embrittlement contention - that Petitioners "provide[] additional support for the contention, of the sort that might have been included in the original basis for the contention."

The panel emphasized that embrittlement of the reactor pressure vessel is a "very serious topic, with regard to Palisades or indeed any nuclear plant," Order p. 35; that it was within the scope of license renewal, Order p. 36, and "warrants close attention." *Id.* But the ASLB proceeded to discard the contention for stating the "obvious" and presenting no specific issue which is Palisades-specific and susceptible to litigation. Order p. 37-38. The panel charitably noted that the rules of contention pleading might have "place[d] . . . petitioners in a difficult position," Order pp. 40-41, but denies the contention, with the ASLB limiting itself to the

¹*Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-01-3, 53 NRC 84, 99 (2001).

²*Houston Lighting, ALAB-549*, 9 NRC at 649.

information which accompanied the presentation of the timely-filed August 8, 2005 petition, not the supplementation filed on September 16, 2005.

By parsing the information available to it so constrictively, the ASLB carefully erected the very “fortress”³ which it had counseled should be avoided.⁴

The ASLB “fortress” is impervious to these inconvenient facts: The Palisades reactor vessel was built some 39 years ago of an alloy containing unknown percentages of copper and nickel. The blend has been lost to history, if it ever were written down in the first place. This fact, alone, creates tremendous difficulty in accurately predicting the degree of embrittlement present in the reactor pressure vessel at any point during Palisades’ operating history.

Moreover, when the reactor pressure vessel was constructed, the utility elected not to install a thermal shield in the vessel, making it somewhat anomalous among similar reactors in the U.S. nuclear industry. When the vessel was completed, it was outfitted with so-called

³*Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2, and 3), CLI-99-11, 49 NRC 328, 334 (1999):

This is not to say that our contention rule should be turned into a “fortress to deny intervention.” [*Philadelphia Elec. Co.* (Peach Bottom Atomic Power Station, Units 2 and 3), ALAB-216, 8 AEC 13, 21 (1974)]. The Commission and its boards regularly continue to admit for litigation and hearing contentions that are material and supported by reasonably specific factual and legal allegations. See, e.g., [*North Atlantic Energy Services Corp.* (Seabrook Station, Unit 1), CLI-99-6, 49 NRC 201, 219-21 (1999)]; [*Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-98-7, 47 NRC 142, *aff’d*, CLI-98-13, 48 NRC 26 (1998)]

Id. at 335.

⁴Prehearing Tr.149-50 (ASLB chair questioning Staff Counsel):
... [t]here’s also case law that says the contention rule should not be used [as] a fortress to deny intervention[,] that what you need is enough to indicate that further inquiry is appropriate. . . . Basically something to indicate that the petitioners are qualified, able to litigate the issue that they raise. So what we have here is [—] we have an allegation that the application is incomplete for failure to address the continuing crisis of embrittlement[,] supported by this factual allegation about early embrittlement and the identification of an expert who used to work with the NRC. So on the face of that it would seem that that provides something to indicate that further inquiry might be appropriate.

"surveillance coupons," pieces of metal deliberately left inside the vessel to be serially removed at refueling outages so they could be analyzed to predict the extent of embrittlement going on in the reactor vessel. Yet there was an insufficient number of coupons originally placed in the reactor, which ran out in the early 1990's, far before completion of the initial, 40-year, licensing period. See Exhibit 1-B in the "Appendix of Evidence" accompanying Petitioners' "Combined Reply."⁵

Calculations by NMC show that the Palisades vessel may have surpassed its Pressure Thermal Shock ("PTS") limits as early as 1995. Re-analyses of Palisades have produced an ever-widening range of resulting estimates for exceeding vessel embrittlement limits with a very broad range of uncertainty (as much as $\pm 25\%$) with many PTS values for the severely-embrittled reactor vessel. Palisades has neared the maximum-embrittlement boundaries time and again over the years,⁶ but each time those "goalposts" have been moved back with contemporaneous rejiggering of the assumptions and calculations. In 1995, for example, the NRC staff noted that the "Palisades RPV . . . is predicted to reach the PTS screening criteria by late 1999, before any other plant." NRC Generic Letter 92-01, Revision 1, Supplement 1: Reactor Vessel Structural Integrity (May 19, 1995) (Exhibit 1-J to "Combined Reply"). The most recent estimates project that the current PTS criteria will be exceeded in 2014⁷ - three (3) years into the proposed 20-year license extension period which would begin in 2011.

⁵ Palisades Thermal Shock, NRC Staff Presentation to the ACRS, Viewgraphs, December 09, 1994, p. 3.

⁶"For example that is sort of a summary of the regulatory framework that applies to annealing. With regard to Palisades, we completed an evaluation in April of 1995 in which we concluded that they would reach the screening criteria. At least they were okay until 1999. That evaluation was consistent with the 50.61, the Pressurized Thermal Shock Rule. The current license for Palisades expires in 2007 so they would fall somewhat short of the current operating license with regard to the life of the vessel." "Briefing on Annealing Demonstration Project," NRC Public Meeting, August 27, 1996.

⁷ Application, p. 4-15.

The Applicant claims that to address new technical issues relating to neutron irradiation embrittlement of the reactor pressure vessel, NMC proposes to use the third measure set forth in 10 CFR § 54.21(c)(1) to disposition the issue - *i.e.*, adequate management of the effects of neutron irradiation embrittlement - for the period of extended operation. But in its application, NMC merely demonstrates that it plans to make an election by 2011 - that the utility currently plans to have a plan at the beginning of the 20-year proposed extension period.

The Petitioners treat NMC's admission (Application p. 4-10) that the option of installing shield assemblies or flux suppression devices to achieve flux reduction would not be cost-effective as a sign that public safety concerns must be given center stage in the license renewal proceeding. NMC admits it cannot cost-effectively reduce an increasing safety-significant risk to the public through flux reduction, states that its current pressure/temperature analyses for the reactor vessel expire in 2014, and cannot adequately demonstrate in advance of the 20-year licensing period that the available alternatives can properly address and mitigate advancing embrittlement and the associated higher Pressure Thermal Shock values any better. The deep and disturbing history of embrittlement management and projection at Palisades compels the conclusion that 2006, not 2011 or 2014, must be the date at which NMC is required to provide a plan which conclusively demonstrates the ability of the company to sustain operations for the full 20 years of additional licensure. The adequacy of that plan would be the focus of an adjudication here, and it is that plan which the ASLB presently, and the NRC staff before it, have declined to require of NMC.

NMC currently relies on a complex re-analysis to assure safety margins in the physically-deteriorating reactor pressure vessel. The resulting labyrinth of smoke-and-mirrors computer models has been viewed skeptically by the NRC's own Advisory Committee on Reactor Safeguards. Petitioners suggest that it is unreasonable for the Applicant to forego

Flux Reduction programs for the extension period which might reasonably reduce the risk to public health and safety from a Pressure Thermal Shock accident potentially occurring during the same license extension period unless NMC can show, *now*, with high confidence that alternative approaches, *including* the option of annealing the vessel,⁸ can adequately preserve required public safety margins in the 20-year extension period. It is therefore unreasonable and unacceptable for the Applicant to foreclose options within its established management strategy for economic reasons without first being required to demonstrate with confidence that the proposed alternatives adequately provide for the public's protection from this significant ongoing and potentially worsening age-associated safety issue.

In its final remarks in denying the embrittlement contention for hearing, the ASLB scolds Petitioners for not requesting an extension to research and develop relevant technical and legal issues and arguments or to obtain access to experts or counsel competent in NRC practice. Order p. 41. It is easy, at this end of the adjudicatory process, to suggest that such requests from the public might have been greeted with compassion and sensitivity. But that is belied by the ASLB's record of time management in these proceedings.

The panel moved the originally-schedule prehearing conference dates back nearly three (3) weeks, from October 14 to November 3, 2005 to accommodate the religious requirements of the lead attorney for the Staff.⁹ Following the November 3-4 prehearing conference, the Board granted itself an indeterminate period of several weeks, into December 2005, by which time to issue its final ruling. On December 21, 2005, the ASLB ordered Petitioners to provide a brief immediately after the holidays on the status of their embrittlement

⁸There is no safe, proven annealing process.

⁹A request to which Petitioners had absolutely no objection.

expert, occasioned by an email to the Board by the NRC staff counsel. Following submission of Petitioners' filing on the expert controversy, the Staff and NMC were given a week to respond, pushing any decision on the overall merits deeper into January 2006. Then, at the end of February 2006, the Board again granted itself an indeterminate period of time into March 2006 to issue its "Memorandum and Order" which, of course, was ultimately issued on March 7.

Any damage from Petitioners' five-week delay (between the August 8 and September 16 filings) which is attributed to the belated completion of these proceedings or the fulfillment of the lockstep mandate of the Nuclear Regulatory Commission to complete milestones according to a strict calendar has been more than offset by the time delays caused by case events beyond the control of Petitioners. Yet the Board's whipping-children for delays remain the Petitioners, who produced relevant and detailed information "too late" - 5 weeks into the license extension case - to have it considered. The ASLB uses Petitioners' supposed delay to justify the exclusion of relevant and detailed information about the "very serious" topic of embrittlement. The ASLB has devoted a lot of time to building a fortress of compliance with process to the detriment of considering potentially inconvenient facts which happen not to have arrived at a technical, rule-prescribed interval.

Such is the method by which form not merely triumphs over, but supplants, substance before the Nuclear Regulatory Commission. Rather than compelling NMC to affirmatively prove the physical capability of Palisades to operate for a full 20 years beyond 2011 (a proposition which Petitioners submit is metallurgically and financially specious), the ASLB ascends the ramparts to stave off the question. Rather than having the NRC staff explain the agency's culpability in the methodological *legerdemain* which contrives never to see firm embrittlement mileposts, the ASLB instead flogs Petitioners for belatedly introducing relevant

detail the tragic flaw of which has nothing to do with its content and all to do with the timing of its introduction.

This result is unfair, unjust, disparages the public interest in safety, flies in the face of even the NRC's present draconian regulations, and should be reversed by the Commission. The embrittlement contention should be sent back to the ASLB for adjudication.

Appeal of Dismissal of Contention No. 3 (The Palisades reactor has no place to store its overflowing irradiated nuclear fuel inventory within NRC regulations)

The licensing board ruled Contention 3 inadmissible because it is outside the scope of a license renewal proceeding for not addressing an age-related component, and because 10 CFR § 2.206 supposedly affords Petitioners a remedy to complaint about two (2) concrete dry cask storage facilities which unaccountably do not meet NRC engineering specifications. Order, pp. 48-49.

Petitioners demonstrated using the expert calculations of Dr. Ross Landsman, formerly of the NRC staff, that Palisades' dry cask storage arrangements violate NRC regulations. Neither the old pad nor the more recently-constructed concrete pad for holding irradiated fuel casks at Palisades conform with longtime NRC requirements for earthquake stability standards. The Affidavit of Dr. Landsman demonstrates that both of the existing pads were built on compacted sand and other subsurface materials, but dozens of feet above bedrock, and well above the ground elevation of the nearby nuclear power plant. Dr. Landsman, who had direct oversight role in the inspection of dry cask storage at Palisades when he worked at NRC Region III during the critical 1993-2005 period of dry cask storage installation and operation, concluded from his personal knowledge of the subsoil conditions that the older pad (the one nearer the lake) violates NRC liquefaction regulations under 10 CFR § 72.212(b)

(2)(i)(B)¹⁰, while the newer pad (further inland) violates NRC amplification regulations under the same regulations. Neither the older nor newer cask storage pads at Palisades plant were designed in consideration of the factors contained in the cited regulation. See Landsman Affidavit, ¶ ¶ 3-13.¹¹

Either violation, then, comprises an ongoing violation of 10 CFR § 72.212(b)(3).¹² This means that the cask storage pads *have violated NRC regulations since they were constructed, and in the absence of enforcement will continue to violate NRC regulations during the contemplated 20-year license extension, and beyond.*

The NRC considers the older pad to be in compliance with regulations and allows NMC to store high-level radioactive waste there,¹³ while the NRC is supposedly still trying to resolve through ongoing inspection, investigation, and analysis the status of the newer pad. During this period of supposed ongoing investigation, and despite evidence of apparent structural insufficiency, the NRC is prepared to let NMC store waste on the new pad in the face of these

¹⁰[The general licensee shall perform written evaluations, prior to use, that establish that]: Cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion.

¹¹The Landsman Affidavit appears in hard copy at pp. App. 3-a through 3-d of the "Petitioners' Appendix of Evidence in Support of Contentions."

¹²[The general licensee shall]: Review the Safety Analysis Report (SAR) referenced in the Certificate of Compliance and the related NRC Safety Evaluation Report, prior to use of the general license, to determine whether or not the reactor site parameters, including analyses of earthquake intensity and tornado missiles, are enveloped by the cask design bases considered in these reports. The results of this review must be documented in the evaluation made in paragraph (b)(2) of this section.

¹³Including the unloadable, unmovable cask #4 at Palisades, loaded in June 1994 and shortly thereafter admitted by Consumers Power to be defective, having faulty welds. Now, eleven years on, Consumers has yet to unload the defective cask, because it technically cannot do so safely. And the configuration of the 18 to 19 dry casks currently stored on the older pad nearer Lake Michigan is such that the casks furthest back cannot be moved or unloaded until all other casks in front of them have been moved out of the way first. This situation increases the risks, making it very difficult to address emergencies involving certain casks in the configuration in a timely manner.

documented, unresolved safety concerns. The simple reality is, there is high likelihood that NRC inaction will make the noncompliant cask storage facilities of 2006 the older, less-compliant storage facilities of 2011-2031.

In 1994, Dr. Landsman, then an NRC Region III safety engineer and dry cask storage inspector overseeing Palisades, warned then-Commission Chairman, Ivan Selin that:

[I]f you use NRC-approved casks under Subpart K [of 10 CFR Part 72], the regulations are silent about the foundation material or the pad. Actually, it's the consequences that might occur from an earthquake that I'm concerned about. *The casks can either fall into Lake Michigan or be buried in the loose sand because of liquefaction. . . . It is apparent to me that NMSS [sic] doesn't realize the catastrophic consequences of their continued reliance on their current ideology.* (Emphasis added)

It is impossible to disconnect the dry cask storage pad problems from the proposed license extension. If both dry cask storage pads are ever finally deemed to violate NRC safety regulations and are barred from use, then where, exactly, would NMC store its bulging inventory of irradiated nuclear fuel? And where would the dozens of dry casks already loaded and stored on those defective pads be moved? The pads constitute aging-related or aging-affected facilities, since they have been obsolescent literally from the date of construction. Petitioners' contention is integral to the 20- year license extension period, since high-level radioactive waste is an inevitable byproduct of electricity production at the Palisades nuclear reactor and there will be several refuelings during the renewal period which will increase the usage of the concrete storage pads.

Petitioners urge reversal and remand of this issue to the ASLB for adjudication. In the alternative, the Commission presently having been put on notice of a potential serious safety issue rife with facial violations of NRC regulations, should assume jurisdiction and set this matter separately for adjudication pursuant to 10 CFR § 2.202 and 2.206.

CONCLUSION

The NRC license extension adjudicatory process is, at turns, reminiscent of a 19th-century children's novel coupled with a post-industrial existential dystopia. Within Petitioners' intervention, it was possible to be on time, but too late, to be superficially complete, but conclusively unfulfilled, as though one were in a novel by Kafka. The obligation to have the entirety of one's case marshaled as if for trial on the first day of the case, poised for its comprehensive and visceral deconstruction, brings to mind Alice in Wonderland: Through the Looking Glass. Just as the inevitability of embrittlement is somehow "obvious" but not remediable for want of just the right wording, linked to the proper documentation and served lukewarm at precisely the optimum moment, it is equally "obvious" that the concept of substantive justice is secondary to perfunctory, bloodless conformance to ironic standards. The notion that one can raise a contention of "very serious" import, yet be denied the opportunity to litigate it on its merits because the NRC Staff deigns ignore it on behalf of the general public, is anathema to the notion of justice. Humpty Dumpty would be pleased.

Petitioners respectfully pray the Commission reverse the ASLB decisions as to their First and Third contentions, and remand the same for a hearing on their merits.

Respectfully submitted for the Petitioners,

/s/ Terry J. Lodge

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)		
)		
NUCLEAR MANAGEMENT	)	Docket No.	50-255-LR
COMPANY, LLC)		
)		
(Palisades Nuclear Plant)	)	ASLBP No.	05-842-03-LR

CERTIFICATE OF SERVICE

I hereby certify that copies of the "PETITIONERS' NOTICE OF APPEAL FROM ASLB DENIAL OF HEARING, AND SUPPORTING BRIEF" in the above-captioned proceeding have been served on the following through deposit in the NRC's internal mail system, with copies by electronic mail, as indicated by an asterisk, by U.S. mail, first class, as indicated by double asterisk, with copies by electronic mail, or by U.S. mail, first class, as indicated by triple asterisk, were delivered all parties at the following mailing addresses; all on this 17th day of March, 2006:

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/s/ Terry J. Lodge
Terry J. Lodge

**UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY**

_____)	
In the Matter of)	
	)	Docket No. 50-255
NUCLEAR MANAGEMENT COMPANY)	
PALISADES NUCLEAR GENERATING)	
STATION)	
)	
Regarding the Renewal of)	
Facility Operating License No.	)	August 8, 2005
DPR-20 for a 20-Year Period)	
_____)	

**REQUEST FOR HEARING
AND
PETITION TO INTERVENE**

Now come the Nuclear Information and Resource Service (hereinafter "NIRS"), West Michigan Environmental Action Council (hereinafter "WMEAC"), Don't Waste Michigan (hereinafter "DWM"), the Green Party of Van Buren County (hereinafter "Green Party"), the Michigan Land Trustees (all collectively known as Petitioners-Intervenors), and Ann Aliotta, Katherine Beck, Lee Burdick, Bruce Cutean, W. Ronald Elmore, Jane Gardner, Barbara Geisler, Karen Heavrin, Janine Heisel, Mary Lou Hession, Alice Hirt, Laretta Holmes, Chuck Jordan, Judy Kamps, Gary Karch, Maynard Kaufman, Nelly Kurzmann, Nan Lewis, Michael Martin, Maria Ochs, Elizabeth Paxson, Ken Richards, Margaret Roche, Pamela S. Rups, James O. Schlobohm, Sally P. Schlobohm, Catherine Sugas, Elizabeth M. Sugas, Robin Tinholt, Barbara Trumbull, and Sally Zigmund (collectively known as Member-Intervenors) and hereby make their REQUEST FOR A HEARING and PETITION TO INTERVENE in the captioned matter, pursuant to the

Federal Register Notice of June 08, 2005 [Volume 70, Number 109, Page 33533-33535] and in accordance with the provisions of 10 CFR § 2.714 and § 2.309.

In support of their Request and Petition, said Intervenors further state as follows:

1. Nuclear Information and Resource Service is a nonprofit corporation with over 6000 members, a number of whom live in the Great Lakes Region of the United States, including over 100 in Michigan and 50 of whom make their residences within fifty (50) miles of the Palisades Nuclear Generating Station (hereinafter "Palisades"). The central office of NIRS is located at 1424 16th Street NW, Suite 404, Washington, DC 20036.

2. Western Michigan Environmental Action Council is a nonprofit, tax-exempt environmental organization started in the mid-1960's. It has 1500 members, most of whom live in Michigan, and an estimated 400 to 500 live within 50 miles of the Palisades nuclear plant.

3. Don't Waste Michigan is a nonprofit organization begun in the 1980's with about 25 members, nearly all of whom live in Michigan, and of which an estimated 5 currently live within 50 miles of the Palisades nuclear plant.

4. The Green Party of Van Buren County is a political party and association of persons which came into being around environmental issues. It has a membership of approximately 15 members, all of whom are residents of Van Buren County, Michigan, and all of whom reside within 50 miles of the Palisades nuclear plant.

5. Michigan Land Trustees (website www.michiganlandtrust.org) was founded in 1976. It is an association of 60 to 70 individuals and

families dedicated to preserving and protecting farm land in Michigan. Most of its members reside in southwest Michigan, at least 15 of whom live within the 50-mile zone around the Palisades nuclear reactor.

6. Members of these organizations who live or have property and family within the 50-mile Emergency Planning Zone (EPZ) including the immediate area around the Palisades Nuclear Generating Station which is sited in Covert, Michigan have requested Nuclear Information and Resource Service, West Michigan Environmental Action Council, Don't Waste Michigan, the Green Party of Van Buren County and the Michigan Land Trustees (hereinafter "Petitioners") to represent them and their respective interests in this proceeding.

6. The Declarations of individuals Ann Aliotta, Katherine Beck, Lee Burdick, Bruce Cutean, W. Ronald Elmore, Jane Gardner, Barbara Geisler, Karen Heavrin, Janine Heisel, Mary Lou Hession, Laretta Holmes, Chuck Jordan; Judy Kamps, Gary Karch, Maynard Kaufman, Nelly Kurzmann, Nan Lewis, Michael Martin, Maria Ochs, Elizabeth Paxson, Ken Richards, Margaret Roche, Pamela S. Rups, James O. Schlobohm, Sally P. Schlobohm, Catherine Sugas, Elizabeth M. Sugas, Robin Tinholt, Barbara Trumbull, and Sally Zigmond are annexed to this Request and Petition, with each individual declarant identifying his or her affiliation with the petitioning organizations.

7. Petitioners-Intervenors, as organizational intervenors, believe that their members' interests will not be adequately represented without this action to intervene, and without the opportunity to participate as full parties in this proceeding. If

the Palisades Nuclear Generating Station license is renewed without resolving the Petitioners'-Intervenors' safety concerns and environmental issues, this nuclear generating station may operate unsafely and pose an unacceptable risk to the environment, thereby jeopardizing the health and welfare of the respective Petitioners'-Intervenors' members who live, recreate and have businesses within the vicinity of the nuclear power reactor.

PETITIONERS' CONTENTIONS

TECHNICAL/HEALTH/SAFETY ANALYSIS CONTENTIONS

1. *The license renewal application is untimely and incomplete for failure to address the continuing crisis of embrittlement.*

The Petitioners allege that the Palisades license renewal application is fundamentally deficient because it does not adequately address technical and safety issues arising out of the embrittlement of the reactor pressure vessel and unresolved Pressure Thermal Shock ("PTS") concerns that might reasonably result in the failure of the reactor pressure vessel ("RPV"). The Palisades nuclear power station is identified as prone to early embrittlement of the reactor pressure vessel, which is a vital safety component. As noted in the opinion of Petitioners' expert on embrittlement, Mr. Demetrios Basdekas, retired from the Nuclear Regulatory Commission, the longer Palisades operates, the more embrittled its RPV becomes, with decreasing safety margins in the event of the initiation of emergency operation procedures. Therefore, a hearing on the public health and safety effects of a prospective additional twenty years of operation, given the present and prospective embrittlement trend of the RPV is imperative to protecting the interests of those members of the petitioning organization who are affected by this proceeding.

2. *Excessive radioactive and toxic chemical contamination in local drinking water due to emissions from Palisades nuclear power plant as part of its daily, "routine" operations.*

The radioactive and toxic chemical emissions from the Palisades nuclear power plant into the waters of Lake Michigan contaminate the recently-installed drinking water supply intake for the City of South Haven, built just offshore from Van Buren State Park and just downstream from the Palisades reactor, due to the direction of the flow of Lake Michigan's waters and the very close proximity of the Palisades reactor to the South Haven drinking water supply intake. U.S. National Oceanographic and Atmospheric Administration models confirm the direction of water flow in Lake Michigan toward the

intake. Petitioners-Intervenors hope to produce public records of toxics and radiation testing of the water source to evidence this public health problem.

ENVIRONMENTAL CONTENTIONS

3. The Palisades reactor has no place to store its overflowing irradiated nuclear fuel inventory within NRC regulations.

The indoor irradiated fuel storage pool reached capacity in 1993. But the outdoor dry cask storage pads at Palisades, both the older one nearer Lake Michigan and the newer one further inland, are in violation of NRC earthquake regulations. 10 CFR § 72.212(b)(2)(i)(B) requires that:

Cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion. . . .

According to Petitioners' anticipated expert, Dr. Ross Landsman, former U.S. Nuclear Regulatory Commission Region III dry cask storage inspector, the older pad violates the liquefaction portion of this regulation, and the new pad violates the amplification portion of the regulation. Petitioners contend that neither the older nor new dry cask storage pads at the Palisades plant were designed in consideration of the factors contained in the cited regulation.

4. The unloadable, unmovable dry storage cask #4 at Palisades.

In 1993, Consumers Power (now Consumers Energy) assured a federal district judge that if it encountered problems with loaded dry casks at Palisades, it would simply reverse the loading procedure and return the high-level radioactive waste to the storage pools. But the fourth cask loaded at Palisades, in June 1994, was shortly thereafter admitted by Consumers Power to be defective, having faulty welds. However, eleven years on, Consumers has yet to unload the defective cask, because it cannot. Petitioners state that Consumers perpetrated a fraud upon the court and the public, with the complicit support by the NRC, and has critically undermined its credibility as to any pledges about the safety of dry cask storage.

The significance of this problem with cask #4 is considerable. For example, the configuration of the 18 to 19 dry casks currently stored on the older pad nearer Lake Michigan is such that the casks furthest back cannot be moved or unloaded until all other casks in front of them have been moved out of the way first. This configuration increases the risks, making it very difficult to address emergencies involving certain casks in the configuration in a timely manner.

5. There is no permanent repository for the nuclear waste which would be generated at Palisades after 2010.

Any waste generated at Palisades after 2010 would be excess to the capacity of the proposed national dump at Yucca Mountain, Nevada according to U.S. Department of Energy projections in its Yucca Mountain Final Environmental Impact Statement (Feb. 2002), as revealed in Tables A-7 and A-8 on pages A-15 and A-16 of Appendix A. In fact, the waste generated at Palisades from 1971 to 2010 may also be excess to Yucca, in that the proposed dump may never open. The State of Nevada maintains that NRC's "Nuclear Waste Confidence Decision" is erroneous, in that it biases NRC to favor the Yucca Mountain dump license lest it be proven wrong in its assurance to the public that a high-level radioactive waste geologic repository will open in the U.S. by 2025. Because so much uncertainty surrounds the Yucca Mountain dump proposal, as well as other high-level radioactive waste proposals, Petitioners-Intervenors contend that waste generated at Palisades during the 20 year license extension could very well be stored at Palisades indefinitely, a scenario inadequately addressed by the applicant and NRC.

6. Intensifying sand erosion and avalanche risk around dry cask storage pads.

The more casks loaded on the storage pads at Palisades, the more risk of erosion to the sand supporting the pads, given the large weight of the casks themselves (well over 100 tons each), weather related erosion of the sand dunes, as well as the erosion that will occur due to more severe weather impacts from the global climate crisis and climate de-stabilization. Arresting erosion at both pads is important to safety and radiation containment over the long haul, given the proximity of the waters of Lake Michigan. The State of Michigan and the U.S. Army Corps of Engineers have designated the sand dunes upon which the older pad is located - so close to the waters of Lake Michigan - as a high-risk erosion zone.

The Lake Michigan dunes are subject to "blow outs" where entire dunes are blown out during wind storms and lightning strikes. See F. Nori, P. Sholtz, and M. Bretz (Department of Physics, The University of Michigan), "Sound-Producing Sand Avalanches," Scientific American Vol. 277, No. 3 (September 1997). At Warren Dunes, some 35 miles south of Palisades, sand blowouts have been estimated to travel as much a one-quarter mile per day, exposing 5,000-year-old trees that have long since turned to charcoal. "Some chilling facts about Dunes history,"

<http://www.nwitimes.com/articles/2005/07/25/news/region/0256d4c429632b30862570460062843b.txt>

The Palisades dunes could, in a wind storm or lightning strike, shift, blow and cover the dry cask storage area. As weather patterns intensify (as anticipated) this potential for erosion will increase. Additionally, the dunes and shore line are geologically prone to sand avalanche. A sand avalanche coupled with a seismic event could compromise the integrity of one or more casks at Palisades.

7. Non-radiological persistent toxic burdens to area water sources.

The impact of 20 additional years of pollution by toxics disclosed but not adequately controlled under requirements of the National Pollutant Discharge Elimination System will directly affect water quality of nearby sources, including Lake Michigan. In 2000, for example, Palisades was found to be in "continuing noncompliance" for its apparent multiple misuses of Betz Clam-Trol in Lake Michigan for the dispersion of mussels and clams affecting the water intakes. See <http://www.epa.gov/region5/water/weca/reports/mi4qtr01.txt>

NPDES violations also contradicts the spirit, intention and explicit recommendation of The International Joint Commission. In its "Ninth Biennial Report on Great Lakes Water Quality," the Commission's Recommendation #16 (at p. 42) urges that "[g]overnments monitor toxic chemicals used in large quantities at nuclear power plants, identify radioactive forms of the toxic chemicals and analyze their impact on the Great Lakes ecosystem."

MISCELLANEOUS CONTENTIONS

8. Increased embrittlement of re-used fuel rods as buffers to reduce embrittlement of RPV walls.

To mitigate the prospect of increased embrittlement of the reactor pressure vessel (RPV), the Palisades operator uses previously-irradiated fuel to create a buffer next to the RPV wall.

The second-use of irradiated fuel assemblies in the reactor core tends to weaken and damage the cladding on the fuel rods, making future waste handling, storage, and ultimate disposal - whether on-site at Palisades, in transport, and at future storage or dump sites - problematic. It poses an elevated risk for the safety of Palisades workers and the general public. Moreover, the U.S. Department of Energy ("DOE") depends on the integrity of the fuel cladding as a means of preventing or minimizing the chances of unanticipated fissioning in storage casks or other units - in effect, as a means of delaying radiation releases into the groundwater at the Private Fuel Storage (Utah) and Yucca Mountain (Nevada) sites.

8. Environmental justice denied by the continuing operations of Palisades.

Palisades nuclear generating station is a the source of environmental justice violations. Located within a predominantly African-American and low-income township, Palisades provides woefully inadequate tax revenues to the host community, considering the large adverse impacts and risks the reactor inflicts. Palisades' African-American employees have traditionally been stuck in the dirtiest and most dangerous jobs at the reactor, with little to no prospects for promotion. Some of Palisades' African American employees have also experienced death threats at the work place, including nooses hung in their lockers or in public places to symbolize lynching, an attempt

to silence their public statements for workplace justice.

Palisades' license extension application also has inadequately addressed the adverse impacts that 20 additional years of operations and waste generation would have on the traditional land uses, spiritual, cultural, and religious practices, and treaty rights of various federally-recognized tribes in the vicinity of the plant and beyond, as well as effects upon non-federally recognized tribes governed by international law. Only three tribes were contacted by the NRC by August 8th, 2005, and invited to participate in the license extension proceedings, which effectively excluded a number of tribes within the 50-mile zone around the reactor. For this reason alone, the August 8, 2005 deadline for requesting a hearing to intervene against the Palisades license extension should be extended, until all tribes within the 50-mile zone and beyond, which have ties to the power plant site and its environs, are contacted.

Also, Palisades' license extension application inadequately addresses the adverse socio-economic impacts of a catastrophic radiation release due to reactor core embrittlement leading to core rupture, as they would be found among the low-income Latin American agricultural workforce of the Palisades area. Too, possible synergistic effects of such catastrophic radiation releases combined with the toxic chemical exposures these low income Latin-American agricultural workers already suffer on the job have not been evaluated.

Finally, there is an unacceptable lack of Spanish language emergency evacuation instructions and notifications to serve the Spanish speaking Latino population within 50 miles of the Palisades reactor, especially migrant agricultural workers.

9. Chronic emergency unpreparedness within EPZ.

Emergency responders in the 50 mile zone around the Palisades nuclear reactor are inadequately trained and inadequately equipped to respond to a major radioactivity release during an accident or attack at the plant.

Even with its shiny new fire trucks, Covert, Michigan does not have the staffing, equipage, training nor preparedness for a major radiological emergency. Covert's best, good as it is, is still no match for a chernobyl style fire. The remainder of the emergency planning zone is occupied by rural, volunteer fire departments, which have even less equipment and resources with which to work. Radiation monitors and radiation-protective gear are in short supply or unheard of. Isolation wards for radioactively contaminated victims (so they don't harm the doctors and nurses and other patients) are very rare or non-existent at most, probably all, hospitals within 50 miles.

10. Economic damage in Palisades region in event of accident or attack on the power plant causing severe radiation release.

Given that a severe radiation release from Palisades due to accident or attack would significantly damage the economic base of western Michigan, not only within the 50 mile zone around the

reactor, but even beyond it, due to crops and products that would have to be destroyed, as well as the lingering stigma attached to western Michigan agricultural products after such a release, a Severe Accident Mitigation Analysis must be performed, publicized and circulated for public review and comment as a precondition to considering whether or not to grant a license extension.

11. Threats of terrorist attack and sabotage against the Palisades nuclear power plant.

Located on the shoreline of Lake Michigan, the source of drinking water, fish, recreation, and other economic value to tens of millions of people downstream, Palisades represents a target for potentially catastrophic terrorist attack or sabotage intended to release large amounts of radioactivity into the Great Lakes basin. Palisades represents a radioactive bull's eye on the shore of 20% of the planet's surface fresh water, the Great Lakes. The operating reactor (containing many billions of curies of radioactivity) and high-level waste storage pool (containing tens to hundreds of millions of curies) are vulnerable to such attack, as are the outdoor dry storage casks, so highly visible stored in plain sight.

12.

Respectfully submitted for the Petitioners,

/s/ Terry J. Lodge
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Co-Counsel for all Petitioners-Intervenors and Member-Intervenors

CERTIFICATION OF SERVICE/TRANSMISSION

I hereby certify that the foregoing Request for Hearing and Petition to Intervene, along with five (5) Notices of Appearance, was sent this 8th day of August, 2005 via email only to the following:

Office of the Secretary
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Rulemaking and Adjudications Staff
Email to Office of the Secretary : HEARINGDOCKET@nrc.gov

Office of General Counsel
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
Email OGCMailcenter@nrc.gov

And that the same was sent via first-class mail on the 9th of August, 2005 to:

Jonathan Rogoff, Esq.
Vice President Counsel & Secretary
Nuclear Management Company LLC
700 First Street
Hudson, WI 54016

/s/ Terry J. Lodge
Terry J. Lodge

**UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY**

_____)	
In the Matter of	)	Docket No. 50-255
NUCLEAR MANAGEMENT COMPANY)	
PALISADES NUCLEAR GENERATING)	
STATION)	
)	
Regarding the Renewal of	)	August 8, 2005
Facility Operating License No.)	
DPR-20 for a 20-Year Period)	
_____)	

NOTICE OF APPEARANCE OF PAUL GUNTER

Pursuant to 10 CFR 2.713(b), Paul Gunter hereby enters an appearance on behalf of Nuclear Information and Resource Service (NIRS) and provides the following information:

1. I am Director of the Reactor Watchdog Project for Nuclear Information and Resource Service at 1424 16th Street NW, Suite 404, Washington, DC 20036, Tel. 202 328 0002 and my email address is <pgunter@nirs.org>.
2. I have been appointed by NIRS to jointly represent the organization and its members in this proceeding.

/s/ Paul Gunter
Paul Gunter

8/8/2005
Date

**UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY**

_____)	
In the Matter of	)	Docket No. 50-255
NUCLEAR MANAGEMENT COMPANY)	
PALISADES NUCLEAR GENERATING)	
STATION)	
)	
Regarding the Renewal of)	
Facility Operating License No.	)	August 8, 2005
DPR-20 for a 20-Year Period)	
_____)	

**NOTICE OF APPEARANCE OF MICHAEL KEEGAN
FOR DON'T WASTE MICHIGAN**

Pursuant to 10 CFR 2.713(b), Michael Keegan hereby enters an appearance on behalf of Don't Waste Michigan (DWM), and provides the following information:

1. I am Co-Chair of the board of Don't Waste Michigan at 2213 Riverside Drive, NE, Grand Rapids, MI 49505, phone (734) 735-6373 and my email address is <mkeeganj@comcast.net>.

2. I have been appointed by DWM to jointly represent the organization and its members in this proceeding.

/s/ Michael Keegan
Michael Keegan

8/8/2005
Date

**UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY**

_____)	
In the Matter of	)	Docket No. 50-255
NUCLEAR MANAGEMENT COMPANY)	
PALISADES NUCLEAR GENERATING)	
STATION)	
)	
Regarding the Renewal of)	
Facility Operating License No.	)	August 8, 2005
DPR-20 for a 20-Year Period)	
_____)	

**NOTICE OF APPEARANCE OF ALICE HIRT
FOR WESTERN MICHIGAN ENVIRONMENTAL ACTION COUNCIL**

Pursuant to 10 CFR 2.713(b), Alice Hirt hereby enters an appearance on behalf of the Western Michigan Environmental Action Council (WMEAC), and provides the following information:

1. I am a member of WMEAC, the office of which is located at 1415 Wealthy Street, SE, Suite 280, Grand Rapids, MI 49506, phone (616) 335-3405 and my email address is <alicehirt@charter.net>.
2. I have been appointed by WMEAC to jointly represent the organization and its members in this proceeding.

/s/ Alice Hirt
Alice Hirt

8/8/2005
Date

**UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY**

_____)	
In the Matter of	)	Docket No. 50-255
NUCLEAR MANAGEMENT COMPANY)	
PALISADES NUCLEAR GENERATING)	
STATION)	
)	
Regarding the Renewal of)	
Facility Operating License No.	)	August 8, 2005
DPR-20 for a 20-Year Period)	
_____)	

**NOTICE OF APPEARANCE OF CHUCK JORDAN
FOR GREEN PARTY OF VAN BUREN COUNTY, MICHIGAN**

Pursuant to 10 CFR 2.713(b), Chuck Jordan hereby enters an appearance on behalf of the Green Party of Van Buren County, Michigan, and provides the following information:

1. I am the Chairman of the Green Party of Van Buren County, the office of which is located at 50521 34th Avenue Bangor, MI 49013, phone (home) 269.427.8339 (cell) 269.271.2038, email <jordanc@btc-bci.com>.

2. I have been appointed by the Green party to jointly represent the organization and its members in this proceeding.

/s/ Chuck Jordan
Chuck Jordan

8/8/2005
Date

UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY

_____)	
In the Matter of	)	Docket No. 50-255
NUCLEAR MANAGEMENT COMPANY)	
PALISADES NUCLEAR GENERATING)	
STATION)	
)	
Regarding the Renewal of)	
Facility Operating License No.	)	August 8, 2005
DPR-20 for a 20-Year Period)	
_____)	

NOTICE OF APPEARANCE OF MAYNARD KAUFMAN
FOR MICHIGAN LAND TRUSTEES

Pursuant to 10 CFR 2.713(b), Maynard Kaufman hereby enters an appearance on behalf of the Michigan Land Trustees and provides the following information:

I am a member of the Michigan Land Trustees. My office is located at my home, 25485 County Road 681, Bangor, MI 49013.

2. I have been appointed by the Michigan Land Trustees to jointly represent the organization and its members in this proceeding.

/s/ Maynard Kaufman
Maynard Kaufman

8/8/2005
Date

**UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION**

Before the Atomic Safety and Licensing Board

_____)	
In the Matter of)	
	)	Docket No. 50-255-LR
NUCLEAR MANAGEMENT COMPANY)	
PALISADES NUCLEAR GENERATING	)	ASLBP No. 05-842-03-LR
STATION)	
)	
Regarding the Renewal of Facility Operating)	
License No. DPR-20 for a 20-Year Period	)	September 16, 2005
_____)	

**PETITIONERS' COMBINED REPLY TO NRC STAFF
AND NUCLEAR MANAGEMENT COMPANY ANSWERS**

Now come the Nuclear Information and Resource Service, *et al.*, Petitioners-Intervenors herein (and hereinafter referred to as "Petitioners"), by and through counsel, and respond to the "NRC Staff Answer Opposing Petition to Intervene and Request for Hearing" (hereinafter referred to "Staff Answer"), and to the "Nuclear Management Company's Answer to the August 8, 2005 Request for Hearing and Petition to Intervene" (hereinafter referred to as "NMC Answer"). Petitioner respond in opposition to those portions of the respective Answers which deny the admissibility of Petitioners' proffered contentions.

ARGUMENT

Preliminary Note As To Standing Issues

Nuclear Management Company raises no objections to the standing of the sundry Intervenors. NMC Answer p. 2. The Staff quibbles, not about the standing of the Intervenors, but only that the Organizational Intervenors have failed to demonstrate that they have

organizational standing. Staff Answer pp. 7-8. Because they are assured that some combination of their numbers has standing to raise the pending contentions, the Petitioners/Intervenors will make no further arguments on the standing issue, but instead will defer to the Board to render a final determination.

Response as to Contention No. 1 (The license renewal application is untimely and incomplete for failure to address the continuing crisis of embrittlement)

NMC and NRC staff have argued that Contention 1 regarding the Application's proposed management of the embrittlement of the Palisades reactor pressure vessel is inadmissible because the Contention (i) fails to challenge the Application and demonstrate the existence of a genuine dispute on a material issue of fact or law; (ii) fails to provide a factual basis to support any dispute with the application, and; (iii) improperly challenges Commission regulation. These assertions are incorrect.

1) The embrittlement contention is within the scope of the proceeding

The extended operation of the Palisades nuclear steam supply system falls squarely under 10 CFR § 54.21 and § 54.29(a) which focuses on the management of aging of certain systems, structures, and components and the review of time-limited aging evaluations.

A genuine dispute exists within the Application that is germane to the health and safety of the petitioners who live, work and recreate out to 50 miles from the Palisades nuclear power station in Covert, Michigan.

The Palisades Reactor Pressure Vessel is the subject component. There is no safety redundancy to this single largest component in the Palisades nuclear steam supply system. Palisades is arguably one of the most embrittled reactor pressure vessels, if not *the* most embrittled vessel, in the United States. The nuclear steam supply system for Palisades was the first of the Combustion Engineering line licensed for construction. Documentation as early as 1970 identifies

Surveillance specimens in the vessel will be used to monitor the radiation damage during the life of the plant. If these specimens reveal changes that affect the safety of the plant, the reactor vessel will be annealed to reduce radiation damage effects. The results of annealing will be confirmed by tests on additional surveillance specimens provide for this purpose. Prior to the accumulation of a peak fluence of 10 E 19 nvt (>1 Mev) on the reactor vessel wall, the Regulatory Staff should reevaluate the continued suitability of the currently proposed startup, cool down, and operating conditions.¹

Exhibit 1-A. All exhibits are found in "Petitioners' Appendix of Evidence in Support of Contentions" (Pet. App.), a copy of which is provided with this response in hard copy to the ASLB and the parties.

The Petitioners have been able to establish that the licensee could not provide surveillance materials for critical weld material in the Palisades vessel beltline welds in 1994.²
See Exhibit 1-B.

A commitment was made for the Palisades plant as early as 1970 to make actual physical efforts by annealing the vessel to restore ductility should any "radiation damage" affecting plant safety be discovered. In fact, calculations later recognized by NRC staff concluded that the Palisades vessel could have surpassed its Pressure Thermal Shock ("PTS") limits as early as 1995. Repeated Palisades re-analyses have produced a widening range of resulting estimates for exceeding vessel embrittlement limits with a very broad range of uncertainty (as much as $\pm 25\%$) with as many PTS values for the severely-embrittled reactor vessel. Palisades has neared the maximum-embrittlement goalposts time and again over the years,³ but each time they have been moved back following rejiggering of the assumptions and

¹Report on Palisades Plant, Letter from Joseph Hendrie (ACRS) to Glen Seaborg, Chair AEC, January 27, 1970.

² Palisades Thermal Shock, NRC Staff Presentation to the ACRS, Viewgraphs, December 09, 1994, p. 3.

³"For example that is sort of a summary of the regulatory framework that applies to annealing. With regard to Palisades, we completed an evaluation in April of 1995 in which we concluded that they would reach the screening criteria. At least they were okay until 1999. That evaluation was consistent with the 50.61, the Pressurized Thermal Shock Rule. The current license for Palisades expires in 2007 so they would fall somewhat short of the current operating license with regard to the life of the vessel."

calculations. In 1995, for example, the NRC staff noted that the "Palisades RPV . . . is predicted to reach the PTS screening criteria by late 1999, before any other plant." NRC Generic Letter 92-01, Revision 1, Supplement 1: Reactor Vessel Structural Integrity (May 19, 1995) (Exhibit 1-J). The most recently-recognized estimates project that the current PTS criteria will be exceeded in 2014, which is early in the proposed 20-year license extension period.

The Applicant asserts that NRC approved methodology was used to perform neutron fluence calculations consistent with Regulatory Guide § 1.190 and described in WCAP-15353, "Palisades Reactor Pressure Vessel Fluence Evaluation." The Applicant argues that "at the appropriate time, prior to exceeding the PTS screening criteria, Palisades will select the optimum alternative to manage PTS in accordance with NRC regulations, and will make the applicable submittals to obtain NRC review and approval."⁴ The Applicant argues that with respect to addressing technical issues relating to neutron irradiation embrittlement of the reactor pressure vessel that the Applicant adopts the third measure set forth in 10 CFR § 54.21(c)(1) to disposition the issue - *i.e.*, adequate management of the effects of neutron irradiation embrittlement - for the period of extended operation.

The content of technical information of an application is set forth in 10 CFR § 54.21 to include a review of systems, structures and components subject to an aging management review to include the reactor vessel, the core shroud and component supports. 10 CFR § 54.21(c)(1) stipulates an evaluation of time-limited aging analyses where the applicant must demonstrate (i) the analyses remain valid for the period of extended operation; (ii) the analyses

"Briefing on Annealing Demonstration Project," NRC Public Meeting, August 27, 1996.

⁴"Application for Renewed Operating License for Palisades Nuclear Generating Station," Nuclear Management Company, March 22, 2005, ADAMS Accession Number ML050940446, p. 4-15.

have been projected to the end of the period of extended operation; (iii) the effects of aging on the intended function(s) will be adequately managed for the period of operation.

Under the current rule (10 CFR § 50.61), three courses of action can be taken to manage aging of the reactor vessel: 1) The operator shall implement flux reduction programs that are reasonably practicable to avoid exceeding the PTS screening criteria;

2) For those plants where no "reasonable flux reduction program will prevent RTpts from exceeding the PTS screening criterion" the operator can take a look at plant-specific evaluation of plant systems, thermal hydraulics, reactor vessel design, etc. This analysis must be submitted at least three years before RTpts is projected to exceed the PTS screening criteria; or;

3) Anneal the pressure vessel as provided under 10 CFR § 50.66, or the annealing rule and Regulatory Guide § 1.162, which provides guidance on how to implement the annealing rule.

There is a requirement that a licensee that desires to anneal the reactor vessel must submit a thermal annealing report 3 years before actually performing the annealing. This thermal report has four major sections in it. One is an operating plan basically identifying how annealing is to be performed.

The Petitioners do not agree that the current rule necessarily affords an either/or choice to be made by the company, as with choosing from a Whitman's Sampler box of candy, but rather, that it contemplates a combination of efforts in concert to achieve the largest margins of safety. The Petitioners further suggest that the operative words in 10 CFR § 50.61(b)(4) [where there is "no reasonably practicable flux reduction program" to prevent exceeding the PTS criteria] require, not only consideration of the financial interests of the utility, but that the

regulation is heavily weighted in the direction of considering public safety. Hence the

Petitioners dispute licensee's assertion in the Application (page 4-10) that:

The flux to the reactor vessel would have to be reduced by an additional factor of 3 in order to reach March 24, 2031. Some additional flux reduction could conceivably be achieved by installation of additional shield assemblies and/or flux suppression devices (e.g. hafnium inserts). Flux reduction of the magnitude required at Palisades would require far more extraordinary measures, such as the installation of neutron shields on the exterior of the core support barrel. *It is unlikely that a plant modification of this magnitude would be cost-effective.* (Emphasis added)

It is highly likely that NMC would pursue alternative solutions rather than rely on flux reduction to extend the reactor vessel life. Other alternatives that would be considered would include completion of the safety analysis as specified in 10 CFR § 50.61 (b)(4), and thermal annealing treatment as specified in 10 CFR § 50.61(b)(7). Any alternative that NMC may propose in the future to extend the life of the Palisades reactor vessel would, of necessity, be discussed thoroughly with the NRC and would be subject to formal NRC review and approval before it could be implemented. The ultimate method used to manage PTS for extended plant operation would be governed by NRC regulations independently from the license renewal process.”⁵

The Petitioners also dispute that part of the Application where the licensee states (p. 4-15) in its Analysis that “The current pressure/temperature analyses are valid beyond the current operating license period, but not to the end of the period of extended operation. These analyses are estimated to expire in 2014.”⁶ The licensee admits in its Application that it seeks to limit an aging management strategy as required in 10 CFR § 54.21(c)(1)(iii) and adopt a subset of the established management strategies as established by 10 CFR § 50.61 for fracture toughness requirements to protect against pressurized thermal shock events based on

⁵ *Id.*, p. 4-10.

⁶ *Id.*, p. 4-15.

economic considerations to the licensee. It does so, however, without adequately demonstrating that the proposed alternatives can confidently address and mitigate advancing embrittlement and the associated higher Pressure Thermal Shock values any better than the licensee's admitted inability to reduce, cost-effectively, an increasing safety-significant risk to the public through flux reduction programs. Petitioners argue that all of these management strategies are in place to provide reasonable assurance that the public health and safety will be protected, first and foremost, and that they are not mere options to be predicated on consideration of the company's financial bottom line.

Petitioners submit that an effective and reliable management plan for a twenty-year extension must begin with the incorporation of all NRC management strategies as outlined under 10 CFR § 50.61, including fluence reduction efforts, not just the company's perceived cost-effective ones. This is particularly germane to Palisades, as the NRC staff has recognized through a broad set of calculations and associated uncertainties in determining the actual severity of the embrittlement that the vessel might have exceeded the PTS criterion as early as 1995 or might, according to later questionable estimations, exceed as late as 2014. That would be three (3) years into the 20-year license extension period sought by NMC.

The Applicant has already abandoned a previous commitment to anneal the severely embrittled Palisades pressure vessel, discussed *infra*. Petitioners are unsure whether the Applicant abandoned its previous commitment to anneal the Palisades reactor pressure vessel because of economic considerations, or because of operational issues and risks associated with re-embrittlement of annealed beltline welds. NMC instead now relies on a complex re-analysis to assure safety margins in the physically-deteriorating reactor pressure vessel. The requisite labyrinth of computer models that has resulted has been subjected to much healthy skepticism from the NRC's own Advisory Committee on Reactor Safeguards.

In light of these problems, petitioners suggest that it is unreasonable for the Applicant to forego Flux Reduction programs for the extension period which might reasonably reduce the risk to public health and safety from a Pressure Thermal Shock accident potentially occurring during the same license extension period without demonstrating with a high degree of confidence that alternative approaches, *including* the option of annealing the vessel, can adequately preserve required public safety margins in the extension period.

Instead, the Application seeks less costly and undemonstrated efforts for the extension period by vaguely proposing to alternately;

1) incorporate another embrittlement and PTS re-analysis which is recognized by significant uncertainties that potentially seek to merely pencil whip a worsening safety issue with narrowing safety margins for the proposed extension period or;

2) resort to a yet-to-be demonstrated effective annealing of the reactor pressure vessel, a process which the same operator had already previously committed to in 1995 and abandoned in 1997.

The applicant's statement that it can abandon actual physical and operational measures to reduce the neutron fluence affecting embrittlement of the pressure vessel raises an undue public risk from a Pressure Thermal Shock event.

Therefore, the Petitioners suggest that under current established management strategy Palisades may have already exceeded the current PTS criteria or if not, will exceed the criteria early in the proposed license renewal period (*viz.*, 2014). It is therefore unreasonable and unacceptable for the Application to foreclose options within its established management strategy for economic reasons without first being required to demonstrate with confidence that the proposed alternatives adequately provide for the public's protection from this significant ongoing and potentially worsening age-associated safety issue.

Petitioners are particularly concerned that safety focused measures such as Flux Reduction Programs at Palisades fall victim to the economic imperative to keep the reactor operating even at unacceptably reduced margins of safety rather than make much-needed investments.

This controversy is an historical problem at Palisades. The New York Times reported April 12, 1992 on a comment by then-NRC Chairman Ivan Selin on the vulnerability of Palisades to early closure because of embrittlement:

Mr. Selin said it was unlikely that any utility would decide to close a plant that was running smoothly and was not in immediate need of any big investment. But if a plant required a large investment, he said, 'that could push it over the brink.' In that category he put the Consumers Power Company's Palisades plant, near South Haven, Mich., which opened in 1971, where the reactor pressure vessel may now be brittle, the same weakness that was suspected at Yankee Rowe. . . .⁷

Exhibit 1-C.

There is a grave issue of law here: whether the economically-dictated priorities of Palisades, or the health and safety concerns of the Petitioners, conform to NRC regulations. A Licensing Board should not address the merits of a contention when determining its admissibility. *Carolina Power and Light Co. and North Carolina Eastern Municipal Power Agency* (Shearon Harris Nuclear Power Plant), ALAB-837, 23 NRC 525, 541 (1986); *Texas Utilities Electric Co.* (Comanche Peak Steam Electric Station, Unit 1), ALAB-868, 25 NRC 912, 933 (1987); What is required is that an intervenor state the reasons for its concern. *Houston Lighting and Power Co.* (Allens Creek Nuclear Generating Station, Unit 1), ALAB-590, 11 NRC 542 (1980).

The Petitioners have stated reasons for their concern. The Board should conclude that the Application is deficient and should be rejected.

⁷ "Cheap and Abundant Power May Shutter Some Reactors," Matt Wald, New York Times, April 14, 1992.

2) There are many factual disputes affecting public health and safety

Palisades Nuclear Power Station is a Combustion Engineering Pressurized Water Reactor identified as one of the earlier reactor vessels of greater concern whose current 40-year license expires in 2011 after being granted a four-year recapture period.

As NIRS has pointed out in its earlier publication, "The Aging of Nuclear Power Plants, A Citizen's Guide to Causes and Effects":

Irradiation embrittlement of the reactor pressure vessel (RPV) may be the single most important factor in determining the operating life of a Pressurized Water Reactor. The design of pressure vessels is generally the same for all PWRs generally constructed from 8 inch thick steel plates, formed and welded to create the vessel structure.

The major age-related mechanism associated with this component is embrittlement. Embrittlement is the loss of ductility, i.e, the ability of the pressure vessel metals to withstand stress without cracking. It is caused by neutron bombardment of the vessel metal and is contingent upon the amount of copper and nickel in the metal and the extent of neutron exposure or fluence. As the metal in the reactor pressure vessel is bombarded with radiation, high-energy atomic particles pass through the steel wall. In doing so, these atoms collide with atoms in the metal and knock them out of position. Over time this results in the loss of ductility.

In an unirradiated vessel the metal loses its ductility at about 40 degrees Fahrenheit. As the vessel becomes embrittled, the temperature at which it loses its ductility rises. This change in the mechanical properties of the metal from ductile to brittle is characterized as the 'reference temperature for nil ductility transition' or RTndt. Thus as the reactor ages and the pressure vessel is exposed to more radiation, the RTndt can shift from its original 40 degree F to as much as 280-290 degrees F or more in extreme cases.⁸

From Exhibit 1-D.

The embrittlement of the all-important reactor pressure vessel, which has no redundant safety feature in a nuclear power station, is of even greater concern to those plants constructed prior to 1972. Palisades was issued its construction license in 1967. According to thermal shock experts within Electric Power Research Institute (EPRI), there is an

⁸ The Aging of Nuclear Power Plants: A Citizen's Guide to Causes and Effects, Nuclear Information and Resource Service, 1988, Chapter IV, "Embrittlement of Reactor Pressure Vessels and Reactor Pressure Vessel Supports in Pressurized Water Reactors," p. 19.

indeterminate amount of susceptible copper in the metal walls of these older vessels and in the weld material used to join the vessel plates.

The significance of embrittlement of the vessel component and the shift in RTndt is the increased susceptibility to pressurized thermal shock (PTS). Pressurized thermal shock occurs when the reactor pressure vessel is severely overcooled. RPV technical specifications generally limit the cool down to a rate of 100° F per hour. During an overcooling event (*i.e.*, pipe break) the vessel may experience a drop in temperature of several hundred degrees per hour. This extreme drop in temperature can send a thermal shock through the vessel wall. As the vessel is overcooled there is a drop in the pressure of the primary coolant loop. This rapid decrease in the pressure of primary coolant cause the high pressure injection pumps in the Emergency Core Cooling System to automatically inject coolant into the primary loop. As the injection of coolant repressurizes the RPV, the vessel is subject to pressure stresses. The stresses placed on the RPV by overcooling and repressurization cause the Pressure Thermal Shock.

Pressure Thermal Shock can be initiated by numerous accidents, including: control system malfunctions, small, medium and large break loss of coolant accidents including main steam line break, feed water pipe break, and steam generator tube ruptures. Any of these events can initiate a PTS event, but as long as the fracture resistance of the reactor pressure vessel material and welds remains high, *i.e.*, RTndt values remain low, such transients are considered unlikely to cause vessel failure. However, the reduction of fracture resistance within the RPV wall and weld materials, severe overcooling accompanied by repressurization can cause pre-existing flaws in the inner surface of the RPV to propagate into cracks which can go through the vessel wall resulting in the associated uncontrollable loss of coolant water over the reactor core.

For failure of the RPV to occur a number of factors must be present:

- 1) the vessel must have a flaw of sufficient size to propagate and a typical vessel can have thousands of varied-sized flaws;
- 2) the vessel material must be susceptible to irradiation embrittlement due to copper and nickel content;
- 3) the vessel must be sufficiently irradiated to cause a decrease in ductility , represented by an increase in the RTndt value;
- 4) an event must initiate a severe overcooling transient with repressurization;
- 5) the resulting crack must be of such size and location that the RPV's ability to maintain core cooling is affected.

Petitioners believe it more likely than not that some or all of these factors are present at Palisades, as they articulate below. Petitioners believe they have provided quite sufficient information to establish the existence of a genuine dispute with the applicant on a material issue of law or fact, as required by 10 CFR § 2.309(f)(1)(v) (formerly § 2.714(b)(2)(iii)). See *Georgia Power Co.* (Vogtle Electric Generating Plant, Units 1 and 2), LBP-9121, 33 NRC 419, 422-24 (1991), appeal dismissed, CLI-92-3, 35 NRC 63 (1992); *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2 and 3), CLI-91-12, 34 NRC 149, 155-56 (1991); *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; *Catawba Nuclear Station*, Units 1 and 2), LBP-02-4, 55 NRC 49, 64-68 (2002).

A. Significant flaws are likely to exist on the surface of the Palisades reactor pressure vessel wall and considerable uncertainty exists to dispute assumptions with regard to the extent that these flaws can contribute to making PTS events increasingly risk-significant.

The Petitioners have significant safety-related concerns with regard to the uncertainty that exists with the analyzed flaw distribution in the Palisades reactor pressure vessel. As documented in transcripts as recent as 2004, the NRC's Advisory Committee on Reactor

Safeguards shares in those concerns and disputed flaw distribution assumptions:

Dr. Wallis [ACRS]: This flaw distribution is based on rather skimpy evidence. This is one of the areas where---I mean, heat transfer Dittus-Boelter if you believe that. It's based on data points. But the flow [sic "flaw"] distribution in these walls is based on a few examinations. Isn't it?

Mr Ericksonkirk [NRC RES]: A few examinations but infinitely more than we had the first time.

Dr. Wallis: It's much better than you had the first time.

Mr. Ericksonkirk: Much better than we had the first time. I think as a laboratory geek at heart I have to admit I would really like to have more data on this and I don't think there's anybody in the technical community that would disagree with this. But I think that it's also important to recognize that the flaw distribution doesn't rest on experimental evidence alone. Certainly we started with — excuse me. We start with experimental evidence both from destructive and nondestructive evaluations but that's then also bolstered by --

Dr. Wallis: But those are individual reactors' vessels.

Mr. Ericksonkirk: That's right.

Dr. Wallis: But there are a hundred reactor vessels. I don't know how convincing it is that the flaw distribution that you might measure in a couple of vessels which were taken apart is typical of all other vessels.

Mr. Ericksonkirk: No. I think it would be unfair to say that a single experimental distribution derived from two vessels could be just looked at and thought to be representative of the other vessels.⁹

Excerpted from Exhibit 1-E.

B. The Petitioners urge that Palisades reactor pressure vessel is susceptible to irradiation embrittlement due at least to its copper/nickel/phosphorus content and dispute assumptions that regard the viability of reactor vessel sampling of susceptible materials and the associated RTndt /RTpts assumptions specific to Palisades reactor pressure vessel.

Palisades does not have representative samples of susceptible materials for surveillance requirements of its reactor pressure vessel, including the weld material in the

⁹ Official Transcript of NRC Proceeding, ACRS Joint Subcommittees: Materials and Metallurgy Thermal Hydraulic Phenomenon Reliability and Probabilistic Risk Assessment Meeting, December 01, 2004, p. 15 line 17 – p. 16, line 25.

vulnerable beltline welds. Palisades' assumptions on the material contaminants in the vessel and weld materials are based on questionable extrapolations of generic industry data and materials taken from weld material in Palisades' discarded steam generator which arguably did not experience the same level of adverse operational conditions as those degrading the reactor vessel beltline welds.

Further, adequate analysis of the Palisades beltline welds has been problematic due to uncertainties in determining the copper, nickel and phosphorous content of the susceptible materials. In 1994, NRC staff at one point clashed with ABB Combustion Engineering staff who had refused to divulge data on reactor vessel weld integrity that the vendor on proprietary grounds that the company wanted to keep confidential. NRC said that it might need to compel CE to release the data.¹⁰ Exhibit 1-F.

C. Petitioners dispute the viability of NMC assumptions regarding the degree to which Palisades pressure vessel materials have been degraded due to radiation-induced embrittlement and suggest that significant uncertainty exists with regard to the degraded state of the vessel, represented by an increase in its RTndt and RTpts values, for them to be accurately used as a reference point for an additional twenty-year extension.

The Applicant has over the years set forth many re-evaluations of the Palisades Rndt and RTpts values with a wide range of findings and uncertainty as to bring into question the viability of the degree of embrittlement of the Palisades reactor pressure vessel in its current condition to withstand a PTS event. The petitioners dispute the Applicants' claim that "The current pressure/temperature analyses are valid beyond the current operating license period, but not to the end of the period of extended operation. These analyses are estimated to expire in 2014."¹¹

¹⁰ Palisades Could Reach Its PTS Screening Limit Earlier Than Expected," Inside NRC, December 12, 1994, p. 13.

¹¹ Palisades Application, p. 4-15

Petitioners are aware of NRC communications which raise **this** dispute with regard to the NMC assertions that they do not exceed PTS screening criteria until 2014:

*From: Stephanie Coffin
To: Hoffman, Stephen
Date: 11/24/04 3:05PM
Subject: Palisades phone call*

We had a phone call with them Monday.

They no longer plan on submitting an exemption to apply "Master Curve" at their facility. Instead, they will be managing it in accordance with the May 27, 2004 guidance from Reyes to the Commissioners. They are following Point Beach and Beaver Valley closely.

I gave them feedback especially about the flux reduction requirements of the current rule and suggested they review the Point Beach submittal and our associated SER with Open Items, and to check for applicability to their plant.

FYI for Matt and Barry and Neil:

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Stephanie

CC: Duvigneaud, Dylanne; Elliot, Barry; Mitchell, Matthew; Ray, Nihar; Stang, John¹²

Exhibit 1-G. Petitioners contend that at best, whether or not Palisades has exceeded its RTpts remains inconclusive and at worst RTpts were exceeded as early as 1995 or 2001. As such, the petitioners dispute that the licensee has established an accurate and reliable reference temperature point for Palisades pressure vessel RTndt and RTpts values as a basis for extending Palisades operations for an additional 20-year period.

D. The petitioners contend that a significant dispute exists with regard to NMC assumptions on the low probability of an event to initiate a severe overcooling transient with repressurization such that the resulting crack will be of such size and location as to make the probability of a significant Palisades vessel fracture acceptably small

¹²Notes from NRC Telephone Call, "Palisades phone call," 11/24/2004, ML043340206.

NMC relies heavily upon assumptions that the probability of an initiating event is acceptably small, as do other pressurized water reactor operators. Given the associated uncertainty with the actual degradation of the Palisades reactor pressure vessel, the Petitioners submit that to take any comfort that the "big one" is not going to occur is uncomfortably reminiscent of the lack of an effective governmental response to the inadequate levees around New Orleans based on the improbability of conditions leading to the Gulf Coast city encountering a hurricane greater than Category III.

This type of accident is beyond the design basis of Palisades Nuclear Power Station, namely its safety systems, including the emergency core cooling system and the containment, which are not designed to withstand cracks in the pressure vessel resulting in the inability to sufficiently cool the reactor core and reactor core damage.

3) The petitioners dispute the Applicant's assertion that it can optionally anneal the embrittled vessel, given the lack of a demonstrated effective annealing process for any irradiated commercial reactor pressure vessels and the applicant's abandonment of a prior commitment for annealing the Palisades reactor pressure vessel that make the abandonment of Flux Reduction efforts for economic considerations unreasonable

Annealing, while a routine process in metallurgy, is acknowledged to be complicated by reactor pressure vessel radioactivity. For Palisades it would involve heating the beltline weld and perhaps the axial welds or some vessel plates to about 850° F for approximately a week or more. Even then, early estimates as to how long an annealing repair will last is a matter of debate and depend on a number of factors. Alan Hiser, U.S. Nuclear Regulatory Commission was attributed to say "If the material is a weld, rather than a plate, the annealing repair will be less effective and the re-embrittlement faster. The chemistry of the material is crucial, as well --

steels or welds containing nickel or copper are more subject to embrittlement and re-embrittlement.”¹³ Exhibit 1-H.

Palisades has previously announced plans to anneal the reactor pressure vessel but has taken no action. On January 5, 1995, Consumers Power Company informed its employees that the Palisades reactor would reach its PTS screening criteria limit as early as 1996. Consumers Power then announced plans to anneal the Palisades vessel by the year 2000.¹⁴

Palisades operators met with the NRC Commission Chairman on May 11, 1995 regarding its planned annealing operation.¹⁵

While the Applicant refers to annealing of the pressure vessel to mitigate the severely embrittled component as an option it can take up at the “appropriate time,” in fact, the Applicant withdrew its original request for further NRC staff review of its Preliminary Thermal Annealing Report as the company disclosed that it no longer had plans to anneal the embrittled vessel in 1998.¹⁶

NRC and the nuclear industry had an opportunity to test the annealing process on the irradiated decommissioned Yankee Rowe nuclear reactor pressure vessel but took no such action, instead Yankee Atomic Corporation used the badly embrittled vessel as a nuclear waste container for burial in Barnwell, South Carolina. While the NRC and industry have referred to the Yankee Atomic vessel as atypical of other commercial vessels, a valuable opportunity to test the annealing process on an irradiated specimen was a lost opportunity for

¹³ Outlook for Life Extension, Special Report to the Readers of Nucleonics Week, Inside NRC and NuclearFuel,” April 11, 1991 p. 10.

¹⁴ “Consumers May Anneal Palisades’ Vessel-A U.S. First,” Nucleonics Week, January 12, 1995, p. 1.

¹⁵ Meeting Summary between the Chairman and Consumers Power Co., US NRC, Microfiche Address 84015:231- 84015:231.

¹⁶ Consumers Energy Co. (formerly Consumers Power Co.) Withdraws Request for Further Staff Review of Preliminary Thermal Annealing Report, April 24, 1997, US NRC PDR, Microform Addresses: 92745:358-92745:359.

the entire industry. As a result, there is no experience with annealing severely-embrittled commercial power reactors in the United States which, coupled with the Applicant's abandonment of Flux Reduction Programs and the unreliability of the Applicant's past safety analysis, renders the Application deficient and deserving of rejection.

4) The Petitioners argue that Contention 1 on the Palisades embrittlement and PTS issue is not an improperly challenge to Commission rulings

The Petitioners have valid and proper concerns regarding consistent, thorough and viable analysis and documentation of Pressure Thermal Shock values calculated by both the industry and the NRC for Palisades, which is arguably one of the most embrittled reactors in the United States. Since 1981, the Palisades pressure vessel has been at the forefront of the embrittlement controversy and associated safety concerns for a Pressure Thermal Shock accident.

The Palisades nuclear power station pressure vessel has been analyzed and re-analyzed by NRC and projected to exceed its Pressure Thermal Shock Screening Criteria in numerous time frames:

> April 03, 1989, Consumers Power provided a revised report on reactor vessel fluence for operational cycles 1 through 8 in association with its vessel fluence reduction report. "It concludes that the PTS screening criteria will be exceeded at the axial welds in September 2001 as opposed to the previously reported exceed date of March 2002."¹⁷ Exhibit 1-I. Consumers Power Company (Now CMS) acknowledges a calculational uncertainty of + / - 25% in estimating the calculated vessel wall fluence, this is said to be typical of current neutron transport methodology uncertainties. Consumers reported:

¹⁷ Compliance with Pressurized Thermal Shock Regulation 10CFR50.61 and Regulatory Guide 1.99 Revision 2 (TAC No. 59970), Consumers Power, May 17, 1990; p. 1.

A number of factors contribute to the uncertainty in the projected peak fast fluence at the reactor vessel wall. These factors are due to the conversion of measured activity data to fluxes, uncertainties in material composition, neutron cross sections, power distributions, as-built core/vessel dimensions and cycle-by-cycle variation in the fast flux lead factors.¹⁸

> In the October 28, 1994 revision of NRC's "Status of Reactor Pressure Vessel Issues" (SECY 94-267) reports the staff indicated that the Palisades Pressure Vessel would reach the pressurized thermal shock (PTS) screening criteria in the year 2004.¹⁹

> In a revision in November 1994, NRC staff reported that:

[T]he staff was informed of preliminary data from the retired steam generators that indicates the Palisades reactor pressure vessel could reach the PTS screening criteria earlier than 2004. The licensee is continuing to evaluate the new data and to gather additional materials properties from its retired steam generators. If the preliminary data are confirmed, the plant would reach the PTS screen criteria at the next outage in May 1995.²⁰

> On January 24, 1995 in a NRC meeting on "Materials Issues in Palisades PTS Evaluation," the Palisades PTS criteria is again referenced and revised in staff view graphs stating: "*November 1, 1994, licensee informed staff that data from SG [steam generators] welds - Indicated higher copper contents than previously assumed - Indicated higher RTndt than mean generic value- Licensee assessment indicated reaching PTS screening criteria in 1999.*"²¹

> On November 24, 2004, a documented NRC telephone conversation further enlightens the ongoing uncertainty and inconsistency of estimating a still elusive timetable for exceeding the public safety-related criteria:

From: Stephanie Coffin

¹⁸ *Id.*, p. 33.

¹⁹ "Status of Reactor Pressure Vessel Issues," SECY-94-267, US NRC, October 28, 1994 (Exhibit 1-K).

²⁰ "Items of Interest," Office of Nuclear Reactor Regulation, Week Ending November 04, 1994 (Exhibit 1-L).

²¹ "Materials Issues in Palisades PTS Evaluation," Presented to NSRRC Subcommittee on Materials and Engineering, US NRC, January 24, 1995 (Exhibit 1-M).

*To: Hoffman, Stephen
Date: 11/24/04 3:05PM
Subject: Palisades phone call*

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Stephanie

CC: Duvigneaud, Dylanne; Elliot, Barry; Mitchell, Matthew; Ray, Nihar; Stang, John"²²

[The petitioners note that the referenced May 27, 2004 communication from Reyes to the Commissioners regarding Palisades management plan is not available to the public through NRC ADAMS.]

Palisades values for exceeding the PTS criteria have been extremely fluid, back and forth, with significant disparity in the year that the criteria is exceeded. The lack of consistent reliable analyses of the rate and level of embrittlement, complicated by the lack of viable Palisades-specific in-vessel sampling materials, together with dependence on generic industry data, demonstrate the unreliability of data used to establish Palisades' compliance with the screening criteria and subsequent effective mitigation actions for the license extension period.

²² Notes from NRC Telephone Call, "Palisades phone call," 11/24/2004, ML043340206, Exhibit 1-G.

This contention arises from evidence contained within the NRC's Staff contacts with the affected utility. The bases for a contention need not originate with the petitioner. Petitioners here properly may base their contention on NRC Staff letters to an applicant, so long as there is an adequate explanation of how alleged deficiencies support its contention and that there is additional information in support. *Louisiana Energy Services L.P.* (Claiborne Enrichment Center), LBP-91-41, 34 NRC 332, 338-339 (1991). See Sacramento Municipal Utility District (Rancho Seco Nuclear Generating Station), LBP-92-23, 36 NRC 120, 136 (1992), appeal granted in part and remanded, CLI-93-3, 37 NRC 135 (1993).

5) The significant uncertainty represents a dispute of fact that undermines confidence in Palisades treatment of PTS values for the License Renewal Process

The Palisades nuclear power station one of four U.S. reactor sites participating in the development of models for developing the technical basis for the revision of the PTS Rule. A review of transcripts of the Advisory Committee on Reactor Safeguards Joint Subcommittees Materials and Metallurgy and Thermal Hydraulic Phenomena and Reliability and Probabilistic Risk Assessment reveals substantial and significant uncertainties with regard to capturing and bounding public safety risk associated with ongoing operations further complicated by the twenty year license extension in three major technical areas: probabilistic fracture mechanics, thermal hydraulics and probabilistic risk assessment.

NRC staff went to the ACRS in November 2004, seeking a letter of endorsement of the staff effort to revise the current PTS rule. The revised PTS screening criteria is incomplete and fraught with uncertainty. According to the NRC Advisory Committee on Reactor Safeguards, in

its Conclusions and Recommendations on NUREG-1809 "Thermal-Hydraulic Evaluation of Pressure Thermal Shock "should be substantially revised."²³

There are numerous citations in the ACRS transcripts that underscore the uncertainty that prompted the ACRS' call for the substantial revision of the technical basis for on Thermal-Hydraulic Evaluation of Pressure Thermal Shock.

5) There is a lack of transparency and an incomplete record of NRC processes and documents which potentially affect the Palisades License Renewal Process with regard to how the Revision of the PTS Rule may affect the outcome of the Application

The NRC has not provided sufficient transparency and completeness of the public record germane to the processes with potential implications for the Palisades license extension. The Petitioners are not able to thoroughly review current NRC efforts to revise its Pressure Thermal Shock Rule. NRC has not made all of its germane safety documentation, albeit draft documents, available for public review. Two key examples are:

1) "Technical Basis for Revision of Pressurized Thermal Shock (PTS) Screening Limit in the PTS Rule (10 CFR 50.61): Summary Report," NUREG-1806, Draft for Peer Review Panel and ACRS Review, November 2, 2004; and

2) "Thermal Hydraulic Evaluation of Pressurized Thermal Shock," NUREG- 1809, Draft, February, 2005.

Whether or not a basis for contentions has been established must be decided by considering the contentions in the context of the entire record of the case up to the time the contentions are filed. Thus, when an application for a license amendment is itself incomplete,

²³ Pressure Thermal Shock (PTS) Evaluation Project: Technical Basis for Revision of the PTS Screening Criterion in the PTS Rule," March 11, 2005, Graham Wallis, Chairman, Advisory Committee on Reactor Safeguards, US NRC, p. 1., NRC ADAMS ML 050730177.

the standard for the admission of contentions is lowered, because it is easier for petitioners to have reasons for believing that the application has not demonstrated the safety of the proposed procedures for which an amendment is sought. *Wisconsin Electric Power Co.* (Point Beach Nuclear Plant, Units 1 and 2), LBP-81-45, 14 NRC 853 (1981). Petitioners urge that this contention should be deemed admissible at a lower standard precisely because there is undisclosed information which can be explored adequately for its relevance to the Application at a hearing.

With respect to their Contention No. 1, Petitioners have demonstrated many factual conundrums which must be resolved by means of a merit hearing. All that is required for a contention to be acceptable for litigation is that it be specific and have a basis. Whether or not the contention is true is left to litigation on the merits in the licensing proceeding. *Washington Public Power Supply System* (WPPSS Nuclear Project No. 2), ALAB-722, 17 NRC 546, 551 n.5 (1983), citing *Houston Lighting and Power Co.* (Allens Creek Nuclear Generating Station, Unit 1), ALAB-590, 11 NRC 542 (1980); *Philadelphia Electric Co.* (Limerick Generating Station, Units 1 and 2), ALAB-806, 21 NRC 1183, 1193 n.39 (1985); *Philadelphia Electric Co.* (Limerick Generating Station, Units 1 and 2), ALAB-819, 22 NRC 681, 694 (1985). The factual support necessary to show that a genuine dispute exists need not be in formal evidentiary form, nor be as strong as that necessary to withstand a summary disposition motion. What is required is "a minimal showing that material facts are in dispute, thereby demonstrating that an 'inquiry in depth' is appropriate." *Gulf States Utilities Co.* (River Bend Station, Unit 1), CLI-94-10, 40 NRC 43, 51 (1994) (citing Final Rule, Rules of Practice for Domestic Licensing Proceedings -- Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,171 (Aug. 11, 1989), quoting *Connecticut Bankers Association v. Board of Governors*, 627 F.2d 245 (D.C. Cir. 1980).

Response as to Contention No. 2 (Excessive radioactive and toxic chemical contamination in local drinking water due to emissions from Palisades nuclear power plant as part of its daily, "routine" operations)

NMC states (Answer p. 14) that this contention "is inadmissible because (i) the substance of the assertions (alleged radioactive and chemical emissions from the plant) are outside the scope of this proceeding, and (ii) the assertions are vague and unsupported by factual basis." The Staff likewise challenges (Staff Answer p. 14) this contention as "...vague and lacking in the required supporting information. . . ." The NRC goes on to state (Answer p. 14) that Petitioners failed "to provide the specific factual information necessary to provide a valid basis for any safety claim. . . ." Petitioners provide considerable information below, but it should be noted that the NRC has had in its possession these very documents for years, even decades. NRC staff also challenges this contention as being "generalized and unsupported arguments," but the information supplied below turns away that assertion. The NRC staff's failures to address these concerns is a violation of the agency's own mandate and mission to protect public health and safety and the environment.

NMC says (Answer p. 15) that "radioactive and chemical emissions from the plant are not issues related to the management of aging or time-limited aging analyses." On the contrary, such emissions are age-related, in that deteriorating and degrading reactor systems, including the Palisades reactor's fuel rods, pipes, tanks, and valves, will increase the amounts of toxic chemicals and radioactivity released into the Lake Michigan ecosystem over time due to increased leaks and malfunctions. Not only do "routine" releases thus increase, but so does the risk of more severe incidents and accidents as the reactor ages.

NMC (Answer p. 15) seeks to dismiss the validity of this contention by stating "[r]adiation exposure to the public during the renewal term is a Category 1 issue determined to

be small, based on a generic finding that radiation doses to the public will continue at current levels associated with normal operations.” However, as stated above, releases of toxic chemicals and radioactivity over time can be expected to increase due to more leakage and malfunctioning of age-deteriorated and degraded equipment and systems. In addition, the recent report published by the National Academies of Science (NAS) Committee on the Biological Effects of Ionizing Radiation (BEIR VII, published June 2005 and entitled “Health Effects from Exposure to Low Levels of Ionizing Radiation”) found that exposure to even low levels of ionizing radiation has a negative impact on human health. See <http://www.nap.edu/books/030909156X/html>. The significance of the NAS BEIR VII Report’s findings and relevance to ascertaining the implications of 20 more years of radioactivity emissions from Palisades is unmistakable. The NRC’s previous conclusion that the impact to public health is minimal or trivial must be re-evaluated in light of the recently published NAS BEIR VII report.

NMC urges that the contention is “inadmissible because it is vague and unsupported by any factual basis, ” that it “fails to identify what toxic and radioactive substances allegedly are released during the plant’s ‘routine’ operations, and in what respect any such emissions are allegedly ‘excessive.’ ” Specifically, the radioactive releases from the Palisades nuclear power plant into the environment of the Great Lakes Basin that are of most concern include radioactive hydrogen (tritium), radioactive noble gases (such as xenon and krypton, which relatively quickly transform into biologically active radioactive substances such as cesium and strontium), as well as fission products, activation products, and transuranics that find their way into the environment after escaping the reactor or the irradiated fuel.

Documentation recording such releases at Palisades includes the “Radioactive Materials Released from Nuclear Power Plants,” NUREG/CR-2907, BNL-NUREG-51581, Vol.

14, Annual Report 1993, prepared by J. Tichler, K. Doty, and K. Lucadamo, Brookhaven National Laboratory, prepared for the U.S. Nuclear Regulatory Commission, covering the years 1974 to 1993, and documenting reported annual emissions of such liquid and airborne effluents from Palisades as tritium, mixed fission and activation products. See Exhibit 2-A.

The following figures were reported for emissions from the Palisades Nuclear Power Plant:

From Table 2, pages 8 to 10

Airborne Effluents Comparison By Year/Fission and Activation Gases (Total Curies)

1974: <1.00E+00
1975: 2.61E+03
1976: 2.99E+01
1977: 5.99E+01
1978: 3.23E+02
1979: 6.84E+01
1980: 1.40E+02
1981: 3.00E+03
1982: 7.38E+03
1983: 3.00E+03
1984: 2.84E+01
1985: 3.68E+03
1986: 1.73E+02
1987: 1.75E+03
1988: 2.43E+03
1989: 1.52E+02
1990: 1.21E+02
1991: 6.26E+01
1992: 7.46E+01
1993: 9.29E+01

From Table 6, pages 20 to 22

Liquid Effluents, Comparison By Year/Tritium (Curies)

1974: 8.10E+00
1975: 4.16E+01
1976: 9.63E+00
1977: 5.58E+01
1978: 1.01E+02
1979: 1.26E+02
1980: 7.47E+01
1981: 2.78E+02
1982: 1.79E+02
1983: 2.35E+02
1984: 6.95E+01
1985: 4.29E+02
1986: 6.32E+01
1987: 1.19E+02
1988: 2.83E+02
1989: 8.06E+01
1990: 1.49E+02
1991: 5.52E+01
1992: 8.09E+01
1993: 2.10E+02

From Table 8, pages 26 to 28

Liquid Effluents, Comparison By Year/Mixed Fission and Activation Products (Curies)

1974: 5.90E+00
1975: 3.45E+00
1976: 4.40E-01
1977: 9.29E-02
1978: 9.65E-02
1979: 1.28E-01
1980: 8.73E-03
1981: 3.31E-02

1982: 1.27E-01
1983: 7.48E-02
1984: 3.68E-02
1985: 5.83E-02
1986: 1.40E-01
1987: 9.23E-02
1988: 3.43E-02
1989: 3.75E-03
1990: 7.75E-03
1991: 1.14E-02
1992: 3.88E-03
1993: 1.40E-02

Similarly, the Palisades effluent release reports for 1994 to 2000 could be similarly examined in detail. The following reports for 2001 to 2003 clearly show that emissions have continued. In fact, annual reports for 2004 to the present day would show that emissions continue still. Radioactivity emissions into the air, water, and soil are inevitable at Palisades nuclear power plant, and would continue from 2011 to 2031 if allowed.

Palisades' "RADIOACTIVE EFFLUENT RELEASE REPORT: GASEOUS EFFLUENTS – SUMMATION OF RELEASES: JANUARY—DECEMBER 2001" ATTACHMENT 2 reports the following:

FISSION & ACTIVATION GASES, Total Release:

1st Qtr: 3.01E+00 Ci
2nd Qtr: 2.92E+00 Ci
3rd Qtr: 2.21E-02 Ci
4th Qtr: 0.00

Specific radionuclides are listed individually. See Exhibit 2-B.

In ATTACHMENT 3, "RADIOACTIVE EFFLUENT RELEASE REPORT: LIQUID EFFLUENTS – SUMMATION OF RELEASES: JANUARY—DECEMBER 2001" the total release of fission and activation products (not including tritium, gases, and alpha emitters) was reported as:

1st Qtr: 2.81E-06 Ci
2nd Qtr: 2.45E-04 Ci
3rd Qtr: 0.000 Ci
4th Qtr: 3.68E-05 Ci

Again, individual nuclides released are identified there. See Exhibit 2-C.

Palisades' "RADIOACTIVE EFFLUENT RELEASE REPORT: GASEOUS EFFLUENTS – SUMMATION OF RELEASES: JANUARY—DECEMBER 2002" ATTACHMENT 2 reports the following:

FISSION & ACTIVATION GASES, Total Release:

1st Qtr: 5.01E-01 Ci
2nd Qtr: 3.20E+00 Ci
3rd Qtr: 1.65E+00 Ci
4th Qtr: 3.26E+01

Specific radionuclides are listed individually. See Exhibit 2-D.

In ATTACHMENT 3, "RADIOACTIVE EFFLUENT RELEASE REPORT: LIQUID EFFLUENTS – SUMMATION OF RELEASES: JANUARY—DECEMBER 2002" the total release of fission and activation products (not including tritium, gases, and alpha emitters) was reported as:

1st Qtr: 9.59E-05 Ci
2nd Qtr: 0.000 Ci
3rd Qtr: 1.83E-04 Ci

4th Qtr: 7.48E-07 Ci

Again, individual nuclides released are identified there. See Exhibit 2-E.

Similarly, Palisades' "RADIOACTIVE EFFLUENT RELEASE REPORT: GASEOUS EFFLUENTS – SUMMATION OF RELEASES: JANUARY—DECEMBER 2003" ATTACHMENT 2 reports the following:

FISSION & ACTIVATION GASES, Total Release:

1st Qtr: 6.07E+01 Ci

2nd Qtr: 3.5E+00 Ci

3rd Qtr: 4.96E-01 Ci

4th Qtr: 7.42E-01

Individual fission gases identified as being released in various amounts from Palisades include: krypton-85, 87, and 88; Xenon-131m, 133, 135m, 138; individual Iodines identified as being released in various amounts from Palisades include: Iodine 131, 132, 133, 135; Particulates with half-lives greater than 8 days include: Chromium-51; Manganese-54; Cobalt-58; Cobalt-60; Niobium-95; Ruthenium-103; Strontium-89; Strontium-90; Cesium-134; Cesium-137; Zirconium-95; Cobalt-57; as well as net identified beta emitters. See Exhibit 2-F.

In ATTACHMENT 3, "RADIOACTIVE EFFLUENT RELEASE REPORT: LIQUID EFFLUENTS – SUMMATION OF RELEASES: JANUARY—DECEMBER 2003" the total release of fission and activation products (not including tritium, gases, and alpha emitters) was reported as:

1st Qtr: 2.09E-04 Ci

2nd Qtr: 5.40E-04 Ci

3rd Qtr: 0.000 Ci

4th Qtr: 1.45E-03 Ci

Again, individual nuclides released are identified there. See Exhibit 2G.

As the NAS BEIR VII Report found, even so-called "low" level radiation exposure has a negative, adverse impact on human health.

Petitioners challenge the methodology upon which all of these annual reports are based. On September 13, 2005 Kevin Kamps of NIRS spoke by phone with a worker at the City of South Haven, Michigan's Water Filtration Plant. The City of South Haven's Water Filtration Plant supplies drinking water to customers in the City and townships of Casco, Covert and South Haven. This plant supplies water to nearly 3,400 customers located in these areas. The water comes from Lake Michigan, a surface water source, through an intake pipe located about a mile offshore from South Beach in the City of South Haven, just several miles north and downstream (given the prevailing direction of flow in Lake Michigan) from the Palisades nuclear power plant, which emits radioactivity into the waters of Lake Michigan daily. The lake water is treated, settled, filtered and disinfected as it goes through the Water Filtration Plant, but radioactivity is not removed by any of these processes.

The worker at the Water Filtration Plant explained that while he does collect samples of Lake Michigan water on a daily and monthly basis to test for radiation, he turns those samples over to the Palisades nuclear power plant, which then performs the testing itself (and/or through subcontractors). This fox-guarding-the-henhouse transfer of the water samples back into the hands of the Palisades nuclear power plant represents an unacceptable methodology, given its vulnerability to falsification by Palisades personnel, which would be in the interest of Palisades, to under-report radioactivity levels in the source of drinking water for nearby communities. Genuinely independent radiation monitoring must be performed, without the risk

of falsification by the very company that stands to benefit from low reports of radiation in the water

NMC states (NMC Answer p. 16) that "...Petitioners. . .failed to provide any 'alleged facts' or 'expert opinion that supports the contention.'" To the contrary, Petitioners have consulted with Dr. John Robbins, a Great Lakes limnologist recently retired from the U.S. Chamber of Commerce, National Oceanographic and Atmospheric Administration (NOAA), Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, Michigan (where, among other things, he specialized in analyzing radioactivity in the Great Lakes, being referenced in such publications as the International Joint Commission's Nuclear Task Force's December 1997 "Inventory of Radionuclides for the Great Lakes," namely, the report he co-authored in 1980 entitled "Plutonium in the Great Lakes," which appeared in "Transuranic Elements in the Environment," edited by W.C. Hanson, published by the U.S. Dept. of Energy, see specifically pages 659 to 683 of that report, referenced on page 98 of the IJC report). See Exhibit 2-H. Dr. Robbins has established that the predominant current flow is from south to north in Lake Michigan near the Palisades nuclear reactor. Therefore, not only the new intake built just offshore from Palisades, but the old intake at South Beach in South Haven are directly in line for radioactive and toxic chemical contamination. Dr. Robbins believes that it is not implausible, on average, for those water intakes to serve as radioactivity receptors from the emissions into Lake Michigan at Palisades. Thus, the drinking water for South Haven, Casco, and Covert could very well be contaminated with radioactivity from Palisades, which, even at so-called low levels, would have an adverse impact on human health, as found by the NAS BEIR VII Report.

To confirm the direction of Lake Michigan water flow in the vicinity of Palisades, Dr. Robbins referred us to Dr. Dave Schwab, who still works at NOAA's GLERL. Dr. Schwab is

one of the top experts on the direction of flow of Lake Michigan's waters. Dr. Schwab confirms that the prevailing direction of Lake Michigan water flow is from south to north, the very direction of flow that would carry radioactivity and toxic chemicals released by Palisades into the drinking water intakes for South Haven, Casco, and Covert. Dr. Schwab pointed to the following field data to support this finding:

Gerald Miller, Michael McCormick, James Saylor
 Great Lakes Environmental Research Lab
 2205 Commonwealth Blvd.
 Ann Arbor, MI 48105
 Phone: 734/741-2119, 734/741-2277, 734/741-2118
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GLERL Vector Averaging Current Meter (VACM) Moorings 10/1999-06/2000

Manufacturer: EG&G

Header Line: N Lat (dec. deg), W. Lon (dec. deg), VACM Depth (m), Inst. No.,
 Year Deployed, Mooring Name

Explanation of Columns in the Data Set

YEAR Year (UT)
 DOY Day of year (UT)
 TIME Universal time (UT - Hours and minutes HHMM)
 E Eastward component of mean horizontal current (cm/s)
 N Northward component of mean horizontal current (cm/s)
 WT Water Temperature (deg C)

Data Sources:

File Name	Mooring	Lat (N)	Lon (W)	Inst	Depth	No.	Dates	VACM/Water	Op #
V01-1999-12M.txt	V01-99	41 48.89'	86 40.80'	556	12/20m		No Data		S1999294.01
V01-1999-19M.txt	V01-99	41 48.89'	86 40.80'	265	10/20/99-06/15/00		19/20m		S1999294.01
V03-1999-14M.txt	V03-99	41 58.17'	86 57.34'	569	10/20/99-06/15/00		14/62m		S1999293.03
V03-1999-61M.txt	V03-99	41 58.17'	86 57.34'	348	10/20/99-06/15/00		61/62m		S1999293.03

V04-1999-10M.txt V04-99 41 54.85' 86 40.74' 347 10/20/99-06/15/00 10/18m S1999294.02
(A)
V04-1999-17M.txt V04-99 41 54.85' 86 40.74' 354 10/20/99-06/15/00 17/18m S1999294.02
(A)
V05-1999-12M.txt V05-99 41 57.95' 86 44.82' 572 10/20/99-06/15/00 12/40m S1999293.05
V05-1999-39M.txt V05-99 41 57.95' 86 44.82' 551 10/20/99-06/15/00 39/40m S1999293.05
V06-1999-13M.txt V06-99 42 00.53' 86 47.90' 274 10/20/99-06/14/00 13/61m S1999293.04
V06-1999-60M.txt V06-99 42 00.53' 86 47.90' 311 10/20/99-06/14/00 60/61m S1999293.04
V07-1999-11M.txt V07-99 42 07.41' 86 41.19' 574 No Data 11/59m S1999299.01
V07-1999-58M.txt V07-99 42 07.41' 86 41.19' 319 10/26/99-06/14/00 58/59m S1999299.01
(B)
V08-1999-09M.txt V08-99 42 15.18' 86 39.87' 279 10/26/99-06/13/00 09/57m S1999299.02
V08-1999-56M.txt V08-99 42 15.18' 86 39.87' 568 10/26/99-06/13/00 56/57m S1999299.02
V09-1999-11M.txt V09-99 42 14.51' 86 25.19' 573 10/27/99-06/14/00 11/19m S1999300.05
V09-1999-18M.txt V09-99 42 14.51' 86 25.19' 352 10/27/99-06/14/00 18/19m S1999300.05
V10-1999-10M.txt V10-99 42 15.83' 86 27.90' 553 10/27/99-06/14/00 10/28m S1999300.04
V10-1999-27M.txt V10-99 42 15.83' 86 27.90' 277 10/27/99-06/14/00 27/28m S1999300.04
V11-1999-10M.txt V11-99 42 17.20' 86 31.35' 555 10/27/99-06/14/00 10/38m S1999300.03
V11-1999-37M.txt V11-99 42 17.20' 86 31.35' 280 10/27/99-06/13/00 37/38m S1999300.03
V12-1999-11M.txt V12-99 42 20.27' 86 38.08' 583 10/27/99-06/13/00 11/59m S1999300.02
V12-1999-58M.txt V12-99 42 20.27' 86 38.09' 349 10/27/99-06/13/00 58/59m S1999300.02
V13-1999-13M.txt V13-99 42 20.04' 86 21.65' 577 10/19/99-04/25/00 13/21m S1999292.01
V13-1999-20M.txt V13-99 42 20.04' 86 21.65' 576 10/19/99-04/25/00 20/21m S1999292.01

(A) Water temperature only

(B) Current velocity data ends 10/26/99, water temperature to end.

Missing data denoted by -999.0

Manufacturers specifications:

Velocity: Threshold 2.5 cm/s

Rotor Constant 34.6 cm/rev

Temperature: Accuracy +/-0.1C

Compass: Accuracy +/-5 deg

See http://www.glerl.noaa.gov/eegle/data/1999-00/moor_miller/vacm.meta.txt for a better laid

out format, and also see http://www.glerl.noaa.gov/eegle/data/objects/obj_18.V13.4.html

Station V-13 is the closest to Palisades, and thus the most relevant to questions of Lake Michigan water flow direction in the vicinity of the reactor. Dr. Schwab has mostly addressed the macro level of water flow in Lake Michigan, but is now delving into the issue of micro level of water flow. Thus, he will address locales of tight scope, such as the immediate vicinity of the Palisades reactor, so close as it is to one operational and one potential source of drinking water for the residents (and large numbers of visitors, given the tourism of the Lakeshore region) in South Haven, Casco, and Covert.

Additionally, Dr. Rosalie Bertell, GNSH, with the International Institute of Concern for Public Health, has provided consultation to Petitioners. Dr. Bertell has also served as a longtime National Advisory Board member of NIRS. Dr. Bertell has served on the Nuclear Task Force of the International Joint Commission, where she helped in the publication of the "Inventory of Radionuclides for the Great Lakes," (Dec. 1997), as well as the 1999 "Report on Bioaccumulation of Elements to Accompany the Inventory of Radionuclides in the Great Lakes Basin." Dr. Bertell has worked professionally in Environmental Epidemiology since 1968, served on the Advisory Boards for the Great Lakes Health Effects Program of Health Canada, and the Ontario Environmental Assessment Board and has been a member of the IJC Science Advisory Board. She has published a "Handbook for Estimating the Health Effects of Exposure to Ionizing Radiation" and the popular non-fiction book "No Immediate Danger: Prognosis for a Radioactive Earth," together with more than 100 other publications. She has provided consultation to Petitioners on the issue of performing water sampling near Palisades in order to correct the methodological flaw mentioned earlier of Palisades handling the water samples before they are actually tested by an independent institution.

Dr. Bertell referred Petitioners to Dr. Hari Sharm in Waterloo, Ontario, Canada, a nuclear chemist who can test for radioactivity and toxic chemicals in Lake Michigan water

samples for Petitioners. Dr. Sharm has expressed an interest in helping to carry out this vital work and is assisting Petitioners in the process of developing a methodology for carrying out this independent assessment on the radiation and toxic chemicals being emitted by the Palisades nuclear power plant into the drinking water source, Lake Michigan, for the residents and visitors in South Haven, Casco, and Covert.

The basis-with-reasonable-specificity standard requires that an intervenor include in a safety contention a statement of the reason for his contention. This statement must either allege with particularity that an applicant is not complying with a specified regulation, or allege with particularity the existence and detail of a substantial safety issue on which the regulations are silent. *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), LBP-82-106, 16 NRC 1649, 1656 (1982), citing 10 CFR § 2.335 (formerly § 2.758). While NRC regulations have not yet changed to accommodate the conclusions of BEIR VII, this major scientific pronouncement compels a rethinking of the exposure of the public to routine radiation emissions from Palisades through their water supply. A substantial safety issue is exposed in this contention, and it must be admitted for the inquiry of a contested hearing.

Response as to Contention No. 3 (*The Palisades reactor has no place to store its overflowing irradiated nuclear fuel inventory within NRC regulations*)

The Staff argue that “[t]his proposed contention lacks basis and support . . . [and] fails to establish that a genuine dispute exists on a material issue of law or fact. . . .” Staff Answer p. 15. The Nuclear Management Company maintains that the contention is “...inadmissible because it is not supported by a basis demonstrating the existence of a genuine material dispute.” NMC Answer p. 16. In a way, the Petitioners agree; there is no material dispute over the facts, but the facts compel the conclusion that Palisades’ dry cask storage arrangements

violate NRC regulations.

Specifically, the material facts prove - and exceed the threshold showing that must be made here - that neither the old nor the more recent, "new" concrete pads holding dry casks at Palisades conform with longstanding NRC requirements for earthquake stability standards. As the attached Affidavit of Dr. Ross Landsman, formerly of the Nuclear Regulatory Commission staff, depicts, both pads were built on compacted sand and other subsurface materials, dozens of feet above bedrock and well above the ground elevation of the nearby nuclear power plant. Dr. Landsman, who has decades of experience and a direct oversight role in the inspection of dry cask storage at Palisades when he worked at NRC Region III during the critical period of dry cask storage installation and operation from 1993 to 2005, has concluded from his personal knowledge of the subsoil conditions that the older pad nearer the lake is in violation of NRC liquefaction regulations under 10 CFR Part 72.212(b)(2)(i)(B)²⁴, while the newer pad further inland is in violation of NRC amplification regulations under the same regulations. Neither the older nor newer dry cask storage pads at the Palisades plant were designed in consideration of the factors contained in the cited regulation. See Landsman Affidavit, ¶¶ 3-13.²⁵ Either violation, then, violates 10 CFR 72.212(b)(3).²⁶ This means that the cask storage pads ***have violated NRC regulations since they were constructed, and absent enforcement will continue to violate NRC regulations during a 20-year license***

²⁴[The general licensee shall perform written evaluations, prior to use, that establish that]: Cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion.

²⁵The Landsman Affidavit appears in electronic form annexed hereto and also in hard copy at pp. App. 3-a through 3-d of the "Petitioners' Appendix of Evidence in Support of Contentions."

²⁶[The general licensee shall]: Review the Safety Analysis Report (SAR) referenced in the Certificate of Compliance and the related NRC Safety Evaluation Report, prior to use of the general license, to determine whether or not the reactor site parameters, including analyses of earthquake intensity and tornado missiles, are enveloped by the cask design bases considered in these reports. The results of this review must be documented in the evaluation made in paragraph (b)(2) of this section.

extension and beyond.

The NRC, unfortunately, considers the older pad nearer the lake to be in compliance with regulations and allows NMC to store high-level radioactive waste there, while the NRC is supposedly still trying to resolve through ongoing inspection, investigation, and analysis the status of the newer pad, which is situated further inland from Lake Michigan. However, during this alleged period of ongoing investigation, the NRC is allowing NMC to store waste on the new pad despite the unresolved safety concerns. Dr. Landsman's understanding is that the newer pad was built big enough to accommodate all the dry casks currently stored on the older pad nearer the lake, because, despite public pronouncements to the contrary by Consumers Energy, Nuclear Management Company, and the NRC, the older pad clearly violates regulations, which means that the 18 to 19 casks currently stored on the older pad²⁷ must be moved to the newer pad. The problem is, moving the casks from the older pad to the newer one is analogous to jumping from the frying pan into the fire.

Dr. Landsman sought repeatedly while he worked for the NRC to see this unresolved safety issue corrected. Now, however, four casks are being stored on the newer pad. In addition, plans have been in place for additional casks to be loaded and stored on the newer pad in the near future, perhaps as early as fall 2005.

While the NRC staff inveighs (Staff Answer p. 16) that "[p]etitioners lack the requisite

²⁷Including the unloadable, unmovable cask #4 at Palisades, loaded in June 1994 and shortly thereafter admitted by Consumers Power to be defective, having faulty welds. Now, eleven years on, Consumers has yet to unload the defective cask, because it technically cannot do so safely. And the configuration of the 18 to 19 dry casks currently stored on the older pad nearer Lake Michigan is such that the casks furthest back cannot be moved or unloaded until all other casks in front of them have been moved out of the way first. This situation increases the risks, making it very difficult to address emergencies involving certain casks in the configuration in a timely manner.

Although Petitioners/Intervenors are withdrawing their Contention No. 7 concerning dry cask #4 as a separate contention (*see infra*), Palisades' noncompliance with earthquake standards has elevated portents for this particular vessel of high-level radioactive waste.

basis and support for their claim, highlighted by the fact that they have not produced any affidavits or other evidence as to the opinion of their 'anticipated expert,' the NRC had the benefit for years of Petitioners' expert's warnings and has done little to nothing about it, contrary to the agency's mission and mandate to protect public health and safety and the environment. NMC states (NMC Answer p. 19) that "Contention 3 is not supported by a basis demonstrating a genuine issue." Actually, it is the dry cask storage pads, and the very deadly high-level radioactive waste they hold, that is not supported by a base that is safe and secure from earthquake dangers. NMC further urges (Answer p. 19) that "[t]he results of the licensee analysis showed that the [older] pad could support the casks safely. The results are documented in a letter to the NRC dated July 27, 1994." NMC additionally cites the NRC's September 20, 1994 "Independent NRC Staff Final Safety Assessment of the Dry Storage Facility at Palisades Nuclear Power Plant Site" as further proof of issue resolution. NMC likewise points out a June 5, 1995 NRC Information Notice (95-28, "Emplacement of Support Pads for Spent Fuel Dry Storage Installations at Reactor Sites," p. 3) as proof that all is fine at the older pad nearer the lake.

But both the Staff and NMC somehow have failed to disclose the contents of a letter written by Dr. Landsman while at NRC Region III as a safety engineer and dry cask storage inspector overseeing Palisades, to the then-Commission Chairman, Ivan Selin, on February 17, 1994, warning that:

[I]f you use NRC-approved casks under Subpart K [of 10 CFR Part 72], the regulations are silent about the foundation material or the pad. Actually, it's the consequences that might occur from an earthquake that I'm concerned about. *The casks can either fall into Lake Michigan or be buried in the loose sand because of liquefaction. . . . It is apparent to me that NMSS [sic] doesn't realize the catastrophic consequences of their continued reliance on their current ideology.* (Emphasis added)

Dr. Landsman has never received a meaningful response to this warning and would attest

under oath at the hearing of this contention that his safety concerns about the older pad, which involve violations of NRC regulations and violations of public health and safety and environmental protection - remain inadequately addressed and unresolved to this day.

The NRC staff (Staff Answer p. 16) asserts that “[t]his part of the Commission’s regulations has no relation to license renewal.” NMC states (Answer p. 16) that “[t]his contention is beyond the scope of 10 CFR Part 54, because the dry cask storage pads are part of the Independent Spent Fuel Storage Installation (‘ISFSI’) facility which is distinct from – and licensed separately from – the Palisades nuclear power plant.” Both responses are disingenuous. It is impossible to disconnect the dry cask storage pad problems from the proposed license extension. If both dry cask storage pads violate NRC safety regulations and are barred from use, then where, exactly, would NMC store its bulging inventory of irradiated nuclear fuel? And where would the 22 to 23 dry casks already loaded and stored on those defective pads at Palisades be moved to? These are not rhetorical questions; the answers are integral to the 20 year license extension proposal, given that high-level radioactive waste is an inevitable byproduct of electricity production at the Palisades nuclear reactor.

NRC staff also claim (Staff Answer p. 16) that this contention impermissibly attacks NRC regulations, specifically the GEIS on reactor license extension as well as the “Nuclear Waste Confidence Rule.” But, truth be told, at present there is no place for the wastes generated during a 20 year license extension at Palisades to be stored without violating NRC regulations. The NRC’s “Nuclear Waste Confidence Decision” places *false* confidence in the availability of a geologic repository in the U.S. by the year 2025, and biases the NRC in favor of approving a license for the proposed Yucca Mountain, Nevada dumpsite (the only one under consideration). It also, by implication, biases the NRC in favor of approving a 20-year license extension at Palisades.

NMC dismisses this contention (NMC Answer p. 18) by stating “. . . it is a challenge. . . .to the generic findings in the GEIS and Appendix B to Part 51.” NMC further cites a Commission ruling on license extension at Oconee which states that “[t]he Commission’s generic determinations governing onsite waste storage preclude the Petitioners from attempting to introduce such waste issues into this adjudication.” But there was not firm evidence of regulatory violation concerning onsite waste storage in the Oconee proceeding. Presumably when the NRC establishes generic findings regarding on-site waste storage it assumes either that its safety regulations are being met at the particular nuclear plant in question, or else that it plans to take enforcement action against any violations of its regulations. But, Petitioners here have articulated evidence that tends to prove in a compelling fashion that **both** of the dry cask storage pads at Palisades are in violation of NRC earthquake regulations. This begs the question, why is NRC allowing high-level radioactive waste storage on pads at Palisades that are in violation of NRC earthquake regulations?

At page 17 of its Answer, NMC states as fact something which is wholly false: that “[b]oth site specific and general licenses are issued for a maximum of 20 years, not 40 years as for nuclear power plants.” Yet, late last year, the NRC Commissioners, by a 2 to 1 split decision (with NRC Chairman Nils Diaz voting against the proposal), approved a 40 year license extension at the Surry Nuclear Power Plant ISFSI in Virginia, the oldest ISFSI in the U.S. So while the initial license may be granted for an initial 20 year period, NRC has indeed granted a license extension for an ISFSI for 40 years. This potentially monumental safety error could well be relicensed.

On page 18 of its Answer, NMC misconstrues Petitioners’ contention, perhaps to mislead the Board. NMC states “[t]he regulations do not require licensees to explore the aging of components for a facility not covered by this license renewal proceeding. . . .”. It is not the

aging of the pads that is at the heart of this contention (although pad deterioration over time is a significant safety issue that must be addressed as well), but rather the fact that both ISFSI pads at Palisades have continuously violated NRC earthquake regulations since the day they were built.

At the August 28, 2005 NRC public meeting in South Haven concerning the proposed 20 year license extension at Palisades, neither NRC nor Nuclear Management Company officials could give the number of dry casks already loaded on the two pads at Palisades. Even if the Staff and NMC don't ascribe the requisite seriousness to these issues - given the deadly nature of high-level radioactive waste - the Board must.

All that is required for a contention to be acceptable for litigation is that it be specific and have a basis. Whether or not the contention is true is left to litigation on the merits in the licensing proceeding. *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), LBP-89-28, 30 NRC 271, 282 (1989), aff'd on other grounds, ALAB-940, 32 NRC 225 (1990); *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2 and 3), LBP-91-19, 33 NRC 397, 411 (1991), appeal denied, CLI-91-12, 34 NRC 149 (1991). Here, the facts alleged, coupled with the expert opinions proffered, easily meet those requirements.

A Licensing Board should not address the merits of a contention when determining its admissibility. *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), LBP-82-106, 16 NRC 1649, 1654 (1982), citing *Houston Lighting and Power Co.* (Allens Creek Nuclear Generating Station, Unit 1), ALAB-590, 11 NRC 542 (1980); *Kansas Gas & Electric Co.* (Wolf Creek Generating Station, Unit 1), LBP-84-1, 19 NRC 29, 34 (1984); *Commonwealth Edison Co.* (Braidwood Nuclear Power Station, Units 1 and 2), LBP-85-11, 21 NRC 609, 617 (1985), rev'd and remanded on other grounds, CLI-86-8, 23 NRC 241 (1986). The petitioner simply

must provide sufficient information to establish the existence of a genuine dispute with the applicant on a material issue of law or fact. 10 CFR § 2.309(f)(1)(v) (formerly 2.714(b)(2)(iii)). See Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), LBP-91-35, 34 NRC 163, 166, 169-170, 175-76 (1991); Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), LBP-91-39, 34 NRC 273, 279 (1991); Louisiana Energy Services, L.P. (Claiborne Enrichment Center), LBP-91-41, 34 NRC 332, 338 (1991); Northeast Nuclear Energy Company (Millstone Nuclear Power Station, Unit 2), LBP-92-28, 36 NRC 202, 214 (1992); Sacramento Municipal Utility District (Rancho Seco Nuclear Generating Station), CLI-93-3, 37 NRC 135, 142 (1993); Sacramento Municipal Utility District (Rancho Seco Nuclear Generating Station), LBP-93-23, 38 NRC 200, 205 (1993); Gulf States Utilities Co. (River Bend Station, Unit 1), CLI-94-10, 40 NRC 43, 51 (1994). Certainly, Petitioners have in respect to this contention shown material facts which implicate serious issues of regulatory law. The ASLB, given the strong facial showing Petitioners have made, cannot inquire more deeply into the merits of the contention, but instead must admit it for hearing.

The standard for a safety contention in operating license cases (Petitioners recognize this is not an operating license case) is relatively loose; a contention about a matter not covered by a specific rule need only allege that the matter poses a significant safety problem [10 CFR § 50.57(a)(3)] for finding of reasonable assurance of operation without endangering the health and safety of the public. Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), LBP-82-116, 16 NRC 1937, 1946 (1982). Here, of course, the contention alleges in compelling fashion the continuous violations of specific regulations. As it appears they would easily meet the operating license standard for a safety issue, the panel must admit their contention for the *continuation* of that operating license for 20 years beyond its expiration.

Because as a matter of fact, Petitioners have met - and exceeded - the pleading

requirements for this contention, the Board must, as a matter of law, proceed to hear it on the merits.

Response as to Contention No. 7 (Non-radiological persistent toxic burdens to area water sources)

NRC staff claim (Answer p. 22) that this contention “lacks specificity and support.”

Below is the actual NPDES report summarizing a number of areas in which Palisades is not in compliance with its National Pollution Discharge Elimination System permit requirements, specifically in continuing non-compliance concerning the toxic chemical Betz Clam-Trol.

NPDES NUMBER	GRANT LIMIT	VIOLATION	ENFORCEMENT	STATUS
INSTANCE OF NONCOMPLIANCE	RNC DATE	ENFORCEMENT		
ACTION	DATE	STATUS	DATE	COMMENTS

0CPCO-PALISADES POWER PIT		NON-COMPLIANT		
COVERT				
MI0001457	***FINAL***			

***** SUMMARY SECTION *****

PH	001A	11/30/00	NC	CONTINUING NONCOMPLIANCE
TRO-DISCHARGE TIME	001A	11/30/00	NC	CONTINUING NONCOMPLIANCE
OXIDANTS, TOTAL RESIDUAL	001A	11/30/00	NC	CONTINUING NONCOMPLIANCE
BETZ CLAM-TROL CT-2	001A	11/30/00	NC	CONTINUING NONCOMPLIANCE
BETZ CLAM-TROL CT-4	001A	11/30/00	NC	CONTINUING NONCOMPLIANCE

“Continuing Noncompliance” indicates that the violation cited in the above summary was not the first time such a violation had occurred, so that violations on limits of releases of persistent toxic chemicals from Palisades nuclear power plant into the waters of Lake Michigan appears to be an unfortunate, and harmful, pattern. As late as 2003 and 2004, the formal NPDES reports on the use of Clam-Trol at Palisades were mere recitations of the 2000 reporting data.

See <http://www.epa.gov/region5/water/weca/reports/mi2qtr04.pdf> (for 2004), and

<http://www.epa.gov/region5/water/weca/reports/mi2qtr03.pdf> (for 2003).

Thus, NMC’s claim (Answer p. 26) that Petitioners’ reference provides “no basis for

Petitioners' allegation or 'apparent multiple misuses of Betz Clam-Trol'" is false, for "continuing noncompliance" indicates a pattern extending over time.

The NRC staff states (Answer p. 22) that "it is not within the [Nuclear Regulatory] Commission's jurisdiction to make any determination as to the adequacy of such permits [such as NPDES permits] in protecting the environment." Yet the scope of 10 CFR Part 54 (set out at §54.4) encompasses "(a) Plant systems, structures, and components . . . [including] (2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1) (i), (ii), or (iii) of this section." Presumably, maintaining unclogged water intakes at Palisades fall within this scoping parameter. If so, then NPDES noncompliance is a relevant issue because NMC is not being truthful about the measures it is taking concerning the perennial clogging problem caused by zebra mussels in Lake Michigan. This disregard for compliance with regulations, not to mention indifference to the environmental health of Lake Michigan and the public health impacts of persistent toxic chemicals released as part of reactor operations does not comport with the NRC's supposed mandate and mission to protect public health and the environment.

Palisades' ongoing releases of persistent toxic chemicals into Lake Michigan is a violation of the letter and spirit of the "Ninth Biennial Report On Great Lakes Water Quality" by the International Joint Commission, the binational U.S.-Canadian federal governmental agency whose mandate and mission is protecting and preserving the Great Lakes. At page 35 of that IJC report, it states:

Specific Persistent Toxic Substances:

The Commission reiterates from its Sixth Biennial Report that, under the Agreement, (Great Lakes Water Quality Agreement of 1978) 'the overall strategy or aim regarding persistent toxic substances is virtual elimination, and the tactic or method to be used to achieve that aim is through zero input or discharge of those substances created as a result of human activity.' This is both necessary and reasonable. 'Persistent toxic substances are too dangerous to the biosphere and to humans to

permit their release in any quantity.'

Twenty additional years of such toxic chemical emissions from Palisades into Lake Michigan - especially if they are too inconvenient to report - will have a significant adverse impact on human and ecosystem health.

There regulations requirement that an intervenor supply the bases on which the intervenor intends to rely. *Georgia Power Company* (Vogtle Electric Generating Plant, Units 1 and 2), LBP-94-22, 40 NRC 37, 39 (1994).

Nonreporting of important, and required, information about toxic releases obscures any meaningful evaluation of the functioning of nonsafety features of Palisades which will be necessary to plant operations during the license extension period. This contention should be admitted.

Response as to Contention No. 8 (*Environmental justice denied by the continuing operations of Palisades*)

NMC states (NMC Answer p. 28) that Petitioners "...fail to challenge the Application and to demonstrate the existence of a genuine dispute on a material issue of fact or law..." and "fail[s] to provide an adequate factual basis to support any dispute with the Application." NMC states that "...none of Petitioners' claims address the 'essence of an environmental justice claim' arising under NEPA in a NRC licensing proceeding – *i.e.*, 'disproportionately high and adverse human health and environmental effects' on minority and low-income populations that may be different from the impacts on the general population."

Petitioners dispute these conclusions. The heart of the contention is that Palisades' 20-year license extension could very well adversely affect minority and low-income populations in disproportionately high ways not faced by the general population in the area, in particular upon Native Americans.

NMC cites (NMC Answer p. 30) NRC pleading rules requiring that contentions “must include references to specific portions of...the applicant’s environmental report...that the petitioner disputes and the supporting reasons for each dispute.” Petitioners take greatest issue with NMC’s Environmental Report, Section 2.10, entitled “Historic and Archaeological Resources.”

The Environmental Report gives very short shrift to historic and archaeological resources. The potential for Native American burial sites, or other Native sites such as former villages or encampments, at or near Palisades is not mentioned anywhere in the Environmental Report.

Petitioners submit that the conclusion “no significant historical or archaeological resources were known to occur in the study area” is unsupported by the “Attachment C. Cultural Resources Correspondence” found in the Report. There are just two letters, one from Consumers/NMC to the Michigan State Historic Preservation Office, the second from the Department of the Interior to the Atomic Energy Commission.

Respecting the February 11, 2005 letter from Dan Malone at NMC and Stephen Wawro at Consumers to Ms. Martha MacFarlane-Faes at the Michigan State Historic Preservation Office (MSHPO), the first paragraph reveals that MSHPO has “concern pertaining to possible unreported archaeological properties on, or within the vicinity of, the Palisades site.” Yet NMC fails to include any documentation spelling out these concerns from MSHPO in the companies’ Environmental Report, other than the brief mention that concerns exist.

Also in the letter, Malone and Wawro state in conclusory fashion that 20 more years of nuclear activities at the site will not disturb the land, and “Therefore, NMC and Consumers do not believe a survey of the project area is necessary, as Federal and state agencies have confirmed on multiple occasions that no historic properties, archeological or architectural, are

known to exist on, or in the immediate vicinity of the Palisades site.”

However, Petitioners fear that 20 more years of operations at Palisades risks a large-scale radiological accident. Even if no accident were to occur, the daily operations of Palisades nuclear power plant releases “low” levels (and sometimes, not-so-low levels) of radioactivity into the air, water, and soil. It also generates high-level radioactive waste, large quantities of which have already been stored at Palisades for nearly 40 years, and ever-growing quantities of which will continue to be stored on-site for at least several decades to come, even if dumps targeted at Native American lands out West (sacred Western Shoshone Indian treaty land at Yucca Mountain, Nevada; the Skull Valley Goshute Indian Reservation in Utah) are opened. Since the actual opening of such dumps is ever more doubtful, this means that Palisades’ high-level radioactive waste could remain on-site indefinitely into the future. The “routine” or “accidental” radioactive contamination caused by 20 additional years of operations at Palisades would be a significant adverse impact upon Native American burial or other sites located there. Such sites are considered sacred and religiously significant in the cultures of many Native American tribes, so befouling these sites with radioactive or toxic chemical contamination or heavy industrial usage could qualify as a desecration under the terms of the federal Native American Freedom of Religion Act.

Certainly this qualifies as a disproportionate, highly adverse impact on Native Americans, that, for example, European-Americans do not face from 20 more years of operations at Palisades. There most likely are not European-American sacred burial grounds at the Palisades site, nor former village sites (also considered sacred and worthy of great respect by Native cultures) there. But there is certainly the potential, and perhaps the likelihood, that burial sites or former encampment, habitation, or village sites exist on the Palisades property. Lea Foushee, a Native American woman at the North American Water

Office in Minnesota, has explained to Petitioners that beautiful vistas were often chosen as burial sites by Native Americans since time immemorial. Palisades certainly overlooks a beautiful vista to the west, overlooking Lake Michigan. Native American cultures in Michigan also regard the westward direction as the one people travel when they pass away, passing through the "Western Door," making it even more likely that burial sites exist at or near Palisades. Traditional Grand River Band of the Odawa Indians storyteller Larry Plamondon also has told Petitioners that rivers and creeks were often chosen as habitation sites by Native Americans since time immemorial.

The Palisades nuclear power plant is bounded not only by the lakeshore to the west, but by the Brandywine Creek to the immediate south, as well as an even larger creek to the immediate north in Van Buren State Park. The possibility for significant Native American archaeological resources on the Palisades site is very real, and should not be so flippantly dismissed by NMC. It is irresponsible that NMC and Consumers would state so strongly that no "survey of the project area is necessary" when it, and federal and state agencies, appear to have done little if any such surveying in the past.

The only documentation NMC and Consumers give in their Environmental Report to support their claims is a letter dated April 7, 1972 from the U.S. Department of the Interior (DOI) to the U.S. Atomic Energy Commission (the predecessor to today's NRC). In that letter, DOI states "It does not appear that the existing plant should directly affect any existing or proposed unit of the National Park System, nor any site eligible for registration as a national historic, natural or environmental education landmark; however, the final statement should contain evidence of consultation with the State Historic Preservation Officer concerning the effects of the power station on places on or being considered for nomination to the National Register of Historic Places." This statement seems potentially irrelevant to such issues as

Native American burial sites, former village sites, etc. located on the power plant site or along the transmission line corridor. It's interesting that consultation with the Michigan State Historic Preservation Officer is mentioned, because from Petitioner Kevin Kamps' (of NIRS) recent contact with Ms. Martha MacFarlane-Faes at MSHPO by phone on August 30, 2005, it appears that very little consultation had taken place between her office and the companies involved. In fact, she admitted that the "ball may have been dropped" on these important matters. The MSHPO's files on this matter do not put to rest the question as to whether or not Native American archaeological resources at the Palisades site could be in harm's way if a 20 year license extension were granted. It's clear that the companies, Consumers and NMC, as well as the state and federal agencies, have allowed this license extension proceeding to progress to this advanced stage without adequately addressing the potential impacts to Native American sites, rights, and values.

The U.S. federal and State of Michigan agencies also have not adequately consulted with the impacted tribes in a meaningful, government-to-government manner, as is required under treaty, law, and regulation. In its February 2005 letter to the Michigan State Historic Preservation Office, NMC and Consumers also mention that: "A May 19, 1972 letter from the Michigan State Liaison Officer for Historic Protection to the AEC [Atomic Energy Commission] confirmed the DOI's determination and stated that Palisades would not 'adversely affect known historical or archaeological resources of the State of Michigan.' " They go on to state that a "Terrestrial Ecological Survey" conducted 26 years ago by a private contractor paid by Consumers "found no significant historical or archaeological resources were known to occur on the Palisades site" and that these findings were confirmed by the Director of the Michigan Department of State's Michigan History Division, which verified that "no significant historical or archaeological sites had been found in the immediate area of Palisades." We question how

“significant” and “immediate” were and are defined by these profit-driven private companies, and by these state agencies? Are Native American sites such as burials or villages considered significant, especially 25 to 40 years ago, when many of these reports referred to were published? It seems imperative that an updated, comprehensive, independent site survey be conducted before Palisades is granted a license to perform nuclear and other activities on this site for another 20 years.

It appears from the lack of supporting documentation that neither the AEC nor the DOI ever did a careful survey of the Palisades site or adjoining transmission lines. NMC and Consumers seem unconcerned about the potential for unknown Native American burial sites or other cultural resources. Yet, given the presence of creeks just north and just south of the Palisades nuclear power plant site, it seems all the more likely that Native American villages or encampments might have been located there. And given the forested, large dunes surrounding the Palisades nuclear power plant, it seems possible that even burial sites might be located there, especially considering the great beauty of the area, and the remarkable view to the west over Lake Michigan. One definition for “palisade,” after all, is “a line of bold cliffs.” (Webster’s New Collegiate Dictionary) It very well may be that the hundred-year-old Palisades Park summer community with 200 cottages immediately south of the Palisades nuclear power plant took its name from the “cliffs,” or tall forested sand dunes, on the site. Certainly Palisades nuclear plant took its name from the Palisades Park community, much to the chagrin of the residents, many of whom have opposed the nuclear reactor since before it was built in the late 1960s.

NMC and Consumers state in the 2005 letter that adequate protections are in place to safeguard cultural resources on the site. They write “Examples of activities requiring an Environmental Review include disturbance of 1 or more acres of previously undisturbed land,

any earth change within 600 feet of water, wetland and waterway activities, and structural interference with landforms, lakes and streams, among others.” But, given the decades of apparent lack of concern, perhaps it should not be surprising that such “protections” actually contain huge loopholes. For example, a good deal of Palisades nuclear power plant property – including much of the forested dunes – almost certainly is more than 600 feet from Lake Michigan. Thus, even such “protections” could still allow for overlooking or ignoring burial sites during construction projects. The nuclear companies state repeatedly throughout the Environmental Report that “NMC does not plan to undertake any major refurbishment activities,” an admission that itself has dire implications, given the deteriorated state of the reactor and its safety systems. But then again, Consumers never envisioned in the early 1970s that it would need to install dozens of 20 foot tall, 132 ton concrete and steel silos to store high-level radioactive waste just 150 yards from the waters of Lake Michigan. And yet, 20 years later, that is exactly what they did. So who knows, really, what projects the companies will need or want to perform on the site over the course of the next 20 years?

In addition to the ever growing stockpile of high-level radioactive waste stored on-site, in 2008 the so-called “low” level radioactive waste dump where Palisades has sent large quantities of atomic trash for decades will no longer accept such wastes from Palisades. It is very possible that Palisades would thus expand on-site “storage” for “low” level radioactive wastes, as well, some of which is actually intensely radioactive, despite the euphemistic name. Lastly, NMC and Consumers state in the last paragraph of their letter that it, and a copy of the response to it from the Michigan Historic Preservation Office, would be included in the Environmental Report. No such response is included. It is disconcerting, given the dearth of supporting documentation (Consumers Power Company’s 1979 “Terrestrial Ecological Survey – Palisades Plant Site” is referenced in the Environmental Report, but a copy of this survey –

seemingly the only actual site survey ever conducted, or at least mentioned in the Environmental Report or documents provided by MSHPO, is not included).

Brian D. Conway of the State of Michigan Historic Preservation Office wrote a letter on March 14, 2005 to James Holthaus at Palisades Nuclear Power Plant stating "...we have reviewed your comments and concur with the recommendations outlined in your [Feb. 11, 2005] letter...". This begs the question, who dropped the ball? NMC/Consumers, or MSHPO? Or both? It's encouraging that MSHPO has expressed concerns, apparently, in the past. But it's discouraging that NRC-imposed deadlines such as the August 8th deadline for intervening/requesting hearings and the August 22nd deadline for environmental scoping comments have come and gone, with no action regarding the potential for Native American impacts from this proposal being adequately addressed by the companies nor by the federal or state agencies.

Given the sovereignty of these tribes and bands, and the treaty rights that exist between them and the United States federal government, the NRC has a government-to-government responsibility to meaningfully consult with these tribes and bands on such significant federal actions as granting the Palisades reactor an additional 20 years of operations. An independent, comprehensive archaeological survey must be conducted before NRC grants a 20-year license extension to assure that Native American archaeological sites are not negatively impacted by future Palisades reactor operations. Such impacts as harm to lake sturgeon – sacred to some Great Lakes tribes – must also be evaluated. It is interesting and telling that NMC's Environmental Report assigns no "importance" to lake sturgeon (in Table 2.3-1, Page 2-47), despite its State of Michigan "threatened" status, and its sacred status in the cultures and traditions of various Great Lakes Native American Tribes, and its importance to the natural history of Lake Michigan as an ancient indigenous species in the

ecosystem. This is an indication that NMC/Consumers is not acknowledging or addressing environmental justice impacts of 20 more years of operations at Palisades on Native Americans.

Quite recently, a Native American cultural site came to the attention of local tribal officials who did not know about it before. An August 12, 2005 article in the Grand Rapids Press (“Sense of adventure: Historic sites will highlight a new Black River paddling pathway”) had an accompanying map showing a Native American site of historical significance southeast of South Haven on the Black River, just south of 12th Street, east of M-43, and west of 66th Street/County Road 687. This is well within the ten mile zone from the Palisades reactor, perhaps even within seven miles. Dave Lemberg, director of the Great Lakes Center for Maritime Studies at Western Michigan University in Kalamazoo, played an important role in selecting the historic sites that would be featured along the water trail for canoes and kayakers described in the article. He and other historical and archaeological experts – but most importantly tribal officials and traditional elders – must be meaningfully consulted to ensure an independent site survey at and around Palisades to protect Native American cultural resources there.

The NRC Staff, in its challenge to this contention, inexplicably ignores Petitioners’ arguments about the potential for disproportionately high adverse impacts on Native American cultural resources on the Palisades site that have never been identified.

Tom Goldtooth, executive director of Indigenous Environmental Network in Minnesota, and Winona LaDuke, executive director of Honor the Earth, are long-time advisors to NIRS on such matters and can serve as expert witnesses on these Native American environmental justice contentions.

Technical perfection is not an essential element of contention pleading. *Private Fuel*

Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-01-3, 53 NRC 84, 99 (2001). The sounder practice is to decide issues on their merits, not to avoid them on technicalities. *Consumers Power Company* (Palisades Nuclear Plant), LBP-79-20, 10 NRC 108, 116117 (1979).

WITHDRAWN CONTENTIONS

Petitioners hereby give notice of the withdrawal of the following contentions from consideration:

Contention No. 5 (no permanent repository for the nuclear waste which would be generated at Palisades after 2010)

Contention No. 6 (Intensifying sand erosion and avalanche risk around dry cask storage pads)

Contention No. 8²⁸ (Increased embrittlement of re-used fuel rods as buffers to reduce embrittlement of RPV walls)²⁹

Contention No. 9 (Chronic emergency unpreparedness within EPZ)

Contention No. 10 (Economic damage in Palisades region in event of accident or attack on the power plant causing severe radiation release)

Contention No. 11 (Threats of terrorist attack and sabotage against the Palisades nuclear power plant)

Respectfully submitted for the Petitioners,

²⁸This Contention was mislabeled as No. 8 in the original Petition inasmuch as there was a separate Contention also numbered 6, but for consistency of reference is defined in this section as being No. 8.

²⁹This Contention is being withdrawn in the belief that the gravamen of it can be addressed within Contention No. 1 raised by the Petitioners, "The license renewal application is untimely and incomplete for failure to address the continuing crisis of embrittlement."

/s/ Terry J. Lodge

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)		
)		
NUCLEAR MANAGEMENT	)	Docket No.	50-255-LR
COMPANY, LLC)		
)		
(Palisades Nuclear Plant)	)	ASLBP No.	05-842-03-LR

CERTIFICATE OF SERVICE

I hereby certify that copies of the "PETITIONERS' COMBINED REPLY TO NRC STAFF AND NUCLEAR MANAGEMENT COMPANY ANSWERS" in the above-captioned proceeding have been served on the following through deposit in the NRC's internal mail system, with copies by electronic mail, as indicated by an asterisk, by U.S. mail, first class, as indicated by double asterisk, with copies by electronic mail, or by U.S. mail, first class, as indicated by triple asterisk, and that paper copies only of "PETITIONERS' APPENDIX OF EVIDENCE IN SUPPORT OF CONTENTIONS" were delivered all parties at the following mailing addresses; all on this 16th day of September, 2005:

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Citizens Action Coalition of Indiana * Citizens for Alternatives to Chemical Contamination * Citizens For Renewable Energy * Coalition for a Nuclear-Free Great Lakes * Don't Waste Michigan * Great Lakes United * The Green Party of Michigan * Kalamazoo Nonviolent Opponents of War * Lone Tree Council * Michigan Citizens for Water Conservation * Michigan Environmental Council * Michigan Land Trustees * National Environmental Trust * Nuclear Energy Information Service * Nuclear-Free Great Lakes Campaign * Nuclear Information and Resource Service * Nukewatch * PIRGIM * Radiological Evaluation & Action Project, Great Lakes (REAP-GL) * Sierra Club, Mackinac Chapter * Van Buren County Greens * WAND Michigan: Women's Action for New Directions * West Michigan Environmental Action Council

March 20, 2006

The Honorable Carl Levin
U.S. Senate
Washington, D.C. 20510

Dear Senator Levin,

We are writing you because of our serious concerns about issues of nuclear safety in Michigan.

The owner (Jackson, Michigan-based Consumers Energy Company, a subsidiary of CMS) and operator (Hudson, Wisconsin-based Nuclear Management Company, LLC) of the long-troubled Palisades nuclear power plant in Covert (just seven miles south of South Haven, on the Lake Michigan shoreline in southwestern Michigan) have applied to the U.S. Nuclear Regulatory Commission (NRC) for a 20 year extension to its original 40 year license.

But concerned citizens fear that extending the 35-year-old Palisades nuclear power plant's operational license from 2011 till 2031 risks a catastrophic accident. Palisades, as affirmed by the NRC [U.S. Nuclear Regulatory Commission, "Generalization of Plant-Specific Pressurized Thermal Shock (PTS) Risk Results to Additional Plants," Date Submitted: October 26, 2004; Revised: December 14, 2004, Table 1, "Plants with highest RTNDT," page 5.], has one of the most embrittled reactor vessels in the United States. In fact, Nuclear Management Company itself has recently admitted that Palisades will violate embrittlement standards by 2014, just three short years into its proposed license extension [Mr. Lewis, attorney for Nuclear Management Company, Nov. 3, 2005 ASLB 20 year license extension proceedings pre-hearing, South Haven, MI, transcript page 114.]. Consumers Energy has previously pledged to take action, such as annealing (superheating to restore the metal's ductility) the reactor pressure vessel by 1999, to address the embrittlement [documented by NRC in "Reactor Pressure Vessel Embrittlement and Annealing" published prior to May, 2000, and Kalamazoo Gazette newspaper coverage]. But apparent NRC regulatory rollbacks have allowed Palisades to keep operating while ignoring embrittlement dangers, which worsen with time.

Embrittlement is caused by neutron radiation from the nuclear chain reaction in the reactor core seriously impacting the reactor pressure vessel's metallic ductility. The safety significance of embrittlement is the vessel's increased susceptibility of "pressurized thermal shock" (PTS). PTS occurs when a vessel is severely overcooled, followed by sudden re-pressurization. As the vessel is overcooled, there is a corresponding rapid drop in the pressure of the primary coolant loop. This causes the reactor's

high pressure injection pumps in the emergency core cooling system to automatically inject coolant into the primary loop. As this injection of coolant re-pressurizes the vessel, it is subjected to significant pressure stresses. The stresses placed on the reactor pressure vessel by overcooling and re-pressurization cause pressurized thermal shock, PTS. [Steve Sholly, "Pressurized Thermal Shock Screening Criteria," Nuclear Information and Resource Service, Jan. 1984.]

Thus, emergency cooling water pumped into the Palisades reactor pressure vessel would cause pressurized thermal shock, which could rupture the brittle vessel like a hot glass under cold water. The vessel, the primary containment for the deadly radioactivity within, could crack. A loss of coolant accident would ensue. The superheated nuclear fuel could melt down, burning its way through the plant's floor and foundations until it hit the underlying water table, releasing catastrophic amounts of radioactivity into the air and Lake Michigan.

The most recent analysis – "Consequences of Reactor Accident Consequences" or CRAC-2, published in 1982 by NRC and Sandia National Lab – on the effects of a large scale melt down at Palisades shows that 1,000 peak early fatalities, 7,000 peak early injuries, 10,000 peak cancer deaths, and \$52.6 billion in property damage (in 1982 dollars; if adjusted for inflation to 2005 dollars, this would be over \$100 billion) would result. This may be a significant underestimate of deaths, injuries, and property damage, given population growth and economic development over the intervening 24 years since the analysis was performed.

Given this severe risk to the safety, health, and environment of Michigan and its residents, as well as to Lake Michigan (source of drinking water, and so much more, to tens of millions downstream throughout the Great Lakes in the U.S. and Canada), a growing coalition opposes the 20 year license extension at Palisades.

Last August, a group of over 50 local concerned citizens and five groups (Don't Waste Michigan, Green Party of Van Buren County, Michigan Land Trustees, Nuclear Information and Resource Service, and West Michigan Environmental Action Council) residing within the 50 mile emergency planning zone around Palisades officially intervened before the NRC Atomic Safety and Licensing Board (ASLB) against the 20 year license extension, citing embrittlement and PTS of the reactor pressure vessel as the primary safety contention.

Since then, nearly 20 additional environmental and public interest organizations and coalitions from Michigan, four other states, and two Canadian provinces have joined the effort against the Palisades license extension. They are: Alliance for the Great Lakes (formerly Lake Michigan Federation), Citizens Action Coalition of Indiana, Citizens for Alternatives to Chemical Contamination, Citizens for Renewable Energy in Ontario, Clean Water Action, Coalition for a Nuclear-Free Great Lakes, Great Lakes United (a bi-national coalition of over 150 grassroots groups in the U.S. and Canada, headquartered in Buffalo, New York and Montreal, Quebec), Green Party of Michigan, Kalamazoo River Protection Association, League of Women Voters of the Holland Area, Michigan Citizens for Water Conservation, Michigan Environmental Council (MEC), Nuclear Energy Information Service of Illinois, Nuclear-Free Great Lakes Campaign, Nukewatch of Wisconsin, Public Interest Research Group in Michigan (PIRGIM), Radiological Evaluation & Action Project of the Great Lakes, Sierra Club's Michigan Chapter, and WAND Michigan (Women's Action for New Directions). Altogether, the organizations comprising this coalition represent well over 200,000 Michigan residents, as well as many thousands more people throughout the Great Lakes Basin.

On Nov. 3 and 4, 2005 the NRC's ASLB convened a pre-hearing in South Haven regarding the admissibility of the contentions filed by the intervening citizens and organizations. The vast majority of

time was devoted to discussing the embrittlement and PTS contention. Not only Nuclear Management Company attorneys (on behalf of Consumers Energy), but also the NRC staff itself, argued against admission of the embrittlement and PTS contention. This was most troubling, given that NRC's supposed mandate is to protect public health and safety and the environment.

It is especially troubling when combined with the history of NRC action – or lack thereof – on national embrittlement standards over the past several decades. Our best efforts to track NRC's actions indicate that embrittlement standards have apparently been weakened several times since the 1980s. There needs to be an objective audit, such as by the U.S. Government Accountability Office (GAO), to determine if and how those standards have been relaxed, and whether those changes were justified or not. We are most concerned with how those relaxed standards have potentially lowered safety margins at Palisades, but embrittlement is a national problem afflicting dozens of reactors across the country. An essential question to address is, have embrittlement safety standards been weakened in order to allow reactors such as Palisades to continue operating? If regulatory rollbacks placing profits over safety have occurred, what actions must NRC and/or Congress take to protect the public? After all, Palisades was first identified by NRC as violating embrittlement and PTS standards in 1981, just ten years into its operations. [“Not Man Apart,” Nov. 1981, Friends of the Earth; “Pressurized Thermal Shock Potential at Palisades,” Michael J. Keegan, Coalition for a Nuclear-Free Great Lakes, July 8, 1993, attached.]

We should hasten to mention that, due to lack of resources, we focused on the single most significant safety issue at Palisades – embrittlement and PTS of the reactor pressure vessel. However, we raised numerous other contentions, such as regulatory violations involving the dry cask storage pads for high-level radioactive waste on the Lake Michigan shoreline. But the focus of our intervention, and of this letter, is on embrittlement and PTS of the reactor pressure vessel.

Embrittlement and PTS had been identified as a significant national nuclear safety issue more than 25 years ago, such as by NRC reactor safety engineer Demetrios Basdekas. Basdekas's courage to speak out on the dangers of embrittlement and PTS in the face of nuclear industry and even NRC harassment led to his being awarded the Institute of Electrical and Electronics Engineers' Society on the Social Implications of Technology Carl Barus Award in 1991, “[i]n recognition of his long-standing efforts to improve the regulatory process in the nuclear power field.” Basdekas advised the Palisades intervenors on the writing of their embrittlement and PTS contention, and they have depended heavily upon the documentation of his work on the issue at NRC over the previous decades.

The intervenors' contentions were submitted to NRC's ASLB on August 8, 2005. On August 22, 2005 Basdekas informed the intervenors he could no longer serve as their expert witness, for personal reasons. Intervenors have since communicated with Dr. Joe Hopfenfeld, another retired NRC safety engineer, who has indicated interest in serving as an expert witness on the embrittlement and PTS contention. A very troubling aspect of the ASLB proceedings is an apparent attempt by the NRC staff attorney to threaten any former NRC employees serving as expert witnesses for the intervenors with a \$50,000 fine and two years imprisonment. After legal consultation we have concluded that such threats are without legal merit, and fortunately Dr. Hopfenfeld (and Dr. Ross Landsman, another former NRC dry cask inspector) have courageously agreed to continue serving as our experts. The attempted intimidation did chill the proceeding, however, including causing Mr. Basdekas considerable anxiety. Our question is, why would the NRC, whose mandate it is to protect public health and safety, attempt to intimidate the expert witnesses of citizen intervenors attempting to raise significant safety concerns?

Numerous rounds of filings have occurred between the intervenors, defending the embrittlement and PTS contention, and the companies and NRC staff, attacking the contention as inadmissible. Almost all of the attacks against the contention involve legalistic technicalities and procedural objections,

disregarding the merits of the safety concerns about embrittlement and PTS. In addition, the disparity of resources (between the intervenors' non-profit and largely volunteer legal effort, versus the substantial resources of the companies and agency involved), the NRC's very strict intervention proceeding rules, and the intimidation intervenors' potential expert witnesses have faced, have put the intervenors at a significant disadvantage.

Unfortunately, on March 7 the NRC licensing board ruled against all of the intervenors' contentions, including embrittlement. They denied granting intervenors a hearing on the merits of their safety concerns, ruling against them based upon legalistic and bureaucratic technicalities under the NRC's overly strict and Byzantine licensing proceeding rules. But this comes as little surprise, given NRC's clearly established pattern of denying intervenors' contentions and approving 20 year license extensions: NRC has approved 37 reactor license extensions since 1998, having ruled against almost all intervenors' contentions, including contentions involving reactor pressure vessel embrittlement and PTS. NRC now seems poised to rubberstamp the Palisades license extension as well. The ASLB's rejection of our contentions reflects an overriding pattern at NRC – the downplaying and outright neglect of significant safety issues such as security, waste, age-related deterioration, and other issues in the rush to rubberstamp 20 year license extensions.

NRC's rubberstamp on the Palisades 20 year license extension will now likely eventually follow as a mere formality, leaving the significant safety issues surrounding embrittlement and PTS of the reactor pressure vessel unaddressed. The intervenors will appeal this adverse ASLB ruling on the embrittlement contention to the five member NRC Commission itself, in order to preserve the record of the intervention and exhaust all administrative remedies. But history is again clear: no intervention appeals to the NRC Commission have ever succeeded against a 20 year license extension. Although very unlikely, if the NRC Commissioners do overrule the ASLB decision and admit the embrittlement contention, the intervenors fully intend to prove during the adjudicatory hearing that embrittlement and PTS risks are too high for NRC to grant Palisades a 20 year license extension.

Seeing the writing on the wall -- that our administrative remedies are being exhausted and our appeal will almost certainly fail at the NRC -- we are writing to ask you to request a GAO investigation into the significant nuclear safety issue of reactor pressure vessel embrittlement and PTS. Michigan residents downwind and downstream from Palisades are not the only Americans put at risk by this. NRC has identified the 30 most embrittled pressurized water reactor vessels in the U.S. (see attached)

According to this NRC listing, the most embrittled reactor vessel in the country is at Salem Unit 1 in New Jersey, very close to the border with Pennsylvania. (Salem Unit 2 is also listed, as the 23rd most embrittled.)

Beaver Valley (2nd most embrittled in U.S.) and Three Mile Island Unit 1 (3rd most embrittled) are both in Pennsylvania. Despite this, they have sent NRC letters of intent to apply for 20 year license extensions. The Indian Point 2 nuclear power plant in New York State has also indicated its intention to re-license, despite being identified as having the 13th most embrittled reactor vessel in the U.S.

In fact, NRC has already granted 20 year license extensions to several reactors also identified as among the 30 most embrittled. These include both Calvert Cliffs units in Maryland, Ginna in New York State, Point Beach Unit 1 in Wisconsin (also on the Lake Michigan shoreline, upwind of northern Michigan), and – of additional concern for Michigan -- both Cook units in southwest Michigan.

Other pressurized water reactors on this NRC watch list, such as Diablo Canyon Units 1 and 2 in California, have not yet indicated their intention to apply for license extensions. But they very likely will

do so, especially if NRC's license extension approvals continue to essentially be pro forma, de facto rubberstamps, despite such significant safety concerns as embrittlement.

Given the potentially catastrophic risks associated with the worsening problem of reactor pressure vessel embrittlement and PTS at pressurized water reactors across the U.S., we urge you, Senator Levin, to join with Senator Stabenow and your Senate colleagues from other impacted states to request a GAO investigation into the apparent weakening and non-enforcement of NRC safety standards regarding reactor pressure vessel embrittlement and PTS at Palisades and other reactors.

We stand ready to assist in whatever way we can, as by providing copies of NRC and other documents showing the worsening embrittlement and PTS potential at Palisades and other reactors across the U.S. Some of the intervenors' legal team members, representing Don't Waste Michigan, Coalition for a Nuclear-Free Great Lakes, and Nuclear Information and Resource Service, have watch dogged the embrittlement and PTS issue for many years, and even decades, at Palisades and nationally, and would be willing to meet with your staff and be interviewed by GAO investigators.

Thank you for your previous leadership on opposing dangerous nuclear proposals, such as: your 2004 vote against allowing the U.S. Department of Energy (DOE) to abandon high-level radioactive waste sludge in underground tanks at such sites as West Valley, New York, which would endanger Lake Erie with severe radioactive contamination; and your 2003 vote against \$7.5 billion in direct federal taxpayer subsidies for the construction of the first new nuclear reactors in the U.S. in 30 years.

Our largely volunteer efforts, as with other grassroots actions around the country, have fallen on deaf ears at NRC, whose ever more strict intervention rules benefit the nuclear power industry at the expense of the public's health, safety and environment. So widespread and significant a problem as reactor pressure vessel embrittlement and PTS should not be left to the vagaries of grassroots interventions in NRC license extension proceedings, where concerned citizens are most often stopped at the threshold, without ever being granted hearings on the merits of this complex yet potentially disastrous generic safety problem. We need Congress to investigate this issue to make certain that NRC's mandate to protect public health and safety and the environment is being fulfilled in the face of embrittled reactor pressure vessels susceptible to catastrophic failure due to PTS.

We respectfully urge you to request GAO to investigate NRC's inaction in the face of the embrittlement and PTS crisis, in order to shed light on this risk to Michigan residents downwind and downstream of Palisades, and other Americans living in the shadow of nuclear power plants with embrittled reactor pressure vessels.

For more information, please contact Kevin Kamps at Nuclear Information and Resource Service in Washington, D.C. (and a board member of Don't Waste Michigan) at 301.270.6477.

Sincerely,

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Clare Mead Rosen
WAND Michigan: Women's Action for New Directions
Southfield, Michigan

Thomas J. Leonard
West Michigan Environmental Action Council
Grand Rapids, MI

Is Palisades Safe?

The field of Evaluation uses “claims and evidence” to support conclusions as to whether or not something is working or worthwhile. I’d like to apply those principles to the question of whether or not Palisades is safe. Entergy and the NRC claim that it is.

But let’s look at the evidence.

There are five permanent indicators. They are conditions that cannot be changed.

1. Entergy is in the business of making money not in community well-being. Entergy’s primary responsibility is to its shareholders not to the community.
2. Palisades is very old and getting older every day. It has already passed its life span. One cannot turn back the calendar when it comes to aging.
3. The Palisades reactor is the most embrittled in the country. That cannot be changed except by annealment. But that’s not logical. I ask: what foundry would be willing to accept such a large piece of radioactive equipment and heat it up to 1400 degrees? In fact then, the present vessel is left to become more embrittled every day.
4. Thousands of spent fuel rods are being stored on site and the number continually grows. There is no national repository for long-term storage so the current policy is to have plants store waste on site. There is no change on the horizon.
5. NRC personnel are on site, but they cannot do anything about the age of the plant or spent fuel rods or even dictate what Entergy should do. They can only deal with day-to-day dashboard readings and file reports. Further, the NRC is bound by administrative code. It can only go so far.

There are three temporary indicators. They are conditions that can be changed.

1. Employee morale is low. That can be mitigated if management changes its approach to employee culture. But so far that has not happened. A cultural change at Entergy would have to start with management style at the top. But Entergy executives don’t appear interested. Aren’t they the ones selling off their Entergy stock?
2. Tritium leaks into Lake Michigan could be halted. We’ve heard time and time again from Palisades and NRC personnel that the water in Lake Michigan dilutes tritium to safe levels. But wait a minute! Dilution is a PR term. In reality, the actual word should be “concentration”. With each leak, Lake Michigan is actually increasing its concentration of tritium.
3. Equipment failures are often reported in the press. They can be fixed. However spending money on maintenance decreases Entergy’s profits.

Is Palisades safe? The evidence is clear. Palisades is **not** safe and is a disaster waiting to happen.
Palisades must be shut down.

Barbara Pellegrini
4022 Evergreen Lane (within the 10 mile evacuation radius)
Benton Harbor Michigan 49022

Halting 20 Extended Years of Risky, Reactor Operations and Radioactive Waste Generation and Storage On Lake Michigan at Palisades Nuclear Power Plant

Comments on NUREG-1437, Supplement 27 to the Generic Environmental Impact Statement for License Renewal of the Palisades Nuclear Power Plant

Submitted to:

Chief, Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, DC 20555-0001

From:

Citizens Action Coalition of Indiana; Canadian Coalition for Nuclear Responsibility/Regroupement pour la surveillance du nucléaire; Citizens for Alternatives to Chemical Contamination; Citizens Resistance at Fermi Two (CRAFT); Citizens for Renewable Energy; Huron Environmental Activist League; Clean Water Action; Home for Peace and Justice; Great Lakes United; IHM Justice, Peace and Sustainability Office; Indigenous Environmental Network (IEN); International Institute of Concern for Public Health; Lone Tree Council; Kalamazoo River Protection Association; Michigan Citizens for Water Conservation; Michigan Land Trustees; Michigan Environmental Council; Michigan Interfaith Climate and Energy Campaign/Voices for Earth Justice; National Environmental Trust; Nuclear Energy Information Service (NEIS); Nuclear-Free Great Lakes Campaign; Nuclear Policy Research Institute; Nukewatch; Radiological Evaluation & Action Project, Great Lakes; Sierra Club, Mackinac (Michigan) Chapter; Van Buren County Greens, West Michigan Environmental Action Council.

Individuals endorsing these comments are listed at the end of this submission.

Please direct questions to the following organizations responsible for research and content development:

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May 18, 2006

I. Introduction

A 20-year license extension is proposed for Palisades Nuclear Power Plant

Consumers Energy, owner, and Nuclear Management Company (NMC), LLC, operator, of the Palisades Nuclear Power Plant situated on Lake Michigan in Covert Township, Michigan, have applied to extend Palisades' operating license 20 years beyond its original 40-year operation tenure, which began in 1971. The Nuclear Regulatory Commission (NRC), a federal agency responsible for regulating nuclear power plants, is required by the National Environmental Protection Act (NEPA) to seek input from members of the public and interested groups, regarding the environmental impacts of this action, as well as alternatives to the proposed action.

Don't Waste Michigan, the Coalition for a Nuclear Free-Great Lakes, and the Nuclear Information and Resource Service have researched, coordinated and taken a lead in the development of these comments on the proposed action. In addition to providing important background information on the plant and its impact on the region, the groups also present their assessment of the NRC's draft environmental impact statement (EIS), comments on the re-licensing process and stakeholder participation, and recommendations for improving security at the plant, as well as comments aimed at prevention of the continued risky operation of the plant, and the establishment of a permanent site for storage of high-level radioactive waste on the Great Lakes shoreline.

Description of groups submitting comments

Don't Waste Michigan is a federation of environmental organizations with a 25-member board and membership of 1,000 founded in 1987 to oppose the designation of the state of Michigan as a repository for what was misleadingly termed "low-level" radioactive waste from eight states. Don't Waste Michigan's work was ultimately successful and the state of Michigan was eliminated from consideration as a repository for the wastes. Don't Waste Michigan, with the Lake Michigan Federation (now the Alliance for the Great Lakes) and support from numerous local grassroots organizations, along with Michigan Attorney General Frank Kelly, brought suit in federal court in 1993 to prevent the loading of high-level nuclear waste in casks on the shore of Lake Michigan at the Palisades plant. The suit was unsuccessful and the issue was further pursued by Don't Waste Michigan and Lake Michigan Federation in a letter [Docket #: 05000255,07200007] sent to NRC Commissioner Dr. Shirley Jackson. A hard copy of this letter will be provided to the NRC by Don't Waste Michigan to be included as comments for this draft EIS.

The Coalition for a Nuclear-Free Great Lakes, founded 1986 in the wake of Chernobyl, is an association of groups and individuals from eight states and three Canadian provinces advocating for a nuclear-free Great Lakes. The group's inaugural conference drew representation from 35 reactor communities throughout the Great Lakes basin. The Coalition exchanges expertise and information across the basin regarding nuclear power while advocating for safe alternative energy sources and has held a series of ten basin-wide educational and conferences. The Coalition and its member groups

succeeded in encouraging the International Joint Commission to acknowledge radio-nuclides as persistent toxic substances, as well as undertaking major studies on the effects of radio-nuclides in the Great Lakes Basin. The coalition is based in Monroe, Michigan.

The Nuclear Information and Resource Service (NIRS), founded in 1978 and based in Washington, DC, is an international information and networking center for citizens and environmental organizations concerned about nuclear power, radioactive waste, radiation, and sustainable energy issues. NIRS and the World Information Service on Energy (WISE) joined forces in 2000, to create a worldwide network of information and resource centers for citizens and environmental organizations concerned about nuclear power, radioactive waste, radiation, and sustainable energy.

History of involvement by submitting groups in the Palisades nuclear power plant

Don't Waste Michigan, the Coalition for a Nuclear-Free Great Lakes, and the Nuclear Information and Resource Service, have a history of monitoring the operations of Palisades, as well as consistently participating in public meetings, providing comments, and instituting legal interventions as needed. The groups have been active participants to date in the meetings, licensing proceedings, and comment processes provided by the NRC as part of the review of the application by Palisades to extend its license.

Both Don't Waste Michigan, and NIRS (representing 50 of its members within 50 miles of Palisades) filed as official interveners against the 20-year license extension, and petitioned the Atomic Safety and Licensing Board (ASLB), the NRC's administrative law licensing board, to hold hearings on the 20-year licensing extension, raising numerous safety and environmental concerns. The ASLB ruled against granting a hearing on March 7, 2006 upon which the groups appealed the decision to the NRC Commissioners. This EIS process is separate and distinct from the ASLB/Commission appeal.

NRC's comment framework unnecessarily restricts public involvement

The NRC has established a framework for this application process that unfairly and arbitrarily eliminates a huge array of issues from consideration, discussion and comment by individuals, organizations, and Native American tribes that provides an effective obstacle to meaningful public participation. Because of this, some of these comments will fall "outside" of the scope of this process. Regardless, these comments are provided on issues that we believe are germane, and we vigorously object to the arbitrary and overly strict limitations on the scope of public input.

II. Adverse Consequences of Approval of Palisades' License Extension Request

There is much at stake with the prospect of 20 additional years of nuclear power and radioactive waste generation and the associated risks and serious consequences associated with the Palisades plant, which is already unfortunately sited right in the

heart of an exceedingly environmentally valuable and sensitive dune and shoreland on Lake Michigan. Part of the Great Lakes basin, Lake Michigan is an essential facet of a system that is invaluable from a planetary perspective, not only for its contribution to the water supply on the globe - approximately 20% of the world's fresh surface water - but also for its rich and abundant fish and wildlife and the ecosystem services it provides to people, as well as supporting a primary economic engine for the nation. There is no price that can be placed on the value of Lake Michigan, but we do know this with absolute certainty:

Lake Michigan provides essential water resources for 10 million people, supports necessities crucial to the overall health of the region, such as fresh, healthy food from its abundant agricultural base, and provides a significant contribution to the recreation and tourism economies of the four states that border its lakeshore. It is the essential core of the region's natural resource base and provides a value to its human inhabitants that cannot be quantified.

Because pollutants tend to remain in the Great Lakes and cycle through the atmosphere, sediment, water, and biological food chain, contamination of Lake Michigan is a concern for the entire Great Lakes basin, home to one-tenth of the population of the United States and one-quarter of the population of Canada.

Lake Michigan is currently in a critical stage of initial recovery, after suffering decades of impacts from toxic substances, as well as habitat degradation. This initial recovery, unfortunately, has already slowed from the impacts of the more recent intrusion of invasive species. Much has been done and millions of dollars spent to restore and protect the values provided by Lake Michigan, as well as the entire Great Lakes. A recent proposal by a government led coalition has recommended that \$20 billion in funds be appropriated to fully restore and protect the Great Lakes.

Given what is at stake with consideration of extending an operating license for Palisades, a nuclear power plant and waste storage facility unwisely situated within the heart of Great Lakes, it is imperative to examine the pertinent issues exhaustively as well as encourage the full and meaningful participation of the large constituency of citizens and stakeholders who will be affected by the license decision.

The aforementioned coalition of organizations and individuals listed at the end of these comments oppose the 20-year extension of a license for the Palisades nuclear power plant for the following reasons, elaborated more extensively further in this document:

1. There is strong evidence that suggest security measures at Palisades are not adequate. Recent reports, including one in March of 2006 by the Government Accountability Office, call into question the ability and motivation of the NRC and nuclear power industry to take the necessary steps to ensure that the nation's nuclear power plants have instituted the most stringent security measures to protect against terrorist attacks.

2. Palisades' license extension will increase the amount of high-level waste on the Lake Michigan shoreline and the number of dangerous barge shipments of high-level

radioactive waste on Lake Michigan. Palisades will generate approximately 290 more tons of high-level radioactive wastes in 20 additional years with no national repository likely to be established to receive the wastes. The U.S. Department of Energy's plan for transporting high-level radioactive wastes generated by the plant's operation, involves barging up to 125 or more giant rail-sized containers of the wastes from Palisades to the Port of Muskegon, up along the Lake Michigan shoreline. The slightest leakage of even a small amount of this waste could not only threaten Lake Michigan as a source of drinking water for ten million people, but also cause a host of other irrevocable impacts on the lake's fish, wildlife, people, and economy.

3. Palisades' high-level radioactive waste storage facility is defective and risky, situated on the Lake Michigan shoreline. There are numerous incidents dating from the installation of the waste storage facility to the present that demonstrate the risks associated with the dry cask storage containers, as well as their problematic placement on a high risk erosion stretch of the shoreline, on pads not adequately designed to be stable during events such as earthquakes.

4. The Palisades plant harms the environment and the health of its workers and surrounding residents from its discharges of radioactive and toxic substances to Lake Michigan, the air, and land. Routine radioactive discharges by nuclear power plants are incorrectly deemed legal and judged to be "safe" by the NRC and the nuclear power industry, contrary to a recent National Academy of Sciences report that confirms that there is no safe level of exposure to radiation. Further, other toxic chemical discharges to Lake Michigan, such as Betz Clam-Trol, discharged via a National Pollutant Discharge Elimination System (NPDES) permit, require stricter controls and enforcement of violations, as part of any license extension application.

5. Aging and extended operation increase the risk of accidents at Palisades. The longer Palisades operates, the more embrittled its reactor pressure vessel becomes, increasing the risk for Pressurized Thermal Shock, a condition caused by any number of system malfunctions which can result in a severe, sudden overcooling of the reactor pressure vessel. This can lead to a loss-of-coolant accident, meltdown, and catastrophic release of radiation to the entire Great Lakes basin.

6. The analysis of alternatives to extending the license for Palisades was flawed and biased. Renewable energy sources such as wind power and solar power, as well as alternatives such as energy efficiency and conservation, are not given credible consideration in the EIS. NMC/Consumers and the NRC reveal a bias in favor of fossil fuel and nuclear power by presenting only those two sources favorably and by downplaying the potential for energy efficiency, energy conservation, and renewable sources of electricity.

7. The draft EIS prepared by the NRC unaccountably discounts the effects of global warming. There is considerable evidence that more extreme winds, as well more frequent and intense tornadoes – all of which global warming could cause – could

make operation of Palisades more and more risky over time.

8. Financial benefits to Covert Township, host to Palisades nuclear power plant, are not evident and not expected with a license extension. The township consistently rates substantially below comparable county, state and national economic indicators in median household and per capita incomes and the draft EIS notes no improvements are expected by the license extension.

9. A 20-year extension for Palisades will be costly. Ratepayers and (by default) taxpayers are to pay for maintenance of the waste generated by the utilities. The fifty year old Price-Anderson Act requires taxpayers to pay for any major accident or terrorist incident at nuclear power plants over a cap of merely \$11 billion paid for by the nuclear utilities and their insurance companies for accidents or terrorist incidents at the plant, a liability that could run into many hundreds of billions of dollars. This liability protection is a unique subsidy provided to the nuclear power industry, at taxpayer expense.

10. A license extension at Palisades increases the fragile status of numerous already threatened, endangered, or candidate species, from daily "routine" radiation releases and/or potential large-scale radiation releases. Species exposed to cumulative exposures from the radioactive discharges of a nuclear power plant may over time develop subtle genetic alterations that are not observable in the short term, but that could have large, subtle impacts within a population, not immediately apparent. This has significant implications for the threatened and endangered species of southwest Michigan.

III. Background

Palisades nuclear power plant, a one-unit pressurized water reactor with 798 megawatt-electric capacity, began operation in 1971. It is owned by Consumers Energy and operated by Nuclear Management Company (NMC). NMC operates six nuclear power plants in Wisconsin, Minnesota, Iowa, and Michigan. Consumers Power is a member/investor in NMC and retains ownership of the Palisades plant.

The operating license for the Palisades nuclear power plant, located 5 miles south of South Haven on Lake Michigan, will expire in March 2011. NMC has applied for an extension to operate the plant for an additional 20 years, until March 2031. Nuclear power plants were originally licensed to operate for 40 years, as allowed by the Atomic Energy Act of 1954. There has been a nationwide movement by government regulators and the nuclear power industry to extend the licenses well beyond that time period, even though the reactors are beginning to show signs of aging, raising considerable concerns about safety. To date, 39 of the nation's 103 nuclear reactors have received 20-year extensions, while 12 others are in the process, including Palisades. The Nuclear Regulatory Commission has approved all applications to date.

The Nuclear Regulatory Commission (headed by a 5-member commission, appointed by the President and confirmed by the Senate) was established in 1974 to license and regulate nuclear power plants with a mission of protecting public health and safety and the environment, as well as protecting the common defense and security. Unfortunately, the NRC's implicit mission has been more one of protecting the nuclear power industry's interests rather than the interests of the public. This may be due in part to its budget: by law, the NRC is required to collect fees from nuclear power plant applicants and holders of licenses for the majority of its budget. \$628 million of the NRC's \$777 million budget for fiscal year 2007 is provided by the nuclear power industry.

The drive for re-licensing of the nation's nuclear power plants started as early as 1982, with research on aging of nuclear reactors, and began in earnest in 1991 when the NRC published safety requirements for renewal. Currently, re-licensing plans are moving more rapidly as proponents attempt to take advantage of the nation's current energy crisis. Extended and new nuclear power generation is now being promoted as a "clean" alternative to the use of fossil fuels, which are now universally acknowledged as contributing to global warming. Many utilities that own nuclear power plants, however, including Consumers Energy, also own coal-burning plants. Consumers Power, in particular, generates a sizable share of its electricity from the burning of fossil fuels.

The NRC and power companies thus advocate for a dangerous source of electricity, nuclear power, calling it "clean" and "green" by appearing to discourage another harmful electricity source, one, however, that they plan to continue utilizing to the fullest extent possible. Nuclear reactors, including Palisades, are not "clean." They emit harmful radioactivity into the environment on a daily basis and generate long-lasting radioactive wastes. Further, nuclear power is not "carbon free," as it relies heavily on the use of fossil fuels in the mining, milling, processing, transportation, management, and storage of its fuel and waste products.

IV. Inadequate Security at Palisades is an Unacceptable Risk

The NRC has placed this issue outside the scope of the EIS for extending the license for Palisades. We strongly disagree and assert that the decision to allow Palisades to operate an additional 20 years in a much higher risk condition mandates extensive involvement by the public.

Maintaining the security of the Palisades plant is a high priority concern since the events of September 11, 2001. That threat is real and imminent, as nuclear power plants were considered to be potential targets by the terrorists who carried out 9/11, according to the report of the 9/11 Commission. The Commission report notes that several of the terrorists had given indications that a nuclear power plant near New York City was a considered target for an airplane attack, due to the large population that would be affected by a release of radioactivity. That did not happen, reportedly, because the

terrorists appeared to have concluded that it would have been difficult to control the effects of a release of radioactivity. But, the fact that it was considered means that each and every nuclear power plant in the U.S., including Palisades, should be regarded as a potential target for terrorism and security measures must be the most stringent available to address this threat. In fact, reactors such as Palisades are likely more at risk of terrorist attack than certain other reactors, as it is situated on the shoreline of Lake Michigan, the source of drinking water for the region.

Both the NRC and nuclear power companies assert that the events of 9/11 stimulated additional security at plants. However, numerous reports following 9/11 suggest otherwise, including a 2002 report by the Project on Government Oversight (POGO) referencing the plight of overworked and fatigued security guards at the plants during the year following 9/11, and numerous high-profile media accounts of risky gaps in security.

An October 3, 2002 Kalamazoo Gazette article, "Palisades incident leads to reassessment," describes a security response lapse due to Palisades' failure to follow proper procedures, leading to a communications breakdown. When three cars approached Palisades on the eve of the first anniversary of the 9/11/01 attacks, Palisades mistakenly phoned the local police rather than the county 911 system, leading to a 45 minute delay before state police arrived on the scene. By that time, the suspicious cars were long gone.

An October 20, 2002 New York Times article, "Guards at Nuclear Plants Say They Feel Swamped by a Deluge of Overtime," described an emotional breakdown by an armed security guard at Palisades with "unescorted access" to vital areas of the plant after she had been forced to work 72 hour work weeks for months on end. If guards complained about their fatigue, they faced the loss of their job, or forced psychiatric evaluations. Apparently, as reported by POGO, some nuclear utilities chose to nearly double current guards' duty time in order to avoid the added costs of training and providing benefits for newly hired guards.

In March of 2006, an independent nonpartisan investigatory federal agency, the Government Accountability Office (GAO), issued a report that demonstrates that there is much yet to be done to protect the nation from terrorist threats to nuclear power plants. The report, Efforts Made to Upgrade Security, but the Nuclear Regulatory Commission's Design Basis Threat Process Should be Improved (GAO-06-388), assessed the NRC's current efforts and found evidence that suggested the nuclear industry attempted to avoid strengthening security to avoid costs. It also noted slow progress in conducting mock attacks or force-on-force exercises to test safety at plants, as well as egregious examples of security lapses in the small number of mock attacks that NRC has carried out to date.

NRC'S process for determining risk to nuclear power plants was flawed and undercut by the nuclear power industry

The recent GAO report was done to review the process that the NRC used to revise the Design Basis Threat (DBT) that was in place for nuclear power plants prior to 9/11. The DBT is a description of the threats that might be anticipated from terrorist activities and is used to recommend appropriate security efforts at plants. The GAO also looked at what nuclear plants were doing to meet the threats, and the results of mock attacks, called "force-on-force" inspections, to test security efforts, carried out by NRC staff.

Trained "threat assessment" staff within the NRC used intelligence information that provided information on the capabilities of terrorists and recommended that the DBT be changed to accommodate a larger suite of threats. After sending out the revised DBT for review by nuclear power plant industry officials and groups, however, the NRC changed their recommendations for revising the DBT to reflect nuclear industry concerns about what was "reasonable and feasible" to defend against.

Judgment calls were made on most likely threats

Much of the threat assessment analysis involved a review of a limited amount of information (not much was available specific to nuclear power plants) as well as personal judgment by NRC staff to predict what might be used in a terrorist attack against nuclear power plants. For example, the staff considered whether to increase the number of potential attackers in the DBT, based on knowing the number of attackers in other incidents. Staff did not, however, recommend increasing the number of attackers in the DBT because they assumed that a large number of attackers would be more likely to be caught before they could carry out an attack - a judgment call. NRC staff concluded that an attack similar to 9/11 would not focus on a single nuclear power plant and that since an attack from the air was not an option used often by terrorists, did not recommend that scenario to be included in the DBT. Staff did assess the possibilities of an attack from water, but concluded that a bomb transported by water would necessarily be of smaller size, because it would need to be carried on a boat. (This assessment would not apply to a facility on Lake Michigan, as boats of quite large size could approach Palisades; in addition, it is plausible that speedboats could have the ability to launch an attack on Palisades before plant security defenses could react.

Undue influence by the nuclear industry changed NRC recommendations

The GAO report, in its review of the revisions to the DBT, noted that because the nuclear industry had the opportunity to review the draft DBT, the changes that were made to the draft appeared to reflect concerns by the nuclear industry over the high cost of some increased security measures, suggesting undue influence by the industry. For example, industry representatives protested the inclusion of certain weapons in the DBT, saying that one would render the ballistic shielding of the plants obsolete and that another would be too costly. The industry argued as well that protecting against the use of certain weapons by terrorists was the responsibility of the U.S. federal government, namely, the Department of Defense.

The industry also opposed the inclusion of a threat of an attack from inside the plant, from an “active violent insider,” saying there were no cost effective ways of avoiding this scenario. NRC staff made changes to the draft DBT that appeared to be influenced by the industry comments. When the draft DBT was presented to NRC commissioners, even more changes were made based on industry objections, for example, allowing plants to use a “human reliability program” to reduce the potential for an insider situation. The commissioners also removed some weapons from the list recommended by staff that plants would have to defend against that would have added to the cost of increasing security, as well as voting to decrease the maximum amount of weight of equipment, weapons, and explosives an attacker might carry, downgrading the level of security required at plants. The GAO report concluded that some of the changes suggested by commissioners and included as part of the DBT, were made due to judgment, rather than specific criteria.

Few mock attacks carried out to date

The GAO report noted that as of November 2005, the NRC had only conducted mock attacks, or force-on-force demonstrations at 20 of the 65 nuclear plant locations (with 103 reactors) in the U.S. The GAO reviewed documents from inspections and force-on-force demonstrations as well as observing a number of force-on-force demonstrations. Its review of 18 baseline inspection reports and demonstrations noted problems, including an intrusion detection failure at one site:

- Notice of demonstration dates were given 8 to 12 weeks in advance, and daytime and nighttime exercises were generally convened at the same times at each event, leading to a lack of unpredictability in the exercises.
- There were instances where advance information about attack scenarios had inadvertently been provided to plant personnel.
- The quality of feedback from NRC personnel to plants after an inspection varied. For example, not all potential problems were discussed by NRC with plant officials after each demonstration.
- Alarms failed to activate; some did not function properly.
- Gaps in patrols were observed.
- Not all personnel entering protected areas within the plant were searched (for example, a security officer did not examine objects that set off the metal detector).
- Some security officers were inadequately trained for a terrorist attack (lack of physical stress preparedness, training inappropriate to threat).
- Security officers in one location were noted as inattentive at their posts.
- A vehicle barrier system was improperly and ineffectively placed at one plant location.

Accountability to the public on security is non-existent

The need to keep classified certain sensitive information about measures taken at potential targets of terrorism is understandable, but those who live in the vicinity of Palisades, as well as those throughout the region who might be affected by a terrorist

attack directed at Palisades, must be assured in no uncertain terms by the NRC, Palisades, and elected leaders that every measure has been instituted that will provide safety and peace of mind to the public. It is disturbing to note that keeping back information on the plants has even broader implications. In March 2004, for example, the NRC decided not to publicize results of problems related to security at plants, as well as enforcement information relating to actions taken by the NRC against the reactor licensees for violations of safety regulations. This appears to be taking advantage of the heightened attention and concern for security at nuclear power plants to limit information about unsafe operations that should be readily available to members of the public.

If a force on force demonstration has not been conducted at Palisades, it should be conducted as soon as possible. Classified results of the demonstration should then be directly communicated to the region's U.S. Congressional representatives and senators, as well as the Governor and Attorney General of the State of Michigan, for their thorough review and approval and reporting back to the public. To truly secure the Palisades nuclear power plant and dry cask storage, the following security safeguards, if not instituted already, would need to be in place.

- Sufficient cameras and patrols;
- Delay measures, such as fences outside buildings and entrances that would delay potential attackers;
- Bullet resistant structures in the protected areas of the plant site;
- Adequate and specific training for security officers;
- Several levels of intrusion detection systems (Needed especially by Palisades to protect against intrusion from potential attackers that may enter from Van Buren State Park, adjacent to the plant site);
- Vehicle barrier systems to prevent vehicles with bombs from entering the site;
- Anti-aircraft capability, and;
- Shore patrol equipped with stationary weaponry capable of preventing an offshore assault.

While some of these safeguards may appear excessive, they are necessary to secure the facility. Unfortunately, some of these measures have significant civil liberties ramifications for the communities surround Palisades, therefore we request that the NRC address how this will be handled in a 20-year license extension in the draft EIS.

Palisades must also ensure that its irradiated nuclear fuel storage pools are safeguarded from terrorist activities. A study released in April 2005 by the National Academy of Sciences shows that the cooling pools at nuclear reactors, which store 10 to 30 times more radioactive material than that contained in the reactor core, are at risk from attacks by terrorists. According to the study, the cooling ponds could be severely damaged by crashing aircraft, high-powered weapons or explosives, releasing large quantities of radioactive material into the environment.

V. Lake Michigan Dunes and Shoreline Unsafe Location for Stored Waste Containers and Concrete Pads

Changing conditions of Lake Michigan dunes pose risks to waste storage facilities

Lake Michigan dunes constitute a series of dynamic environmental settings, from bare beach shorelines, to “growing dunes” or lightly vegetated foredunes, fragile interdunal wetlands and ponds, and finally to mature, forested “oldest” dune hills. Vegetation -- grasses, bushes, and trees -- is an essential key to the stability of the dunes. When dune vegetation is disturbed by footpaths or other activities, high winds and storms can widen a small stretch of bare sand into an increasingly wide swath or “blowout.” Blowouts, areas of blowing and unstable sands, in dunes in the vicinity of Palisades’ dry cask storage system could threaten the integrity of the dry cask storage waste system, by clogging vents in the casks, and causing the wastes to overheat, which could lead to an explosion. Left unattended, large blowouts in the dunes surrounding the casks could possibly decrease the stability of the pads on which the casks are situated. This issue must be addressed in the EIS. Palisades must, at minimum, be required to monitor the dunes for potential blowouts and ensure that the dunes are consistently vegetated and stable.

Threat to the waste storage facility from earthquake impacts ignored

Michigan has had a lengthy history of earthquake activity, dating back to the first several historically recorded quakes, in 1811 and 1812, originating from the New Madrid fault, centered in New Madrid, Missouri. These quakes registered at 8.0 or higher on the Richter scale. Additional quakes were felt in a variety of locations throughout Michigan in the later 1800s. The largest earthquake experienced in Michigan was in 1947. With a magnitude of 4.6, it was felt throughout southern Michigan, affecting an area of 50,000 square miles. A quake originating in south central Illinois in 1968 extended approximately 580,000 square miles and was felt throughout southern Michigan. The last earthquake in Michigan registered 3.5 and was centered in Lansing in 1994.

The New Madrid zone has produced the country’s largest earthquake and is considered the country’s most seismically active region east of the Rocky Mountains. The United States Geological Survey (USGS) has given the New Madrid fault a 25 to 40% probability of having an earthquake of 6.0 or greater in the next 50 years (USGS Fact Sheet FS-131-02). Movement has already been noted and described in a June 2005 *Nature* article describing the results of a University of Memphis study that detected a half-inch shift in the fault from 2000 to 2005.

The potential for earthquake activity to damage Palisades’ outdoor dry cask storage pads, upon which the casks have been placed, warrants rigorous consideration, which unfortunately, is not in evidence in the draft EIS. Concerns regarding the impacts of an earthquake that might cause disruptive movement to the waste storage facilities at Palisades surfaced as early as 1994, from within the NRC. Dr. Ross Landsman, Nuclear Safety Engineer and Palisades Dry Cask Storage Inspector, questioned the adequacy of

requirements associated with earthquake activity for Palisades' dry cask storage facility in a letter to the chairman of the NRC. In his letter, Dr. Landsman voiced his concerns, "Actually, it's the consequences that might occur from an earthquake that I'm concerned about. The casks can either fall into Lake Michigan or be buried in the loose sand because of liquefaction [soil taking on liquid characteristics]. This event might be in the public's mind in view of what just happened in Southern California. It is apparent to me that NMSS [NRC's Office of Nuclear Material Safety and Safeguards] doesn't realize the catastrophic consequences of their continued reliance on their current ideology."

In a September 15, 2005 affidavit, Dr. Landsman further describes his concerns regarding the ability of the storage pads to withstand movement due to earthquakes, asserting that both the older pad nearer Lake Michigan and the newer one further inland, are in violation of NRC earthquake regulations, 10 CFR § 72.212(b)(2)(i)(B), which require that: "Cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion. . . ." Dr. Landsman noted that Palisades' analysts and engineers apparently failed to acknowledge the differences in elevation between the plant and pad sites in their design of the storage facility. This led to mistakes in the calculations made to determine the potential movement of the pads due to an earthquake. Dr. Landsman noted the violation after inspecting the new storage pad in 2004 and warned that it was not safe, but his concerns were not addressed and casks have nonetheless been allowed by NRC to be placed on the pad right up to the present.

The implications of damage to the casks from an earthquake are significant. Wastes in casks covered in or buried by sand, could overheat, causing severe damage to the irradiated nuclear fuel assemblies and making future storage, handling, transport, and management more dangerous. Overheated radioactive wastes could damage the dry storage casks, leading to leakage of radioactivity into the environment. Emergency responders could be at risk from any damage to the radiation shielding measures on the casks.

The dangers of nuclear waste cask submersion underwater are two fold. First, radioactivity could leak from the cask into the water. Leakage of even a fraction of a cask's contents into Lake Michigan could endanger the source of drinking water for ten million people. Second, enough fissile uranium-235 and plutonium is present in the high-level radioactive waste inside the casks, that water, with its neutron moderating properties, could actually cause a nuclear chain reaction to take place within the cask. This would complicate emergency responses, as potentially fatal radiation doses could be emitted from within the cask.

There is undoubtedly an elevated probability of a strong earthquake originating from the New Madrid fault in the next 50 years, and the potential for it to extend to

southwest Michigan. Because of that, it is imperative that the question of the safety of the concrete pads and the 29 storage casks of high-level wastes be resolved to the satisfaction of citizens of the region.

VI. Native American Tribes Left Out of the EIS

NRC staff, in the draft supplement to the Generic Environmental Impact Statement (GEIS), recommended that the Commission determine that the impacts of continued operation of Palisades were not significant enough to make its extended operation unreasonable. The document states further that: "This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by NMC; (3) consultation with Federal, State, and local agencies; (4) the NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received during the scoping process." Astoundingly, it is obvious that Native American tribes were **not** included in the consultation process for the development of the draft EIS for Palisades.

The role of affected federally recognized, as well as non-federally recognized Native American tribes can best be described as unfairly and severely restricted throughout all aspects of the development of the EIS. Even though the re-licensing application from NMC was submitted to the NRC in March of 2005, it was not until four months later that eleven tribes in Michigan and Oklahoma were invited to participate (via one letter) in the license extension proceedings. A single letter to a federally recognized tribe is not legally sufficient government-to-government consultation. However, other tribes that might be expected to have a substantial interest in proceedings involving Palisades relating to treaty rights and other related issues were left completely out of any part of the process, such as the Bay Mills Indian Community, the Keweenaw Bay Indian Community, the Sault Saint Marie Tribe of Chippewa Indians, all in Michigan's Upper Peninsula, tribes in Wisconsin, the Sauk and Fox Tribes and others in Oklahoma, and the Kickapoo Tribe of Texas (which absorbed the Mascouten Tribe), all with ancestral ties to the Lake Michigan shoreline. In particular, there are concerns for the continued disregarding of sacred burial grounds and other artifacts of tribal groups that may be present on the site and possibly along electric transmission lines extending from the plant, as well as concerns from the tribes in safeguarding such species as the sturgeon that may be negatively impacted by continued operations at Palisades.

Native American tribes are known to have traveled regularly throughout the dunes in West Michigan, hunting in them and using dune plants for food and medicinal purposes. Because of that, it is likely that villages or encampments, as well as burial sites, may well have been located on or in the vicinity of Palisades, especially given the presence of creeks just north and just south of the plant site and the heavily forested, large dunes of the property. This likelihood is confirmed in the draft EIS, on page 2-61 to page 2-62, where the NRC reports "Native American groups that inhabited the area during the historic period were predominantly the Potawatomi, Mascouten, Miami, and Ottawa. During the early historic period, their villages were situated on the edge of

forested land, adjacent to prairies and convenient to streams or the lakeside; temporary winter camps were established in sheltered areas. By the beginning of the nineteenth century, the Potawatomi had established 11 known villages in southern Michigan. Most were near the shorelines of Lake Michigan and Lake Erie, generally along the streams that flow into their waters." Thus, Palisades has a significant potential for such Native American sites to be located on its property.

Nuclear Management Company (NMC), however, gives scant attention to the interests of Native American tribes in its over 500 page Environmental Report, prepared as part of the re-licensing application process. Section 2.10, "Historic and Archaeological Resources," of the report consists of four paragraphs, taking up less than two-thirds of one page (Page 2-46). In fact, the potential for Native American sites on the Palisades property is not explicitly mentioned at all. In its Environmental Report, NMC referenced a number of documents prepared as part of the original license application for Palisades that noted the absence of known archeological or historical resources on the site or in the vicinity to discount the potential for Native American artifacts to be impacted by the license extension application.

The only specific documentation NMC provides in the Environmental Report to support its claim that there are no Native American artifacts, is a letter dated April 7, 1972 from the U.S. Department of the Interior (DOI) to the U.S. Atomic Energy Commission (the predecessor to today's NRC), in terms of nuclear power plant regulation). In that letter, reproduced from Pages C-5 to C-9 of NMC's Environmental Report, DOI states "It does not appear that the existing plant should directly affect any existing or proposed unit of the National Park System, nor any site eligible for registration as a national historic, natural or environmental education landmark; however, the final statement should contain evidence of consultation with the State Historic Preservation Officer concerning the effects of the power station on places on or being considered for nomination to the National Register of Historic Places." However, the DOI statement does not seem to indicate that there was attention placed on locating Native American burial sites, former village sites, etc. located on the power plant site or along the transmission line corridors.

Even though the Michigan State Historic Preservation Office (MSHPO) noted the possibility of unreported artifacts (see Page C-2, Cultural Resources Correspondence of NMC's Environment Report), there has been no survey done by Consumers Power to confirm or dispute this claim and no actions taken by MSHPO officials to resolve the question, demonstrating a distinct lack of significance attached to protecting the interests of Native American tribes. In fact, NRC staff acknowledged in the draft EIS that no adequate surveys have ever been conducted at Palisades. Further, although the draft EIS document determined that the license extension for Palisades might pose a "moderate" impact on the interests of Native American tribes regarding archaeological or historical cultural resources, this initial determination was verbally deemed "a mistake" by NRC staff at the April 5, 2005 draft EIS public comment meeting in South Haven, Michigan. We ask for an explanation as to the reason for this "mistake" and

justification for a significant downgrading of the impact level ascribed to Native American interests in such cultural resources as burial sites from "moderate" in the draft EIS to "small" at the public meeting.

Forty years ago, Native American tribes were seemingly ignored in decisions regarding the original placement and construction of the Palisades nuclear power plant, even though it was an intense and disruptive use on lands at one time occupied by a number of tribes along Lake Michigan, which is revered by all Native Americans of the region. It can only be concluded from this most recent lack of attention in the re-licensing process, that these tribes have once again been accorded neither legally sufficient notification nor appropriate involvement, which is especially negligent in respect to the federally recognized tribes, which are sovereign entities and are legally entitled to have a government-to-government relationship with the United States.

All Native American tribes and bands that could be expected to have an interest in the application by Palisades to operate an additional 20 years deserve both notification of this process, as well as the opportunity to share government-to-government decision making regarding the application, as allowed for under NEPA and other federal laws. A comprehensive site wide survey should be performed on the entire Palisades property - as recommended by Palisades' own cultural resource assessment subcontractor as described in the draft EIS - carried out in close consultation with all affected tribes. If Native sites, such as burials, are found, then appropriate actions should be taken to protect them from damage, again, in close and meaningful consultation with affected tribes in order to ensure that NEPA, treaties, and the terms of other relevant federal laws, such as the Native American Graves Protection and Repatriation Act and the National Historic Preservation Act, are met.

VII. Socio-economic Impact Conclusions in EIS Biased by Substandard Methodology

Palisades has been considered a major contributor to Van Buren County's property and municipal tax revenues, but the economic benefit to Covert Township has been ambiguous. In fiscal year 2004, a total of \$3.6 million in property taxes went to Covert Township and schools, with an additional \$1.6 million to Van Buren County and schools. As host to the Palisades plant and benefactor of its tax revenue, it is reasonable to assume that Covert Township should at minimum be at economic parity with surrounding geographic household and per capita incomes. Despite the financial benefit such payments suggest, however, Covert Township consistently rates substantially below comparable county, state and national economic indicators in median household and per capita incomes. The EIS overlap of Geographic Distribution of Minority Populations (figure 4-1 on p. 4-29 of the NRC draft EIS) and Low-Income Populations (figure 4.2 on p. 4-30) shows a large area of Covert Township (and St. Joseph/Benton Harbor) to be both "high minority and low-income. Poverty persists in the Covert Township, a high minority and low-income community, despite the presence of the Palisades nuclear power plant for nearly four decades.

Consumers Energy is described as the largest employer in Van Buren County, with 484 employees (draft EIS, Table 2-8). The draft EIS states that unemployment in the county "was moderately high at 7.2% in December 2004," but determines no "incremental change" in employment and personal income resulting from a Palisades license renewal --new employment opportunities are not projected to occur.

Palisades' Permanent Employee Residence Information by County and City (Table 2-3) lists employee residence totals as: South Haven (156), Bangor (14), Grand Junction (13), Paw Paw (12), Hartford (8), and Others (30). Unfortunately, residents of Covert Township that might be employed at Palisades are not specified in this information, raising the question as to whether or not Covert Township residents benefit at all from employment at the plant.

A review of household income further shows a lack of positive benefit to Covert Township from Palisades. Per capita incomes in 2000 were \$21,587 for the United States, \$22,168 for Michigan, \$17,878 for Van Buren County and \$12,156 for Covert Township (U.S. Census Bureau, 2000 Census, in 1999 dollars). These figures reveal incomes for Covert Township that range from 45% and 33% consistently lower than the state of Michigan and Van Buren County respectively.

Covert Township reported 14.3% of families with incomes less than \$10,000, three times the rate of Van Buren County. There are over three times as many families below poverty level in Covert Township as in Van Buren County. Covert bears the burden of 34% of related children under 18 years of age in poverty compared to Van Buren's 11%; related children under 5 years of age in poverty, 38% compared to Van Buren's 17%; Covert families with female householders, no husband present, 48% compared to Van Buren's 25%; related children under 18 years of age for Covert at 57% compared to Van Buren's 30%, and Covert related children under 5 years of age living below poverty level at 80% versus Van Buren's at 48%. Covert reports 32% of individuals in poverty while Van Buren reports 11% of individuals living in poverty. As unfortunate as Van Buren County poverty levels may be, Covert Township's poverty is consistently two and three times worse. None of this data was provided whatsoever in the scope of the EIS socio-economic factors.

Comments by local and county government and Chambers of Commerce officials at public hearings have extolled the benefits of new fire trucks and infrastructure improvements, and the EIS notes that Palisades' property tax revenues are "used to fund local and county emergency management programs, public safety, local public schools, local government operations, local road maintenance, and the local library system," (page 2-58, of the draft EIS). Still, Covert Township experiences chronic poverty.

NRC staff ultimately determined that the socio-economic impacts resulting from Palisades' license renewal would be "small", implying that the impacts "would not produce an incremental change in any of the impact measures used. Unfortunately, the draft EIS's methodology neglected a comprehensive analysis of socio-economic

conditions in Covert Township and Van Buren County, leaving out those conditions that did not support a positive benefit from the nuclear power plant.

NMC/Consumers discounts potential impacts to Latin American migrant workers in southwest Michigan from an extension of Palisades' license. NMC/Consumers' Environmental Report (page 2-32) notes (inaccurately) that "Berrien and Van Buren Counties host moderate numbers of migrant workers." According to the U.S. Department of Agriculture, however, in 2004, 3,677 and 6,733 temporary farm laborers (many of them Latino) were employed in Berrien and Van Buren Counties, respectively. These numbers, in addition to family members of the workers, represent populations as large as the county seats and even the biggest towns in these counties. Rather than characterizing the number of migrant workers, many of whom are Latino and of low income, as "moderate," a more accurate characterization relative to the populations of the host counties would be "large," and therefore worthy of significant consideration not only in NMC's Environmental Report, but also in NRC's draft EIS.

The Latin American agricultural workforce of the Palisades area is also at disproportionate risk from both routine radioactive discharges, as well as catastrophic radiation releases, given this workforce's complete reliance on agricultural sector employment. A large-scale radiation release from Palisades could seriously damage the region's agricultural base. Even a "minor" accident at Palisades involving radiation release could significantly harm area agriculture, due to the stigma attached to radioactive contamination. In either scenario, the Latino migrant labor workforce would suffer disproportionate harm. There also has been no evaluation of the potential for the synergistic effects of chronic or catastrophic radiation releases combined with the toxic pesticides to which field workers have been exposed. In addition, there are no Spanish language emergency evacuation instructions and notifications prepared to serve the Spanish speaking Latino population within 50 miles of the Palisades reactor.

VIII. NRC's Re-Licensing Process Arbitrarily Eliminates Major Impacts from Consideration

With no new nuclear plant orders (that were not later canceled) since 1973, a consequence of the partial meltdown in 1979 of the Three Mile Island plant in Pennsylvania, and with the last reactor built in the U.S. completed in 1996, the American public believed that nuclear power was on the way out, too risky and costly to contemplate. That was not the case. Plans for extending the licenses of operating nuclear power plants were already underway, begun in 1991, with draft rules written to establish a process that would ensure approvals for the extension applications. Although there were major concerns about the procedure raised by the U.S. Environmental Protection Agency, the President's Council on Environmental Quality (CEQ), state officials, environmental and safe energy organizations, concerned citizens, and others about the proposed rule, the procedure nonetheless went forward and ended with a final rulemaking published in the Federal Register in 1995 that provides

for a generic environmental impact review process for any and all nuclear power plants in the country intending to extend their licenses.

The rule requires nuclear power plant applicants to submit an environmental report (ER) and the NRC to write an environmental impact statement (EIS). Both documents are to analyze the environmental impacts associated with the proposed license extension, consider alternatives to a 20-year extension, and alternatives for reducing adverse environmental effects.

This process allows renewal applicants to take advantage of a generic analysis of environmental impacts for numerous environmental issues. Out of 92 issues identified that need to be addressed in an environmental impact analysis of re-licensing, the NRC has determined that 69 are already "adequately" addressed in the generic impact statement. Only 23 issues were found to require additional assessment for at least some plants at the time of the license renewal review. In other words, members of the public and those who live around Palisades are not allowed to address the 69 issues in comments to the NRC about re-licensing, only the short list of 23 identified by the NRC. At that time, over a decade ago, NRC made no meaningful or adequate public outreach in the vicinity of Palisades to alert the public and potentially interested stakeholders to the significance of the rulemaking and the opportunity to provide meaningful input into the decision.

The NRC also made a determination "that, although no standard exists that can be used to reach a conclusion as to the significance of the magnitude of the collective radiological effects attributable to any plant, these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated." This determination made by the NRC is in direct conflict with a 2005 National Academy of Science report, which concluded that no dose of radiation, no matter how small, can be declared "safe."

The NRC also concludes that any impacts from high-level waste and irradiated fuel disposal from a license extension (even acknowledging the uncertainties about the proposed Yucca Mountain repository) would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated.

Through these determinations, the NRC has effectively stifled debate on two of the most significant impacts of a 20-year license extension – the continued and cumulative effects of radioactive discharges to the environment and humans from the Palisades plant, and the buildup of close to 300 more tons of high-level radioactive waste. This means storage of more wastes on the lakeshore, added to the 29 storage casks already in place, and the remainder of wastes stored in the pool within the plant, which is also a risky method for storing these deadly wastes.

IX. Routine Radioactive Discharges Pose Serious Threat to Health

The NRC has placed this issue outside the scope of the EIS for extending the license for Palisades. We strongly disagree.

There are routine everyday discharges from nuclear power plants, deemed to be both explicitly “permissible” or “allowable,” and implicitly “safe” or “insignificant” by the NRC and the nuclear power industry. Prior to the advent of nuclear power, radioactive fission products, produced in nuclear reactors, were present in only exceedingly rare, trace amounts in isolated locations on earth. Over 300 different radioactive chemicals are currently created by nuclear chain reactions – and it takes hundreds of thousands to many millions of years for these new chemicals to return to a stable state.

Radioactivity is emitted to the air and the water, as part of routine discharges by nuclear power reactors. It settles upon or is washed back up on the soil and beach as well. For example, reactors use large amounts of water for cooling, and that water when it is returned to a lake or river will have radioactive substances in it. Radioactivity from air discharges also can fall out into water bodies and become embedded in bottom sediments, as well as upon soil on land. Contamination of soils and groundwater can occur through routine discharges, as well as through leaks, accidents, and spills, which are not always fully detected or reported. Wind, water, precipitation, and ecological processes (such as bio-accumulation) can move the radioactive contaminants off site where they are dispersed or diluted, but still present in the ecosystem where they can eventually make their way into living organisms.

Although radiation monitoring occurs at reactor sites, it only provides information on levels of discharges emitted or released. It does not provide specific information about where the radioactive materials end up, or if they contribute to radiation levels in plants, fish, and wildlife as well as body burdens of local and downwind or downstream residents. The Nuclear Regulatory Commission relies upon self-reporting and computer modeling from reactor operators to track radioactive releases and their projected dispersion. A significant portion of the environmental monitoring data is extrapolated – or virtual, not real.

Radioactive materials are toxic, persistent pollutants, now widely acknowledged to have many adverse affects on people, as well as fish and wildlife. According to the Union of Concerned Scientists (UCS), the adverse affects are numerous, and can include cancer, reproductive difficulties, genetic and birth defects, and death. “Routine” radioactive releases from nuclear power plants, while reported by the utility to be below “permissible” levels, are still potent due to their ability to become concentrated in organisms. For example, a report by UCS found that mallard ducks carried concentrations of cesium-137 in their flesh that was 2,000 to 2,500 times that in their food, while strontium-90 was concentrated by a factor of 65,000 in clam shells. UCS’s report also found increased levels of radioactivity in marine life up to 300 miles from the source.

Ionizing radioactivity differs from natural background radioactivity because it produces radioisotopes that mimic natural chemicals and concentrate in the body where these chemicals reside. Strontium-90, which is routinely released during fission, can get into cow's milk and mimic calcium, following the path of that element in the body and end up in teeth and bones. It can concentrate to high levels and cause leukemia, a deadly form of cancer. Iodine-131, another highly toxic by-product of nuclear power, can concentrate in the thyroid where naturally occurring iodine is deposited, and produce serious hormonal dysfunctions or even thyroid cancer in children.

Radioactive byproducts in reactor waste have different half-lives -- the amount of time it takes for half of a given amount of radioactive material to decay. Some decay in a few hours. Others, like strontium-90 and cesium-137 last longer, with half-lives of about 30 years. It takes them around 300 years, or ten half-lives, to decay. But some by-products, like iodine-129, have half-lives of a million years or longer. Plutonium-239, one of the most toxic human-made materials, has a half-life of nearly 25,000 years.

While concerns about the consequences of human exposure to ionizing radiation are not new, the 2005 National Academy of Science's seventh Biological Effects of Ionizing Radiation (BEIR VII) report on "Health Risks from Exposure to Low Levels of Ionizing Radiation" has confirmed that there is no safe level of exposure to radiation -- that even very low doses can cause cancer and other maladies -- and that risks from low dose radiation are likely greater than previously thought. The implications of NAS's recent findings require a thorough analysis by NRC in its EIS of the human health impacts of the radioactive substances released by Palisades.

NMC/Consumers should be required to provide the communities in the vicinity of the Palisades plant, with a monitoring program to supply independent information regarding radioactive discharges and releases. These communities are currently dependent upon the operators of Palisades to provide notification of radiological releases. Establishment of an independent program would give evidence of NMC/Consumers' interest in and commitment to ensuring the health of its surrounding communities.

Historically, the NRC has relied on a 1990 National Cancer Institute (NCI) study to address cancer rates near nuclear power plants. However, this study is now outdated, not accounting for latency periods which could have developed into cancers since 1990. And it was essentially methodologically flawed from the start, as the only data considered by the NCI was from the county that each reactor is located in, and not other downwind and downstream populations potentially affected by radioactive releases of the plants. Further, there are a host of other diseases associated with radiation exposure that have not been assessed, such as thyroid disease, infertility, genetic damage and birth defects, heart disease, and immune system suppression, which require monitoring and attention. A baseline assessment, as well as regular monitoring, of cancer and other disease rates is warranted prior to consideration of Palisades' proposal for a 20-year license extension.

X. More Palisades Waste to Build Up On the Lake Michigan Shoreline

Palisades' high-level radioactive waste storage facility is defective

The NRC has placed the issue of waste generation and storage outside the scope of the EIS for extending the license for Palisades. We strongly disagree.

The Palisades nuclear power plant has generated, on average, 14.5 tons [U.S. Dept. of Energy's Feb. 2002 Final EIS for Yucca Mountain. Appendix A. Tables A-7 and A-8] per year of high-level radioactive waste. The Nuclear Waste Policy Act was amended in 1982 to allow the NRC to approve interim storage of high-level radioactive waste in dry cask storage facilities in a "generic licensing" without studies specific to each plant site or Environmental Impact Statements. In 1993, several tons of wastes that were accumulating in the Palisade plant's overfull irradiated fuel pools were moved into massive concrete and steel storage casks on concrete pads on the plant site.

Inexplicably, the extremely dangerous radioactive wastes from Palisades, that will remain dangerous for tens to hundreds of thousands of years, were deliberately placed within a high-risk erosion zone, which is highly unstable, dynamic and risky. Currently, around 20 of a total of 29 casks, weighing 132 tons each, are situated approximately 150 yards from Lake Michigan, sitting atop loose sand dozens of feet thick. Thus, the casks, and the concrete pad upon which they sit, are not anchored to bedrock. This stretch of Lake Michigan's southwest shoreline is known to have the ability to recede in an exceptionally short time frame. The high-risk erosion zone requires 30-year construction setbacks that range from 55 ft. to 140 ft. and 60-year setbacks that range from 115 ft. to 260 ft.

One of the waste storage cask systems at Palisades, the "VSC-24," (Ventilated storage cask containing 24 pressurized water reactor irradiated nuclear fuel assemblies) utilizes passive ventilation to keep the waste at the appropriate temperature. The vents on this type of cask need regular cleaning so they will not clog from blowing dune sand, debris, or snow. This cask is also not considered transportable, like some casks, and as such, wastes contained within them will need to be unloaded and transferred into shipping containers, when or if transport occurs. But even though Consumers Energy and the NRC testified in federal court that the casks could be safely unloaded, there have been numerous problems. When weld defects were detected in the fourth VSC-24 cask to be loaded in 1994, for example, it was found that there were critical questions about how to handle the procedure. This defective cask has yet to be unloaded, twelve years later.

To further complicate the unloading problems of Palisades' casks, the configuration of the dry casks currently stored on the older pad nearer Lake Michigan is such that those casks furthest back cannot be moved or unloaded until all other casks in front of them have been moved out of the way first. Thus, casks that cannot be unloaded on the shore side of the pads will effectively halt unloading of the casks behind them.

There have been other accidents and incidents with the VSC-24 system. While a VSC-24 cask was being welded shut at the Wisconsin Point Beach nuclear power plant in 1996, a spark from the welding caused a hydrogen gas explosion that tilted the lid of the cask (3 tons of metal) several inches ajar; this incident occurred on the edge of the waste storage pool, threatening to damage the pool and unleash a potentially catastrophic radiological accident. Additional weld defects have been detected in other casks at Palisades and at other plant sites.

On February 6, 1997, Mary P. Sinclair Ph.D. co-chair of Don't Waste Michigan, wrote to Dr. Shirley Jackson, Chair U.S. Nuclear Regulatory Commission and reviewed this history in great detail with documentation and references for each point made. In her letter to Dr. Jackson, Dr. Sinclair wrote the following:

" . . . Attorney General Frank Kelley petitioned for an injunction in May 1993, against the loading of these casks in the Western Michigan Federal Court at Grand Rapids. (Case No. 4:93 CV 67). Consumers Power Co.'s response to the Court was that the company would unload the casks and place the nuclear waste back in the spent fuel pool if the Court should rule against them and, therefore, an injunction to prevent loading was unnecessary. A supporting position for the utility's action was filed by Charles Haughney of the NRC, in which he assured Judge Robert Holmes Bell that Consumers was able to do this by simply reversing the process of loading, if the Court so ordered. This demonstrates that, not only did Consumers Power Co. mislead the Judge, perhaps out of ignorance, about Consumers' ability to unload these casks, but more importantly, Charles Haughney of the NRC pledged the Agency's credibility in support of this position. His statement is signed, "Pursuant to 28 U.S.C. sec. 1746, I declare under penalty of perjury that the foregoing is true and correct." (Executed and signed on May 5, 1993). Judge Bell, of course, could hardly grant an injunction under those circumstances. This is one of many instances in which the judgment of the staff was flagrantly in error, and helped to compound the problems that have later developed. [pp. 3-4, Requests that Commission review 2.206 petition filed on 950919 & amended on 960930 by Lake Michigan Federation & Don't Waste Michigan, Sinclair MP. Accession Number: 9704090248, Docket Number: 05000255,07200007, Microform Address: 92410:204-92410:211] A hard copy of this letter is being provided by Don't Waste Michigan to be entered in its entirety into the record as part of comments being submitted on this draft EIS. There are additional comments in the letter, which also pertain to this EIS process.

The Wisconsin explosion led to a three year hiatus in the loading of VSC-24 casks nationwide, in order to improve safety procedures. Palisades was the first plant in the country to begin loading VSC-24s again, in June, 1999. However, mistakes were made yet again. A welding crew accidentally ignited flammable hydrogen gas being vented off a loaded VSC-24. But it failed to notify the next welding crew coming on shift to replace them. The new crew also ignited the leaking hydrogen gas, representing a breakdown of safety protocols, risking a repeat of the Wisconsin explosion.

During the June, 1999 dry cask loading campaign, Palisades also loaded irradiated fuel that had not yet thermally cooled and radioactively decayed in the underwater storage

pool for the required minimum of five years. This represented a violation of the technical specifications for the casks, and thus NRC safety regulations. Also in June 1999, a fire at Palisades in an office trailer storing paper records on the dry cask storage installation destroyed records on the most recent, and earlier, accidents.

Palisades also uses Transnuclear NUHOMS-32PT dry storage casks. In October 2005, crane handling errors led to a 107 ton NUHOMS transfer cask fully loaded with high-level radioactive waste dangling for 55 hours above the storage pool. Reports confirmed that the risk of a heavy load drop had been increased due to improper emergency brake manipulation during the incident. NRC reported that, had the load dropped, severe damage to the pool could have resulted.

A separate NRC report, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," (NUREG-1738, Feb. 2001) revealed that a heavy load drop can cause the cooling water to drain away. The densely-packed waste in the pool could then overheat, spontaneously combust, and ignite a waste fire causing catastrophic radiation release. NRC concluded that up to tens of thousands of people could die from cancer over time, downwind of such an accident.. Despite similar crane problems years earlier at its Big Rock Point nuclear power plant in northern Michigan, failure to communicate "lessons learned" within the nuclear utility contributed to repeating the same dangerous errors at Palisades.

Establishment of a permanent national waste repository remains indefinitely delayed

In 1982, with the passage of the Nuclear Waste Policy Act, the U.S. Department of Energy (DOE) was given the responsibility for finding a permanent site to build and operate a repository for all of the wastes accumulating at the reactors across the country. Original plans were for the repository to begin accepting irradiated nuclear fuel in 1998, but it has been pushed back until 2020, according to the most-recent predictions made by Energy Secretary Samuel Bodman. In 2002, Congress voted to allow DOE to apply for a license from NRC to construct and operate a repository at Yucca Mountain in Nevada. The opening of the repository is uncertain: the State of Nevada has actively opposed the plan, and raised legitimate questions about the suitability of the site; DOE does not have full funding for construction and operations, and recently, a federal appeals court found that the impact of the project must be evaluated for longer than the 10,000 years currently considered. Even if the Yucca site were to open in 2020, DOE has projected in its 2002 Final EIS for Yucca that it would take 24 to 38 years to transport wastes to Yucca from reactors across the U.S., including Palisades. Thus, even if Yucca opened in 2020, it would take until 2044 or even until 2058 for the wastes generated before 2010 at Palisades to be moved to Yucca Mountain, Nevada. Because of this, existing wastes from Palisades are likely to remain on the Lake Michigan shoreline indefinitely.

Waste from 20 additional years of operation at Palisades will not go to Yucca Mountain

Yucca Mountain is limited by law to store 70,000 metric tons of nuclear waste. Only 90%, or 63,000 metric tons, of that can come from commercial nuclear reactors. 63,000

metric tons is approximately the amount of nuclear waste that will be stored on-site at reactors around the country by 2010. A 2004 analysis by the Environmental Working Group found that the 26 reactors at nuclear power plants re-licensed between 2000 and 2004 will produce an additional 9,000 metric tons of high-level nuclear waste over the 20-year period of their license extensions. Eighteen more reactors at nine power plants with license extensions pending would add another 6,600 metric tons of waste, for a total of 15,600 additional metric tons. Wastes produced at Palisades for 20 additional years-- 290 additional tons of irradiated nuclear fuel --will likely be stored indefinitely in the same manner as the other Palisades wastes that have been produced to date, resulting in a massive assemblage of concrete and steel silos extending along the high risk erosion zone on Lake Michigan, as well as a packed storage pool within the Palisades plant.

If Yucca Mountain opens, waste will be transported by barge and rail

The DOE has estimated that transporting the waste from the plants to Yucca Mountain would require more than 53,000 truck shipments to Yucca over 24 years or about 2,200 per year. If rail is the primary means of transporting the waste – and DOE has stated that it prefers rail – the proposed action would require more than 10,700 cross-country shipments over 24 years, or about 450 per year (Halstead 2002). Re-licensing to date has added about 5,700 more truck shipments, or 1,050 rail shipments to that total.

The Department of Energy declared in April 2004 that rail shipment to Nevada is the preferred mode of transportation for high-level nuclear waste. Barge shipments are being considered under this option because 17 nuclear power plants, including Palisades, have no rail access, yet could connect to rail lines via barges.

For Palisades, DOE has proposed barging up to 125 giant rail-sized containers of high-level radioactive waste from Palisades to the Port of Muskegon, up the Lake Michigan shoreline. DOE's estimate of 125 shipments may very well be an underestimate, in that DOE assumed Palisades would only get a 10-year license extension, while NRC's practice to date has been to approve every request for a 20-year license extension. Thus, an additional 10 years worth of waste generation would mean that many more barge shipments between Palisades and Muskegon.

The barging of 125 or more shipments of high-level radioactive waste is very risky. Any submersion of the casks in water, could stimulate the fissile uranium-235 and plutonium, both present in the high-level waste, to cause a nuclear chain reaction. The slightest leakage of even a small amount of this waste could not only threaten Lake Michigan as a source of drinking water for ten million people, but also cause a host of other irrevocable impacts on the lake's fish, wildlife, people, and economy.

Storage of "low" level radioactive waste from Palisades not addressed in the draft EIS

The Barnwell, South Carolina "low" level radioactive waste dump, which has accepted shipments from Palisades for decades, will close its doors to wastes from Michigan in 2008. Neither NMC in its Environmental Report, nor NRC in its draft EIS, have

explained how Palisades will deal with the “low” level radioactive wastes when Barnwell closes, such as establishing storage installations for “low” level radioactive wastes on the plant site. What NRC and the nuclear industry term “low” level radioactive wastes contain many of the same radio-nuclides as high-level radioactive waste, only less concentrated. Some “low” level radioactive waste can even deliver a lethal dose of radiation at close enough range in as little as 20 minutes. “Low” level radioactive waste management at Palisades is a significant health, safety, and environmental issue that requires is largely unaddressed by NMC and NRC in the license extension application and requires specific consideration.

XI. Plant Aging Increases Accident Risk

A top concern directly related to the re-licensing of Palisades for 20 additional years, is the aging of the plant, in particular *embrittlement*, or the gradual weakening of the reactor pressure vessel (RPV) from decades of bombardment by neutrons emitted by the nuclear chain reaction in the core. It is generally acknowledged that the reactor pressure vessel at Palisades is one of the most embrittled in the nation. The longer Palisades operates, the more embrittled its RPV becomes, increasing the risk for Pressurized Thermal Shock (PTS), a condition caused by any number of system malfunctions which can result in a severe, sudden overcooling of the reactor pressure vessel. This, combined with the intense pressurization in a pressurized water reactor, can stress the RPV such that its walls could crack or rupture, leading to a loss-of-coolant accident, meltdown, and catastrophic release of radiation to the entire Great Lakes basin.

Age-related failure of Palisades’ systems could initiate the sequence of events that leads to PTS. Examples of aging systems at Palisades are evident in this short list of recent incidents:

1. Alert Declared Due to Loss of Shutdown Cooling (Event # 39699 March 25, 2003)
2. Failure of the Control Rod Drive Mechanism (see PNO-III-04-010 August 11, 2004)
3. Reactor Manually Tripped Due to Fire in 2B Condensate Pump (Event# 41002 August 31, 2004)
4. Relief Requests for Reactor Vessel Head Penetration problems (NMC Request 10/4/04)
5. Reactor Vessel Head Nozzle Cracking - Through Wall Cracks (Degraded Condition 10/17/2004)
6. Manual Reactor Trip/Main Condenser Vacuum (Event # 41319)

7. Emergency Declared on Primary-Coolant System Integrity (Event # 41681)
8. Control Rod Stuck in Reactor Core (Event #42569 May 11, 2006)

The embrittlement at Palisades, the unresolved risks of PTS, and the ever-increasing likelihood of the failure of the RPV as Palisades ages warrant special environmental considerations. This type of accident is considered one that goes beyond the design of the reactor. NRC has not, however, included the issue in the EIS nor incorporated it in "Beyond Maximum Credible Accident" scenarios for Palisades as a potential accident. Further, NMC in its Environmental Report, has declined to undertake major refurbishment for Palisades' license renewal, despite Consumers Energy's earlier pledge to "anneal" (super-heat) the reactor pressure vessel. This super-heating theoretically can bring back ductility or flexibility to the metal, thus reducing potential for PTS. Annealing has never been performed in the U.S., however, and thus raises concerns itself as an experimental procedure.

Please include for the record the Adobe PDF document entitled "Palisades Nuclear Plant Yearly Capacity Factors" & "Palisades Plant - Record of Transients or Operational Cycles" for Occurrence #1 dated 1/11/1972 through Occurrence # 126 dated 1/9/2005. This is a record which has major implications for embrittlement and the Reactor Pressure Vessel at Palisades. A hard copy will be sent. Please enter it into the record.

Age-related deterioration also increases the likelihood of unintentional leaks, as plant systems, structures and components wear out and fail. Palisades' age-related degradation means increasing amounts of radioactivity will be "routinely" released over time. Plans for addressing embrittlement and other aging issues at Palisades are not provided in NMC's Environmental Report or in the EIS. Any discussion of 20 additional years of operation at Palisades necessitates a specific plan for addressing embrittlement and aging issues.

The most recent NRC report on a potential accident at Palisades, done in 1982, (Calculation of Reactor Accident Consequences or CRAC- 2), predicted that a meltdown and large-scale radiation release from the Palisades reactor would cause 1,000 fatalities and 7,000 injuries in just the first year, 10,000 cancer deaths over time, \$52.6 billion in property damage (based on 1980 census, expressed in 1980 dollars, thus significantly underestimating current and future impacts due to population growth and inflation; adjusting for inflation, property damage could exceed \$100 billion expressed in year 2005 dollars). The above CRAC - 2 report did not take into account a "Beyond Maximum Credible Accident" scenario. We request the EIS provide assessment of the consequences of a "Beyond Maximum Credible Accident" as Palisades' embrittlement status increases the likelihood of such an accident.

XII. Emergency Evacuation Plans Need Updating

Emergency responders in the 50-mile zone around the Palisades nuclear reactor are likely to be inadequately trained and inadequately equipped to respond to a major radioactivity release during an accident or attack at the Palisades plant. Covert Township does not have the staffing, equipment, training or preparedness for a major radiological emergency, the risk of which increases with 20 additional years of operation at Palisades., as the plant ages.

Other communities within the 50-mile zone are mostly rural, and maintain only volunteer fire departments, which have even less equipment and training than Covert Township. Radiation monitors and radiation-protective gear are unheard of, or in limited supply. Isolation wards for radioactively contaminated victims - the patients themselves posing a hazard to emergency medical technicians, doctors, and nurses -- are limited as well at hospitals within 50 miles of Palisades

NMC/Consumers are obligated to demonstrate how the communities that surround its facility are equipped for such a risk referenced in NRC's 1982 report, of a catastrophic radiation release, as well as ensuring that the plant's current Radiological Emergency Response Plan projects 20 years forward and incorporates population trends and development, highway construction projects, transitory populations of migrant workers, and provisions for bi-lingual notifications and dissemination of information.

XIII. Dispute Regarding Violations of Palisades' NPDES Permitted Discharges Remains Unresolved

There are questions regarding the status of the NPDES permit of Palisades to utilize and eventually discharge a compound, Betz Clam-Trol, to Lake Michigan to control mussel and clam mussel colonization in discharge and intake pipes. Reports posted by the Michigan Department of Environmental Quality (MDEQ) in 2000 and through 2004 indicated "continued non-compliance." Subsequent updating of the reports now appears to indicate that the plant is and was in compliance with its permit. To further confuse the matter, MDEQ has stated that the original reports were erroneous. We ask that a full explanation be provided for this situation and how it will be considered in the re-licensing decision. The impact of 20 additional years of pollution improperly controlled under requirements of the National Pollutant Discharge Elimination System will adversely affect the water quality of nearby sources, including Lake Michigan.

In its "Ninth Biennial Report on Great Lakes Water Quality," the International Joint Commission urged that "[g]overnments monitor toxic chemicals used in large quantities at nuclear power plants, identify radioactive forms of the toxic chemicals and analyze their impact on the Great Lakes ecosystem." The draft EIS must address how the NRC or the U.S. Environmental Protection Agency has met this obligation.

XIV. Analysis of Alternatives to License Extension Flawed and Self-Serving

In the draft EIS, Section 7.0, "Alternatives to the Proposed Action," renewable energy sources such as wind power and solar power, as well as alternatives such as energy efficiency and conservation, are not given credible consideration. Polluting electricity sources such as fossil fuels are cited by NMC/Consumers as the only realistic alternatives to approval of a 20-year license extension at Palisades. This is not surprising, as nearly three-quarters of Consumers' electricity generation (in 2002) comes from fossil fuel facilities. But the choice is not just between nuclear power and coal as sources for electricity generation. NMC/Consumers reveal a bias in favor of fossil fuel and nuclear power use by presenting only those two sources favorably in their Environmental Report, and by downplaying the potential for energy efficiency, energy conservation, and renewable sources of electricity. NRC echoes this as well in its draft EIS.

Renewables, efficiency and conservation are not only available, reliable, safe, clean and affordable options for electricity generation and savings, but also a source for tremendous job growth and cost savings. Using simple energy efficient techniques, Michigan citizens and businesses could easily reduce the state's energy demand by 1%, the energy used by 40,000 homes. In the state of Michigan there is currently 19,250 megawatts of generating capacity. Palisades generates 798 megawatts, or 4% of the power generation in the state of Michigan. Wind power potential in Michigan, according to the DOE, is 16,000 megawatts, or twenty fold the mega-wattage of Palisades, and could be a viable replacement for the energy that Palisades provides. In fact, wind power is the fastest growing new source of electricity in the United States, relative to all other sources.

NRC staff's assertion in the draft EIS that such wind power expansion would have a large negative impact due to the large surface area of land it would require is incorrect, and ignores the fact that small-scale family farmers could benefit from the placement of wind turbines on their fields. These farmers could either benefit from the lease payments from wind power companies for use of their land's "windshed," or could work towards owning their own wind turbines on their own land, and thus receive the full income from wind powered electricity generation. Wind turbines would not preclude the farmers' continued use of fields for agricultural crop or livestock production. Wind power could serve as a valuable source of income for farming families, complementing their agricultural livelihood, while also providing safe, clean, reliable, and inexpensive electricity for the region.

There are also many examples of new efforts underway in Michigan to move forward with renewable energy, with the deployment by Mackinaw Power of modern, large capacity wind turbines on the northern tip of Michigan's lower peninsula, plans to deploy more wind turbines on the Lake Michigan shoreline of west Michigan, and advances in solar electricity by United Solar Ovonic in Troy, Michigan (which

manufactures solar electricity generating roofing shingles). President Bush visited the headquarters of United Solar Ovonic earlier this year to promote promising renewable energy technologies.

It is especially significant that on April 6, 2006, Michigan Governor Jennifer Granholm signed Executive Directive No. 2006 - 2, which charges the Michigan Public Service Commission to prepare an "Energy Plan for the State of Michigan" by December 31, 2006. The directive calls for the development of a renewable portfolio standard that "establishes targets for the share of this state's energy consumption derived from renewable energy sources" and initiates the "appropriate use and application of energy efficiency, alternative energy technology, and renewable energy technologies.... consistent with the goal of assuring reliable, safe, clean and affordable energy." This puts the state of Michigan in a favorable position to promptly substitute clean energy sources for those with adverse impacts, such as nuclear power, as it moves into the forefront of renewable energy technology.

The full cycle of nuclear power illustrates its complete adverse environmental impact

There are many different types of nuclear power reactors. In the U.S. there are two types of light water reactors, Boiling Water Reactors (BWR) and Pressurized Water Reactors (PWR). Palisades is a pressurized water reactor. All, however, rely on a nuclear fission chain reaction to generate heat to boil water, to create steam, which is then used to drive an electrical generator. The radioactive material used in the fission process is uranium.

Mining for uranium involves separating the ore from rock, which leaves "tailings" that contain residues of uranium, and other radioactive materials (such as radium, radon, and thorium) from the radioactive decay of uranium and, although being considered "low-level" radioactive waste, actually contain around 85% of the natural uranium's original radioactivity. Mining of uranium is likely to impact the quality of Michigan's environment with an extension of Palisades' license, as there have been recent proposals to mine uranium in the Upper Peninsula of Michigan. The Great Lakes have already been damaged by such mining activities. Uranium mining at Elliot Lake, Ontario from the 1940s to the 1990s released vast quantities of radiological and toxic chemicals into Lake Huron. Despite the mines shutting down in the late 1990s, harmful effluents still flow into the Great Lakes. Mine tailings were flooded over with water to prevent oxidation, thus creating "dead," artificial lakes which dot the landscape.

After mining, raw ore is milled, ground up, and chemically leached into a powder called "yellowcake." The yellowcake powder is chemically processed or enriched, into either uranium dioxide for use in power plants or uranium metal, used in making nuclear weapons. Wastes from the enrichment process, also miss termed a "low-level" radioactive waste by NRC, are called depleted uranium or DU. The U.S. and some other countries use DU to coat tank armor and armor piercing shells/weapons. There is considerable controversy regarding DU coated weapons and the potential for exposure to depleted uranium to cause kidney and lung damage, and cancer and birth defects.

According to Dr. Arjun Makhijani, Director of the Institute for Energy and Environmental Research, uranium mining and milling inflicts some of the worst human health impacts of the entire uranium fuel chain. This is due to the careless handling of the radioactive materials involved, and dumping of waste materials upon the surface of the land, where they can be dispersed in air and water. Because of this, the Navajo Indian Tribe in the Southwestern United States – the largest Indian tribe in the country – has officially banned the mining, milling, or processing of uranium upon its reservation territory.

Nuclear power is not carbon-free. Considerable amounts of fossil fuel energy are used to mine, mill, process, and transport, and manage uranium ores and byproducts. As more reactor licenses are extended, fossil fuel use is likely to increase as poorer-quality ores are used due to the depletion of higher quality ore reserves because poorer quality ores require much more conventional energy for extraction and processing. Mining of more distant deposits also contributes greater carbon dioxide inputs to the atmosphere. Uranium enrichment is also energy intensive, and has historically involved the release of very large amounts of ozone layer destroying chlorofluorocarbons. NRC's draft EIS does not address such negative environmental impacts of the nuclear fuel chain. A full cost accounting of the uranium fuel chain's negative impacts on health and the environment is required to properly evaluate Palisades' twenty-year license extension request.

Nuclear power generation is more costly than readily available alternatives

Many costs associated with nuclear power are often hidden or externalized; for example, the very existence of the nuclear industry is only possible due to the government's assumption of the accident liability risk. According to Public Citizen ("Renewable Energy Is Capable of Meeting Our Energy Needs" fact sheet, 2006) direct taxpayer subsidies to the nuclear energy industry totaled \$115 billion between 1947 and 1999, with a further \$145 billion in indirect subsidies. In contrast, subsidies to wind and solar during the same period amounted to only \$5.5 billion.

Decommissioning, or the closing and dismantling of nuclear power plants, ranges from \$280-\$612 million for each plant, ultimately paid for by utility customers. DOE's latest cost prediction for the Yucca site for high-level radioactive waste generated up to the year 2010 is \$58 billion. Energy Secretary Bodman has recently admitted, however, that DOE has no total price tag predictions for the project and the state of Nevada predicts the cost will top \$100 billion. Ratepayers who receive electricity from nuclear reactors pay a Nuclear Waste Fee on their electricity bills. Several billion dollars of the Fund have already been spent at Yucca; about \$20 billion remains in the Fund, far short of DOE's now underestimate of \$58 billion for Yucca. The shortfall will have to be paid, yet again, by US taxpayers, many of whom have already paid as ratepayers.

Nuclear power is not, as currently promoted, cost effective compared with other energy sources. In a 2006 paper on the "economics and climate-protection potential" of nuclear power, Amory Lovins, energy researcher and director of the Rocky Mountain Institute,

describes the advantages of energy efficiency and explains that ".... nuclear power saves as little as half as much carbon per dollar as wind power and traditional cogeneration, half to a ninth as much as innovative cogeneration, and as little as a tenth as much carbon per dollar as end-use efficiency. Empirically, on the criteria of both cost and speed, nuclear power seems about the least effective climate-stabilizing option on offer." [Amory B. Lovins, "Nuclear power: economics and climate-protection potential, Rocky Mountain Institute, 11 September 2005, updated 6 January 2006, p. 15.]

Lovins puts it succinctly in his recent analysis: "No other energy technology spreads do-it-yourself kits and innocent disguises for making weapons of mass destruction, nor creates terrorist targets or potential for mishaps that can devastate a region, nor creates wastes so hazardous, nor is unable to restart for days after an unexpected shutdown."

The full costs of operating the Palisades nuclear plant for 20 additional more years, including the costs of accidents, waste storage, and decommissioning, must be assessed as part of the EIS.

Impacts from extreme weather/global climate change discounted by NRC

A majority of scientists throughout the world now believe that increased emissions of carbon dioxide since the Industrial Revolution are enhancing the greenhouse effect of the atmosphere that surrounds the earth, and causing a warming that will cause dangerous effects to the earth's climate and inhabitants - global warming. The NRC confirms it as well, in its analysis of impacts of alternatives that might be more appropriate options than extending the license for Palisades, as it concludes that the impacts of substituting coal plants for Palisades would be a "large" impact, due to their contribution to global warming.

A one-degree Celsius warming of the earth's surface may seem insignificant, but it is not. The temperature of the earth's surface greatly affects our climate in many ways. In particular, a warmer planetary climate means more rain, flooding, and snow in various regions, earlier spring arrivals, hurricanes, heat waves, drought and fires in some places, frigid cold in others.

The effects are already seen in Michigan, where water in the Great Lakes is warming. According to Dr. Natalia Andronova, research scientist at the Department of Atmospheric, Oceanic, and Space Sciences at the University of Michigan in a May 7, 2006 interview with the Ann Arbor News, "Measurements of the near-surface temperature over the northern part of Lake Michigan and southern part of Lake Huron showed that for both lakes the period from 2000 to 2005 was warmer by at least two degrees Celsius than the period from 1981 to 1985." An increase of Lake Michigan water temperatures may eventually affect Palisades' operation, since the condenser within the plant requires cooler water to operate efficiently. During a heat wave in the late 1990s, reactors on the U.S. side of Lake Ontario shut down because the water temperature was too high to efficiently cool the reactor and generate steam for electricity production. During the extreme heat wave in France in recent years, nuclear reactors released so

much superheated water to rivers that fish kills occurred; operators had to hose down the exterior of reactors as an emergency measure to provide additional cooling at the same time.

In the recent interview, Dr. Andronova also noted conditions particular relevant to re-licensing of Palisades. She commented that “it is becoming windier over the Great Lakes. The extreme winds increased from the one period to the next by more than 3 meters per second.” More extreme winds, as well more frequent and intense tornadoes – all of which global warming could cause – could make operation of Palisades more and more risky over time. For example, documents received by the Nuclear Information and Information Resource from NRC during a Freedom of Information Act request regarding the October 2005 “near-drop” of a storage cask into the irradiated nuclear fuel pool at Palisades revealed that on extremely windy days, Palisades is prohibited from lifting loaded dry casks from the pool, as the high winds make crane operations too dangerous.

The potential danger presented by tornadoes to reactors was clearly shown in 1998, when a tornado struck the Davis-Besse nuclear plant in Ohio, knocking out the off-site electricity supply; the emergency back up diesel generators also malfunctioned. If not for extreme efforts by staff, the plant could have lost coolant, leading to a meltdown. An increase in severe weather due to global climate destabilization in the region could well increase risks at Palisades. Far from being a solution to global warming, nuclear power could become unacceptably dangerous and unreliable due to global warming.

The draft EIS prepared by the NRC unaccountably discounts the effects of global warming, noting that its effects cannot be predicted. We assert that there is sufficient information currently available that should be investigated and considered regarding the impacts of changes in weather that may occur in a 20-year extension to Palisades’ license. This must also include an analysis of the increased potential for an electrical station loss of power that could lead to loss of cooling in the reactor core and waste storage pool, with the potential for core meltdown and waste pool fires, with consequent catastrophic large-scale radiation releases to the environment. The warming of the cooling water supply from Lake Michigan must also be considered in regards to the efficiency and safety of Palisades continued operation till 2031.

XV. Endangered Species Harmed by Radioactive Discharges

Plant and wildlife species become endangered for a variety of reasons, including loss of habitat, overexploitation, disease and pollution, and the introduction of invasive species. Official designation of a species by federal or state government as endangered or threatened not only acknowledges the importance of that species, but also its fragile status that requires special protection efforts. These special protection efforts most certainly encompass protection against the routine and cumulative exposure to radioactive substances.

Frameworks for radiological protection have traditionally been focused on the protection of humans. The International Commission on Radiological Protection (ICRP), which provides recommendations on protection against ionizing radiation, has maintained that "if man is adequately protected then other living things are also likely to be sufficiently protected" (ICRP, 1977). There is no scientific evidence, however, to support this viewpoint.

In addition, it is well established that ionizing radiation is one of the causes of genetic mutation. Species exposed to cumulative exposures from the radioactive discharges of a nuclear power plant may over time develop subtle genetic alterations that are not observable in the short term, but that could have subtle, but large impacts within a population. This has significant implications for threatened and endangered species.

NMC/Consumers' Environmental Report identifies numerous federal and State of Michigan endangered, threatened, candidate or species of special concern – such as the eastern box turtle, lake sturgeon, lake herring, creek chub sucker, Pitcher's thistle, prairie warbler, prairie vole, eastern massasauga rattlesnake, spotted turtle, Indiana bat, globe-fruited seedbox, scirpus-like rush, bald rush, Carey's smartweed, and sedges that either already live at or near the Palisades reactor or along its transmission lines, or very likely could in the future.

Approving a license extension of 20 more years of reactor operations at Palisades increases the fragile status of these already threatened, endangered, or candidate species, from daily "routine" radiation releases and/or potential large-scale radiation releases. At minimum, NMC/Consumers must be required to establish a baseline for the status of the endangered species listed above and conduct appropriate monitoring to ensure that Palisades is not further endangering their health and viability.

XVI. Conclusions

For the reasons laid out in this document, the coalition of aforementioned environmental, social justice, and public interest organizations oppose the application by Palisades nuclear power plant to operate for an additional 20 years beyond its original 40 year license. The decision to sanction approval of the 20-year license extension appears to have been predetermined and the invitation to members of the public and citizens of this region to participate in this decision making process has been merely perfunctory. This coalition of organizations protests the severe limitations of the process and advocates for a decision-making framework that allows for an unbiased, deliberative, participatory discussion as to whether or not to allow 20 more years of operation by the Palisades nuclear power plant.

With a **fair and just** Environmental Impact Statement – the conclusion reached in the EIS would not have been the continued operation of a potentially catastrophic accident risk and terrorist target on our beloved Lake Michigan shoreline. These risks are

exacerbated by the already regrettable high-level radioactive waste storage -- or de facto high-level nuclear dump -- in the heart of the Great Lakes.

There are too many explicit threats to the region's environment and people that have been ignored in order to promote the use of an energy that is far too costly, exceedingly hazardous, increasingly risky and highly irresponsible, as the question of a solution to the waste problem is passed down as a regrettable legacy to future generations.

For these reasons we urge that the proposed 20-year license extension be denied until all environmental impact concerns raised here and by other stakeholders are addressed in an objective process that is deemed acceptable by the public as prescribed by the 1969 National Environmental Policy Act (NEPA).

Recommendations

Security issues at Palisades must be addressed immediately. If a mock attack or force on force demonstration has not been conducted at Palisades, it should be conducted as soon as possible. Classified results of the demonstration should then be directly communicated to the region's U.S. Congressional representatives and senators, as well as the Governor and Attorney General of the State of Michigan, for their thorough review and approval and reporting back to the public. The following security safeguards, if not instituted already, must be put in place immediately:

- Sufficient cameras and patrols;
- Delay measures, such as fences outside buildings and entrances that would delay potential attackers;
- Bullet resistant structures in the protected areas of the plant site;
- Adequate and specific training for security officers;
- Several levels of intrusion detection systems (Needed especially by Palisades to protect against intrusion from potential attackers that may enter from Van Buren State Park, adjacent to the plant site.);
- Vehicle barrier systems to prevent vehicles with bombs from entering the site;
- Anti-aircraft capability, and;
- Shore patrol equipped with stationary weaponry capable of preventing an offshore assault.

NRC and Palisades must also ensure that the plants irradiated nuclear fuel storage pools are safeguarded from terrorist activities as well as address civil liberties ramifications of increased security to the host and surrounding communities of Palisades.

Native American interests must be addressed. All Native American tribes and bands that could be expected to have an interest in the application by Palisades to operate an additional 20 years deserve both notification of this process, as well as the opportunity to share government-to-government decision making regarding the application, as allowed for under NEPA and other federal laws. A comprehensive site wide survey

should be performed on the entire Palisades property – as recommended by Palisades' own cultural resource assessment subcontractor as described in the draft EIS - carried out in close consultation with all affected tribes.

Effects on the health of populations surrounding Palisades and subject to downstream or downwind discharges must be studied and quantified. The implications of the National Academy of Science's recent findings require a thorough analysis by the NRC in its EIS of the human health impacts of the radioactive substances released by Palisades. NMC/Consumers are obligated to provide the communities in the vicinity of the Palisades plant, with a monitoring program to provide them with independent information regarding radioactive discharges and releases. There is also a need to establish a baseline assessment of cancer and other disease rates, as well as a program of regular monitoring, prior to consideration of the proposal for a 20-year license extension. This should also include an evaluation of the potential for the synergistic effects of chronic or catastrophic radiation releases combined with the toxic pesticides to which migrant field workers in the region have been exposed.

NRC must provide a detailed explanation to the public as to the ultimate disposition of the wastes stored currently on the Palisades plant site, as well as the 290 additional tons expected as part of 20 additional years of operation.

The proposed national repository for high-level wastes from nuclear power plants, Yucca Mountain, Nevada, is not expected to open until at least 2020, and is likely to be delayed beyond that date. Further, by law, the repository can only store 70,000 metric tons, which will not include the additional wastes generated at Palisades during a license extension. NRC in its EIS, must also explain how Palisades will deal with its "low" level radioactive wastes when its current repository site in Barnwell, South Carolina closes in 2008.

Barging of high-level radioactive wastes in Lake Michigan must be removed as a transportation option. The barging of 125 or more shipments of high-level radioactive waste on Lake Michigan is simply too risky. Any submersion of the casks containing the wastes in water, could stimulate the fissile uranium-235 and plutonium, both present in the high-level waste, to cause a nuclear chain reaction. The slightest leakage of even a small amount of this waste could not only threaten Lake Michigan as a source of drinking water for ten million people, but also cause a host of other irrevocable impacts on the lake's fish, wildlife, people, and economy.

NRC must require Palisades to develop and implement a specific plan for addressing embrittlement and aging issues. Plans for addressing embrittlement at Palisades are not provided in by NMC or in the EIS. Any discussion of 20 additional years of operation at Palisades necessitates such a plan to address the aging of plant structures and components. We request the EIS provide assessment of the consequences of a "Beyond Maximum Credible Accident" as Palisades' embrittlement status increases the likelihood of such an accident.

NMC/Consumers must demonstrate how the communities that surround its facility are equipped for a catastrophic radiation release. The plant's current Radiological Emergency Response Plan is inadequate and must be revised to project 20 years forward and incorporate population trends and development, highway construction projects, transitory populations of migrant workers, and provisions for bi-lingual notifications and dissemination of information. This requires Spanish language emergency evacuation instructions and notifications prepared to serve the Spanish speaking Latino population.

A comprehensive analysis of socio-economic conditions in Covert Township and Van Buren County must be conducted to encompass income disparities. NRC must account for the lack of positive benefit by Covert Township residents as a result of the presence of Palisades' nuclear power plant and potential license extension. NRC must also direct NMC/Consumers to address the potential for disproportionate harm to the Latino migrant labor workforce from harm to the agricultural base from a radiation release.

The safety of the concrete pads and the storage casks of high-level wastes must be resolved to the satisfaction of citizens of the region. The potential for earthquake activity to damage Palisades' outdoor dry cask storage pads, upon which the casks have been placed, warrants rigorous consideration, which unfortunately, is not in evidence in the EIS. Further, blowouts, areas of blowing and unstable sands, in dunes in the vicinity of Palisades' dry cask storage system could threaten the integrity of the dry cask storage waste system, by clogging vents in the casks, and causing the wastes to overheat, which could lead to an explosion. Palisades must be required to monitor the dunes for potential blowouts and ensure that the dunes are consistently vegetated and stable.

NRC must revise its analysis of energy alternatives. Full and objective consideration must be afforded the options of renewable energy and efficiency. NRC must also provide a thorough cost accounting of the uranium fuel chain's negative impacts on health and the environment.

The EIS should be revised to include how the NRC meets its obligations as described in the International Joint Commission's (IJC) "Ninth Biennial Report on Great Lakes Water Quality." In it, the IJC urged that "[g]overnments monitor toxic chemicals used in large quantities at nuclear power plants, identify radioactive forms of the toxic chemicals and analyze their impact on the Great Lakes ecosystem."

NRC must assess and consider as part of the EIS, the information currently available regarding the impacts of global warming to the region. This must also include an analysis of the increased potential for an electrical station loss of power that could lead to loss of cooling in the reactor core and waste storage pool, with the potential for core meltdown and waste pool fires, with consequent catastrophic large-scale radiation releases to the environment. The warming of the cooling water supply from Lake

Michigan must also be considered in regards to the efficiency and safety of Palisades continued operation till 2031.

NMC/Consumers must be required to establish a baseline for the status of the endangered species and conduct appropriate monitoring to ensure that Palisades is not further endangering their health and viability. Approving a license extension of 20 more years of reactor operations at Palisades increases the fragile status of these already threatened, endangered, or candidate species, from daily "routine" radiation releases and/or potential large-scale radiation releases.

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Hiromitsu Ino

Aging Nuclear Power Plants

focusing in particular on irradiation embrittlement of pressure vessels

Japan’s Aging Nuclear Power Plants

Japan began generating nuclear power in 1970. The Tsuruga-1 plant began operations on March 14, 1970, just in time to provide atomic energy for the Osaka Expo. At the time most people were not aware of the dangers associated with nuclear power. It is fair to say that they hoped that scientific and technical progress would enable the same nuclear energy that brought about the tragedy of Hiroshima and Nagasaki to be used for peaceful purposes.

After Tsuruga-1, which was a boiling water reactor (BWR), on November 28 of the same year the Mihama-1 pressurized water reactor (PWR) began operations. Thereafter, as can be seen in Figure 1⁽¹⁾, the number of nuclear power plants in Japan increased rapidly. By the 1990s Japan was third in the global nuclear energy stakes after the United States and France. In 2005 the Higashidori and Shika-2 reactors came on line bringing the number of reactors to 55, with a total generating capacity of 49.58 GW. Since then, Hamaoka Units 1 and 2 were permanently closed down (January 2009), Tomari-3 came on line (December 2009), and six reactors at the Fukushima Daiichi Nuclear Power Station were effectively knocked out by the Great East Japan Earthquake, bringing the number of “surviving” reactors to 48. (As of the end of March 2012, TEPCO has officially recognized the permanent shutdown of Fukushima Daiichi Units 1 to 4.) However, of those there is no indication that eleven reactors will restart: three reactors (Units 2, 3, 4) of the seven-reactor Kashiwazaki-Kariwa Nuclear Power Station

have not restarted since the Chuetsu-oki Earthquake in July 2007; the three Onagawa reactors, the four Fukushima Daini reactors and the Tokai Daini reactor were all shut down by the Great East Japan Earthquake. Besides these, Japan's other nuclear reactors have not yet passed stress tests, so all Japan's reactors are likely to be out of action by early May 2012.

Japan's nuclear power plants began commercial operations over ten years later than the first plant in the United States. With the exception of two reactors (USA) started up in 1969, the power plants which began operations in the 1960s in countries such as the United States and Germany have been decommissioned, so Japan is now a world leader in the operation of aging reactors⁽²⁾. Unlike when the plants were built, there is no model for managing aging plants.

Before nuclear power plants reach 30 years of operations, and every ten years thereafter, utilities are required to produce a technical assessment for the operation of aging plants. Utilities may be granted approval to continue operating aging plants on the basis of a review by The Ministry of Economy Trade and Industry's (METI) Aging Response Review Committee. At the moment there are over 20 reactors in Japan which have been operating in excess of 30 years, including Tsuruga-1, Mihama-1~3, Fukushima Daiichi-1~6, Shimane-1, Takahama-1&2, Genkai-1. Of those, Tsuruga-1, Mihama-1 and Fukushima Daiichi-1 have already been operating for 40 years and been granted approval to operate for a further 10 years.

How long were nuclear power plants designed to operate? These days utilities and METI claim that no life expectancy was determined, but in fact Japan's nuclear power plants were designed with an expected life of 40 years. That is evident if one looks at the pressure vessel. In the 1970s the utilities' license applications included an evaluation of neutron irradiation embrittlement (see below) based on an assumed operating life of 40 years. Furthermore, monitoring specimens placed in the reactors assume 40 years of inspections. In most cases only five or six sets of specimens were placed in

the reactors. This became a problem when the issue of life extensions arose, so in 2007 a rule (JEAC 4201-2007) was hurriedly introduced which allowed the specimens to be cut and re-used.

It is thought that the reason why Japan's reactors were designed to last 40 years was because the license to operate nuclear power plants in the United States was for 40 years. However, there is evidence that at first the estimated life was 30 years. According to a Toshiba engineer who worked on nuclear power plants, Shiro Ogura (personal correspondence), the design life written in specifications at the time when GE was prime contractor for Fukushima Daiichi-1&2 was 30 years. He said that when Toshiba became the prime contractor for Fukushima Daiichi Unit 3 the design life was changed to 40 years.

Articles⁽³⁾ about changes due to aging written in the 1980s by researchers at the Japan Atomic Energy Research Institute were based on the assumption of a 40-year life, so it can be assumed that at the time the shared understanding was that the life expectancy of nuclear power plants was 40 years.

No matter what the equipment or machinery, as it gets older the frequency of breakages and other problems increases, making maintenance difficult. Associated costs and labor also increase. Nuclear power plants are no exception. Rather, it is normally assumed that damage will occur sooner in nuclear power plants because of their high technology nature, which pushes design capabilities to the limit.

In 2003, immediately after revelations of cover-ups of cracks at Tokyo Electric Power Company's (TEPCO) nuclear power plants, we set up the Nuclear Aging Research Team to focus on issues associated with aging of nuclear power plants. The pamphlet "Rokyuka suru genpatsu: gijutsu wo tou" (Aging Nuclear Power Plants: Questioning Technology)⁽⁵⁾, which we published in 2005, raised the alarm about the dangers of aging nuclear

power plants. Thereafter, in July 2007 the Kashiwazaki-Kariwa Nuclear Power Station was struck by the Chuetsu-oki Earthquake and then in March 2011 the Great East Japan Earthquake caused a severe accident at the Fukushima Daiichi Nuclear Power Station. As a consequence the world is now concerned about the seismic resistance of nuclear power plants, but accidents can be caused by other things besides earthquakes. Even if there is no earthquake, or else in combination with an earthquake, deterioration of equipment and machinery could trigger a severe accident. We cannot relax our vigilance towards nuclear power plants whose lives have been extended beyond their use-by date.

The above mentioned “technical assessment for the operation of aging plants” contains headings related to aging, such as stress corrosion cracking and reduction of insulation of electrical equipment and instruments, but most importance is placed on the neutron irradiation embrittlement specimens in the pressure vessel. This is the issue that I will focus on in the rest of this article.

Outline of Neutron Irradiation Embrittlement in Aging Nuclear Power Plants

Destruction of the reactor pressure vessel due to neutron irradiation embrittlement should be called an *extreme* severe accident. If the pressure vessel breaks, there is almost no way of preventing a runaway chain reaction. There is also no way of preventing melt down of the nuclear fuel. Such extreme damage must be avoided at all costs.

The benchmark for irradiation embrittlement is the ductile-brittle transition temperature (DBTT). If an extreme situation arises such as pipe rupture due to an earthquake, it is necessary to cool the core using the emergency core cooling system (ECCS). However, if the DBTT is high, this is a dangerous operation. When cooled suddenly, a temperature difference arises between the inner and outer walls of the pressure vessel and strong tensile stress is

brought to bear on the inner wall. If such tensile stress is applied when the temperature is below the DBTT range, there is a danger that the pressure vessel could suddenly break completely.

Table 1 shows Japanese nuclear power plants in descending order of the DBTT of their pressure vessels. (*Recently the DBTT of Takahama-1 was reported to have been measured at 95°C, making it the second worst.) The table shows seven reactors in which DBTT exceeds 50°C. They are all old reactors that began operating in the 1970s.

Table 1: Reactor Pressure Vessel Ductile-Brittle Transition Temperature (DBTT) – Worst 7

Rank	Reactor Unit	Type	Startup	Classification	DBTT	Neutron fluence (10^{19} n/cm ²)	Date of experiment (removal)
1	Genkai-1	PWR	Oct. 15, 1975	Mother material	98°C	7.0	April 2009
2	Mihama-1	PWR	Nov. 28, 1970	Mother material	74°C	3.0	May 2001
				Weld material	81°C		
3	Mihama-2	PWR	July 25, 1972	Mother material	78°C	4.4	Sep. 2003
4	Ohi-2	PWR	Dec. 5, 1979	Mother material	70°C	4.7	March 2000
5	Takahama-1	PWR	Nov. 19, 1974	Mother material	68°C *	1.3	Nov. 2002
6	Tsuruga-1	BWR	Mar. 14, 1970	Mother material	51°C	0.094	June 2003
				Weld material	43°C		
7	Fukushima Daichi-1	BWR	Mar. 26 1971	Mother material	50°C	0.09	Aug. 1999

Source: Prepared by the author from "Results of Monitoring Tests on Steel in Nuclear Reactor Pressure Vessels," CNIC
*As of July 2011. A DBTT of 95°C was later observed in Takahama-1.

Genkai-1 is the worst. The DBTT for this reactor was announced in October 2010. The figure comes from the most recent test of monitoring specimens in April 2009. The DBTT rose 42°C since the previous test result of 56°C in February 1993. This is a new record for Japan. This reactor is discussed in detail in the next section.

All the reactors listed from second to fifth place in the table are located in Fukui Prefecture and owned by Kansai Electric Power Company (KEPCO). In particular, we have been concerned about the continued operation of Mihama-1&2, where high DBTTs have been observed since the beginning of the 1990s. KEPCO asserts that results of pressurized thermal shock (PTS) analysis show that even if the ECCS was used in the event of a pipe rupture the pressure vessel would not fail.⁽⁶⁾ However, the evaluation methodology for the stress arising K_I has not been released, so it is not possible to know whether this analysis is reliable.

PTS analysis⁽⁷⁾ assesses the pressurized thermal shock to the core of the pressure vessels of PWRs in the case of accidents such as loss of coolant accidents and main steam pipe ruptures. If sudden cooling occurs in the case of accidents such as these, temperature differences arise between the inner and outer surfaces of the pressure vessel and strong tensile stress arises on the inner surface. If the pressure vessel has become brittle (below DBTT), cracks progress and the pressure vessel fails causing a severe accident. It is necessary to confirm that the stress intensity factor K_I does not exceed the fracture toughness K_{IC} .

The reactors listed in sixth and seventh places in Table 1 are BWRs. The inner diameter of BWR pressure vessels is large compared to PWRs and the amount (flux) of neutron irradiation received in a given time is one or two orders of magnitude less than in PWRs. From the table it can be seen that the total amount (fluence) of irradiation received by Tsuruga-1 is about one thirtieth of that of Mihama-1, even though they began operating at much the same time. (There is a slight difference in operating time and also in the date the specimens were taken.) Consequently, it was thought that neutron radiation embrittlement was not such a big problem in BWRs as it was in PWRs. (Even now many researchers and engineers are still in the grips of that “common sense”.) However, after many years of operation, as we came to know the reality of irradiation embrittlement in BWRs, this “common sense” was overturned. The total amount (fluence) of irradiation is not the only determining factor for irradiation embrittlement. It has become clear that the rate (flux) at which irradiation occurs is also a determining factor. As will be discussed later, this led to an amendment to the monitoring specimen method JEAC-4201 and led to the situation where two BWRs are now listed among the worst seven, besides other BWRs with high levels of irradiation.

Why Does Irradiation Embrittlement Occur? - Basic Concept

Metal materials are degraded for all sorts of reasons. One reason is

“radiation damage”. This phenomenon is investigated at the atomic level by means of the concept of lattice defects. The Physical Society of Japan has had a section on lattice defects for over 50 years. Pardon me for speaking of my personal involvement in this field, but I have devoted myself to this field of research since becoming interested in it as a university student. I became a tutor at Osaka University and experienced the student uprisings of the 1960s. In hindsight I can see that this field of research, which originated in America, developed in tandem with nuclear energy. Nevertheless, that fact did not lead me to abandon the field. I was eager to carry out materials research using radiation as a guest researcher of the Kyoto University Research Reactor Institute.. However it was difficult to see a connection between this research and the social problems associated with nuclear energy.

The reason why irradiation defects became an important research theme was because when neutrons generated by nuclear fission hit reactor vessels and pipes they damage metal materials. This is called “neutron radiation damage”. If it causes materials to become brittle, it is called “neutron irradiation embrittlement”. Of particular importance is neutron irradiation embrittlement of the steel of the reactor pressure vessel, which is the heart of a nuclear power plant. If this is damaged it can lead directly to an uncontrollable severe accident.

What type of lattice defects arise from neutron radiation? Atoms in their crystals are precisely aligned in lattices, but if they are struck by a neutron they are displaced, leaving a hole. This is called a “vacancy”. Displaced atoms are called “interstitial atoms”. This phenomenon is called a “lattice defect”. In addition, secondary defects result when vacancies and interstitial atoms move about and accumulate, creating “vacancy clusters” and “interstitial atom clusters, respectively. Impurities within the metal (copper atoms etc.) move to form “impurity clusters”. These “secondary lattice defects” cause metals to lose their characteristic ductility (plasticity) and make them

brittle. To compare it to the human body, it is like the hardening of the arteries which makes blood vessels vulnerable to rupture.

Usually, when a force is applied to steel it just deforms without breaking, but below a given temperature, if the slightest force is applied, rather than deforming plastically it breaks like pottery. This critical temperature is called the ductile-brittle transition temperature (DBTT). This brittleness of steel used to be the bane of shipbuilders. Many ships sank due to this phenomenon. The Titanic, which sank exactly 100 years ago in 1912 when it struck an iceberg while crossing the North Atlantic Ocean, is a famous example. Subsequent studies showed that poor quality steel plate was used and that the DBTT was 27°C.

When reactor pressure vessels are bombarded by neutrons the DBTT rises. When designing nuclear reactors it is necessary to predict how high the DBTT will rise and whether they can survive for the period of their design lives. However, assuming a design life for nuclear reactors of 40 years, it is impossible to know how they will be after 40 years until 40 years has elapsed. That presents a problem, so accelerated experiments are conducted. Accelerated experiments are commonly used tests to assess endurance by, for example, applying beyond normal load, or operating plants at greater than normal speed.

Likewise, when conducting tests for neutron irradiation embrittlement, the amount (flux) of neutron exposure in a given period of time is increased far above normal amounts. Materials test reactors can radiate materials at a rate of 10^{12}n/cm^2 . The "n" stands for "neutron". This rate (flux) of exposure is between 100 and 10,000 times the rate of exposure in normal reactors, given that the rate of exposure for PWRs is 10^{10}n/cm^2 , while the rate for BWRs is 10^8n/cm^2 . That means the amount of irradiation a BWR would sustain in 40 years can be applied in one or two days. Using such data a formula predicting embrittlement was produced. Furthermore, besides the normal monitoring specimens, accelerated monitoring specimens are also

placed in BWR reactor vessels. They are placed not on walls of the vessel itself, but nearer to the core, where the rate (flux) of radiation is an order of magnitude higher. The idea is to predict the future state of the reactor. Likewise monitoring specimens are placed deeper inside PWRs than the walls of the reactor vessel. For example, in the case of Genkai-1 discussed below, the rate of radiation is about double the normal rate. It is an attempt to read the future.

However, there is an assumption underlying the notion that the future can be predicted. That is that regardless of the rate (flux) of irradiation, or, to put it another way, regardless of the period of exposure, if the total amount (fluence) of radiation is the same, the result will be the same. The formula for this assumption is as follows:

$$\text{Rise in DBTT} = \text{material factor} \times F(\dot{F})^{(8)}$$

The material factor is determined by the type and the concentration of impurities in the steel. For example, if there is a lot of copper, the material factor will rise. $F(\dot{F})$ is the irradiation factor. It is postulated to be a function of the fluence of neutron irradiation " F " alone.

With accumulated experience of operating nuclear power plants, it became possible to obtain long-term data of monitoring tests in real life conditions and it became clear that this formula was suspect. In particular, with regard to BWRs, for which the rate of irradiation is slower, it became clear that the results for the normal monitoring specimens and the accelerated monitoring specimens placed in reactors did not agree. This trend is particularly pronounced in reactors like Tsuruga-1 and Fukushima Daiichi-1 where there is a lot of copper impurity in the steel of the reactor pressure vessels. It can be seen from this that the irradiation factor $F(\dot{F})$ is dependent not only on the fluence of neutron irradiation " F ", but also on the flux of irradiation.⁽⁹⁾

We noticed this over ten years ago and alerted researchers to the issue.⁽¹⁰⁾ However, at the time, the results of American research refuting dependence on the flux of irradiation held sway, so Japanese researchers refused to take

the matter seriously and they did not alter the embrittlement prediction formula.⁽⁸⁾ Faced with data from Tsuruga-1 showing unpredicted high levels of DBTT, METI's Aging Response Review Committee dismissed the results saying they were due to data scatter.^(11,12)

Thereafter, analysis of the micro-formation of copper progressed, and it became clear that when the rate of radiation is slow mainly clusters of copper atoms (obstructions) form, whereas in accelerated irradiation tests mainly clusters of vacancies form, so the cause of the hardening (embrittlement) is different. The results of this micro-analysis backed up our computer simulations.⁽¹³⁾ The outdated thinking described above was forced to change and now the dependence of radiation embrittlement on the flux of irradiation is the shared academic understanding. The irradiation embrittlement prediction formula used in monitoring test methodology was changed and a new methodology (JEAC 4201-2007) was produced.⁽¹⁴⁾ From mid-2011 assessment of pressure vessels shifted to the 2007 formula, but when the increase of DBTT using this formula is smaller than that using the previous 2004 formula, the 2004 formula is included as a reference.

However, even the 2007 formula cannot explain high DBTT for metal welds in Tsuruga-1 that we have drawn attention to. The metal welds in Tsuruga-1 have low levels of copper impurities, unlike the parent metal, so they shouldn't have high DBTT. The amended JEAC-2007 was not able to adequately explain the complex reality.

Unpredicted Embrittlement in Genkai-1 Reactor Pressure Vessel

We looked into the "unpredicted" monitoring specimen data. The results were from Genkai-1. At the October 25, 2010 meeting of Karatsu City Municipal Assembly's Pluthermal Special Committee, Kyushu Electric Power Company announced that the DBTT observed in Genkai-1's fourth monitoring test specimen, which was taken during a periodic inspection in April 2009, had reached 98°C. Previously, the highest DBTT for a reactor

pressure vessel had been 81°C for metal taken from a weld at Mihama-1 (see Table 1). The Genkai-1 specimen exceeded this, so it would be fair to conclude that Genkai-1 is the most dangerous reactor pressure vessel in Japan.

Furthermore, it is significant that this embrittlement was unpredicted. The DBTT observed in the previous (third) monitoring test (February 1993) was 56°C. That had increased by 42°C, which was contrary to the predicted result. Figure 2 is a diagram submitted by Kyushu Electric in its December 2003 Aging Technical Assessment, with a “×” added to the top right corner to show the result of the fourth monitoring test. Up until the third monitoring test the data points could be more or less plotted onto the predicted curve, but the latest data point is way above that curve. If you look closely at the diagram you will see that the broken line is the predicted curve and that a line is added above that showing the upper limit of the margin for error. However actual embrittlement is way above that upper limit.

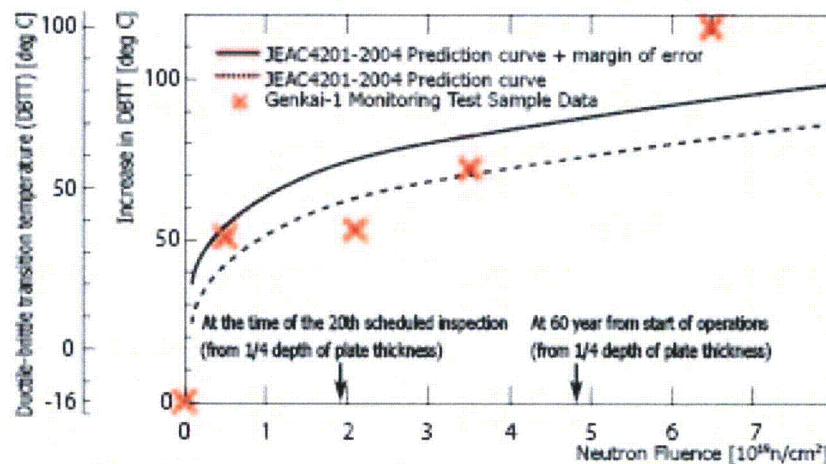


Figure2
Genkai- Monitoring Test Sample Data and JEAC 420 1-2004 Prediction Curve.

Kyushu Electric says that 98°C is the value predicted for 2060 (85 years after the start of operations), while the predicted DBTT for 2035 (60 years after the start of operations) is 91°C and for August 2010 (35 years after the start of operations) is 80°C. (*If the 2007 formula is used the predicted DBTT is somewhat higher, so Kyushu Electric has amended it.) Let us

consider whether this is correct.

We must first understand the data on which this is based. Table 2 shows the results for the first to fourth monitoring tests. The amount of neutron irradiation is the amount for the specimens, not for the pressure vessel itself. The specimens were placed deeper inside the reactor than the reactor walls, so they were irradiated by more neutrons. Since the specimens have been irradiated by more neutrons than the reactor walls in the same time, operating years are converted to “effective operating years”.

Effective operating years for the fourth monitoring test specimen was 66 years, meaning the reactor walls would be irradiated by the same amount of neutrons after 66 years. Since the reactors do not operate continuously, this amount of irradiation would not actually be reached until 85 years after the reactor began operating. How then are the present DBTT and the DBTT after 60-years estimated? Since DBTT is 98°C after 85 years, bringing it back to 35 years and 60 years Kyushu Electric comes up with the lower temperatures of 80°C and 91°C respectively.

The method used to derive this estimate is to redraw the prediction curve, adding a margin of error so that it passes through data point “×” in the top right corner of Figure 2, then to read off the DBTT corresponding to the amount of irradiation after 35 years and 60 years respectively. But for such a method to have a basis, the embrittlement prediction curve in Figure 2 must have some legitimacy. However, as discussed above, the formula used in the past has been pronounced invalid.

So can the new 2007 prediction formula explain the DBTT of Genkai-1? The answer is no.

Figure 3 shows the irradiation embrittlement prediction curve drawn by us on the basis of the 2007 prediction formula, and the observed DBTT.⁽¹⁵⁾ Like Figure 2, this diagram shows both the scale for DBTT and also for the

increase in DBTT, the difference from the initial DBTT of minus 16°C.

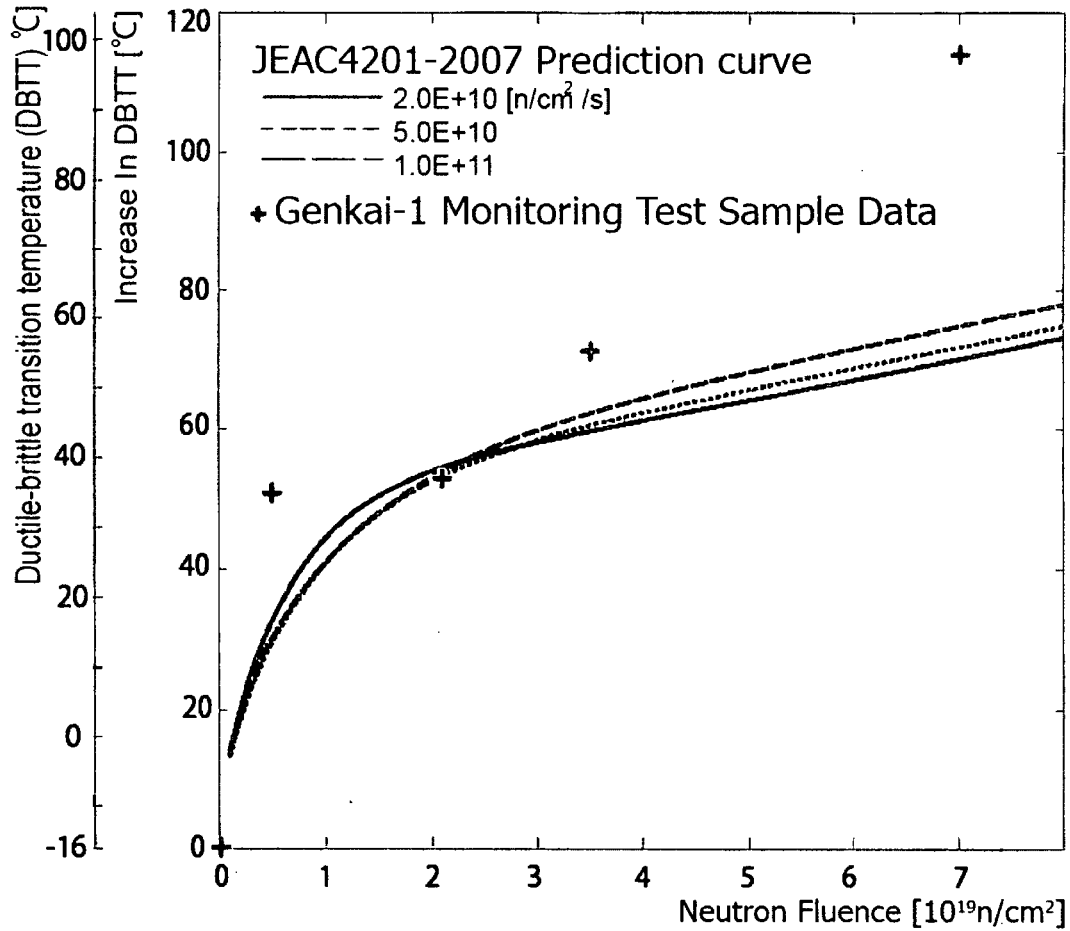


Figure 3: Genkai-1 Monitoring Data and JEAC-2007 Prediction

It can be seen that the observed data of 98°C is 42°C above the predicted curve. This cannot be explained in terms of margin of error. Compared to Figure 2, if anything the deviation is greater. Thus the 2007 prediction formula fails completely to reproduce the irradiation embrittlement behavior of Genkai-1. Hence, there is no explanation why a high DBTT was observed in Genkai-1. Given that such high DBTTs are observed when there is a high amount of copper impurity, or there is phosphorous grain boundary segregation, we cannot rule out the possibility that the Genkai-1 pressure vessel contains, depending on the location of the monitoring specimens, low quality steel with high levels of impurities. In regard to Genkai-1, both the 2004 formula (Figure 2) and the 2007 formula (Figure 3) have lost their

predictive power. It is meaningless to estimate based on these formulas that the current DBTT is 80°C, or that after 60 years operation it will be 91°C.

So what should we suppose the DBTT to be now? There is no sound method of estimating it. In that case, Kyushu Electric should respect the observed data of 98°C, assume that the pressure vessel itself has already reached this high DBTT (that being a true safety margin) and consider what response should be taken. The response should be to carry out the abovementioned PTS assessment based on a DBTT of 98°C, reconsider the operating sequence based on the 98°C figure, and also carry out pressure tests based on 98°C.

NISA's Response and Public Comments

We were surprised at the observed high DBTT for Genkai-1. As soon as we found out about it we requested Social Democratic Party leader Mizuho Fukushima to arrange a hearing with officers of Nuclear Industrial and Safety Agency (NISA) to find out about the monitoring test methodology etc. To our amazement, at that point in time (December 15, 2010) NISA had received no information about the results of the fourth monitoring test for Genkai-1. The first they heard of it was from the questions in our letter. Kyushu Electric had not informed NISA of the strikingly high DBTT and NISA said they did not know because they had no obligation to inquire. What a careless and lax safety monitoring system. At the hearing we demanded that NISA pay great attention to Genkai-1's DBTT, and that it publish raw data for the Charpy test.

It is a matter of great significance that the results of the fourth monitoring test for Genkai-1 cannot be accounted for by either the former prediction formula (JEAC 4201-1991), or the current formula (JEAC 4201-2007), and that the high DBTT cannot be accounted for. NISA called for opinions regarding the 2010 supplement to JEAC 4201-2007, so, in light of this serious situation, the Nuclear Aging Research Team submitted a public

comment to NISA articulating fundamental questions about the monitoring test methodology.¹

The essence of our public comment was as follows (abbreviated):

- The 2007 prediction formula is totally unable to reproduce the results of the monitoring test on mother material in the Genkai-1 reactor and metal welds in the Tsuruga-1 reactor, so the monitoring test system cannot be implemented based on the 2007 prediction formula.
- It is necessary to **make a decision** to permanently shut down nuclear reactors in which a high DBTT that cannot be explained by the prediction formula is observed.
- A fundamental review of JEAC-4201 is necessary, including whether prediction is possible.

This public comment calls for a **fundamental review** of JEAC-4201, which stipulates the monitoring test methodology for steel in pressure vessels, and for an explicit statement in the rule that there are cases where the option of permanent shutdown should be selected.

NISA's response to our public comment was published on its web site on May 6, 2011. There was no direct response to the points we made. The response made no reference to the striking deviation in the Genkai-1 data. It simply stated that where there is a deviation the margin for error should be reset and that there was no problem. NISA's reply was an insult to our intelligence. What needs to be corrected is the thinking behind the monitoring test methodology that uses margin for error to paper over problems.

Tables and Figures

H. INO

表1

Table 1: Reactor Pressure Vessel Ductile-Brittle Transition Temperature (DBTT) – Worst 7

Rank	Reactor Unit	Type	Startup	Classification	DBTT	Neutron fluence (10^{19} n/cm ²)	Date of experiment (removal)
1	Genkai-1	PWR	Oct. 15, 1975	Mother material	98°C	7.0	April 2009
2	Mihama-1	PWR	Nov. 28, 1970	Mother material	74°C	3.0	May 2001
				Weld material	81°C		
3	Mihama-2	PWR	July 25, 1972	Mother material	78°C	4.4	Sep. 2003
4	Ohi-2	PWR	Dec. 5, 1979	Mother material	70°C	4.7	March 2000
5	Takahama-1	PWR	Nov. 19, 1974	Mother material	68°C*	1.3	Nov. 2002
6	Tsuruga-1	BWR	Mar. 14, 1970	Mother material	51°C	0.094	June 2003
				Weld material	43°C		
7	Fukushima Daichi-1	BWR	Mar. 26 1971	Mother material	50°C	0.09	Aug. 1999

Source: Prepared by the author from "Results of Monitoring Tests on Steel in Nuclear Reactor Pressure Vessels," CNIC
 * As of July 2011. A DBTT of 95°C was later observed in Takahama-1.

表2. 玄海1号炉压力容器母材監視試験結果

2003年高経年化技術評価書(2003年12月)p15、表2.3-1、唐津市議会(2010年10月25日)での公開資料、第5回高経年化意見聴取会(2012年1月23日)配布資料3による。

監視試験	取出時期	脆性遷移温度	中性子照射量	相当運転年数
照射前 (初期値)	1975年10月運転開始	-16°C	($\times 10^{19}n/cm^2$) 0	0
第1回	1976年11月	35°C	0.5	約5年
第2回	1980年4月	37°C	2.1	約20年
第3回	1993年2月	56°C	3.5	約33年
第4回	2009年4月	98°C	6.5	約66年

図1 NIT148に載っていない

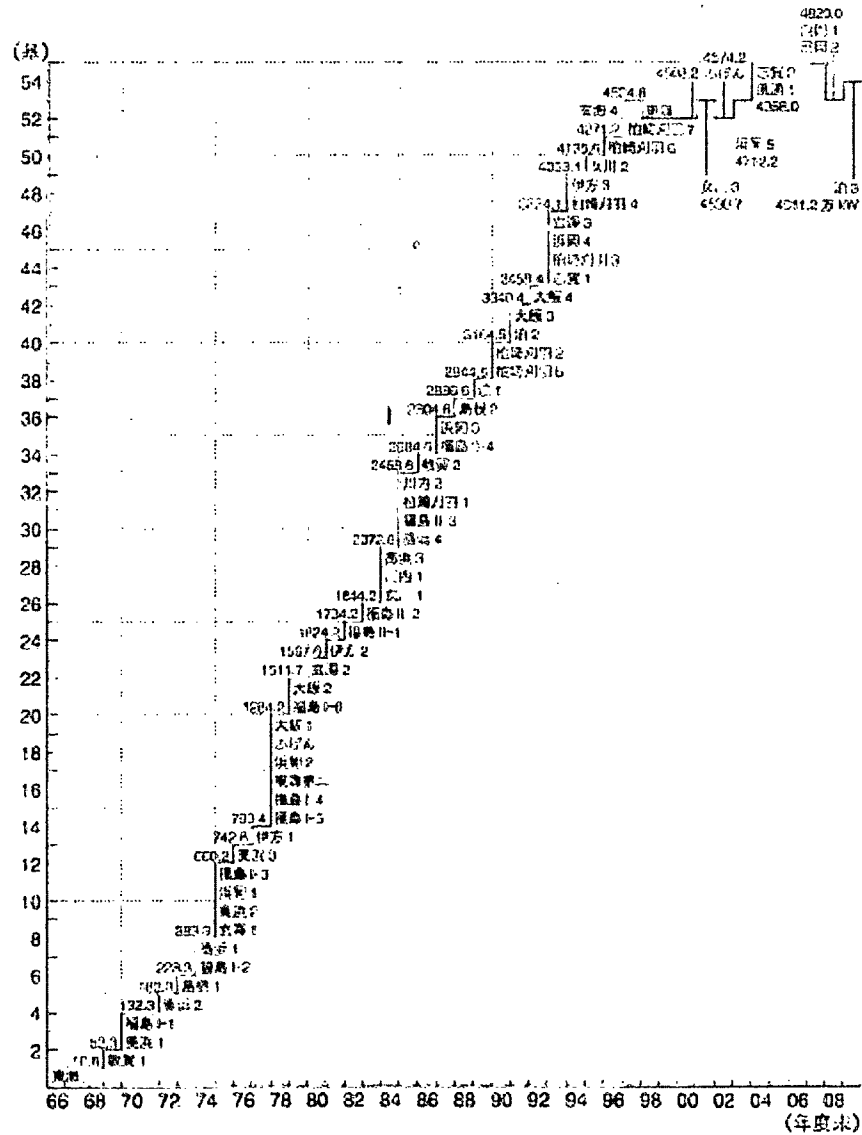


図1—原発基数と設備容量の推移

図2

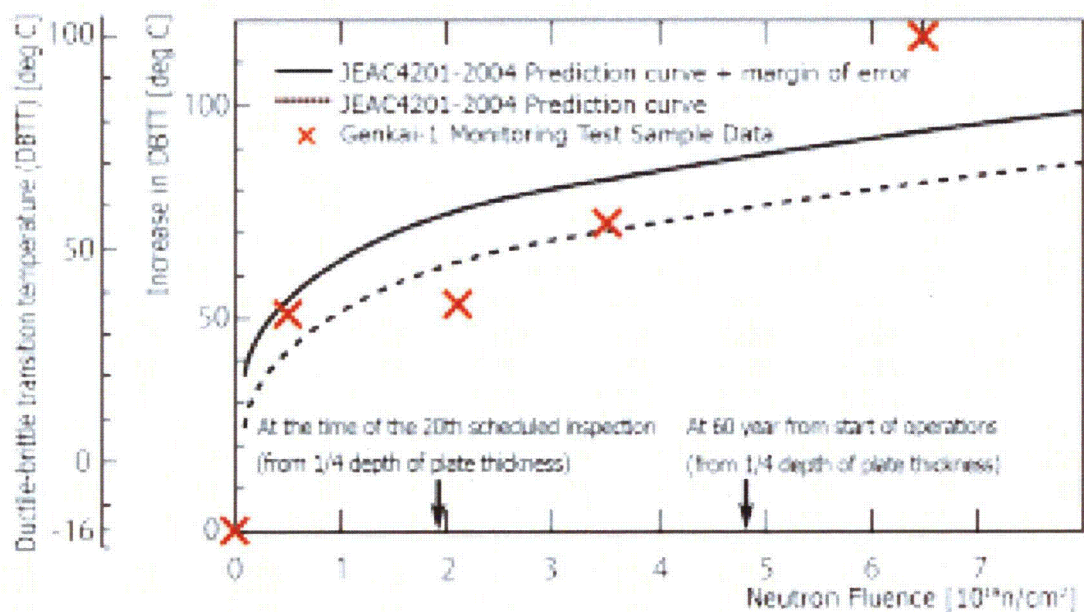
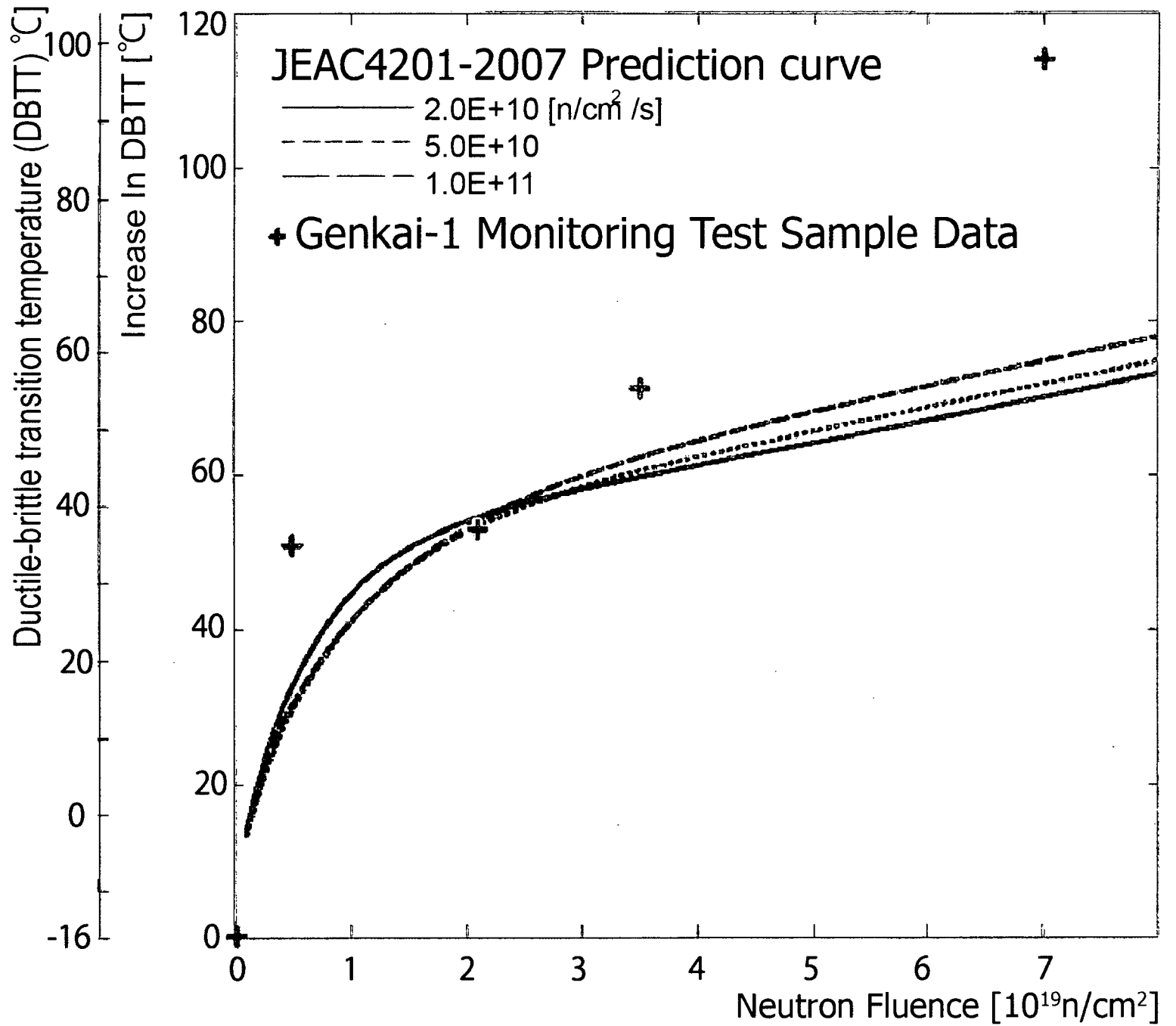


Figure 1.
Genkai-1 Monitoring Test Sample Data and JEAC 4201-2004 Prediction Curve

図3



九州電力PTS評価

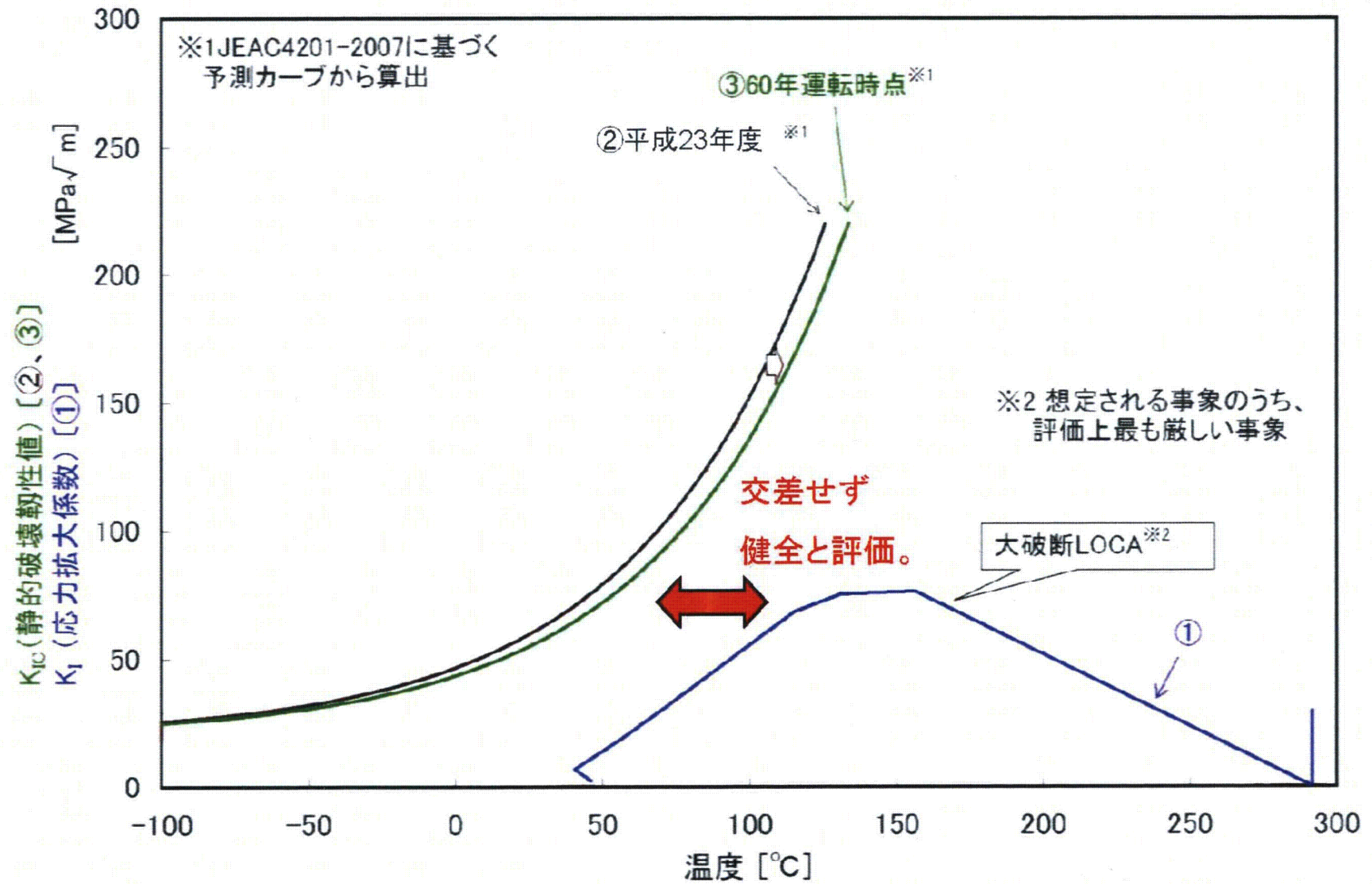


図4 九州電力による玄海1号機圧力容器の加圧熱衝撃(PTS)評価

K_{IC} : -25%, -50%

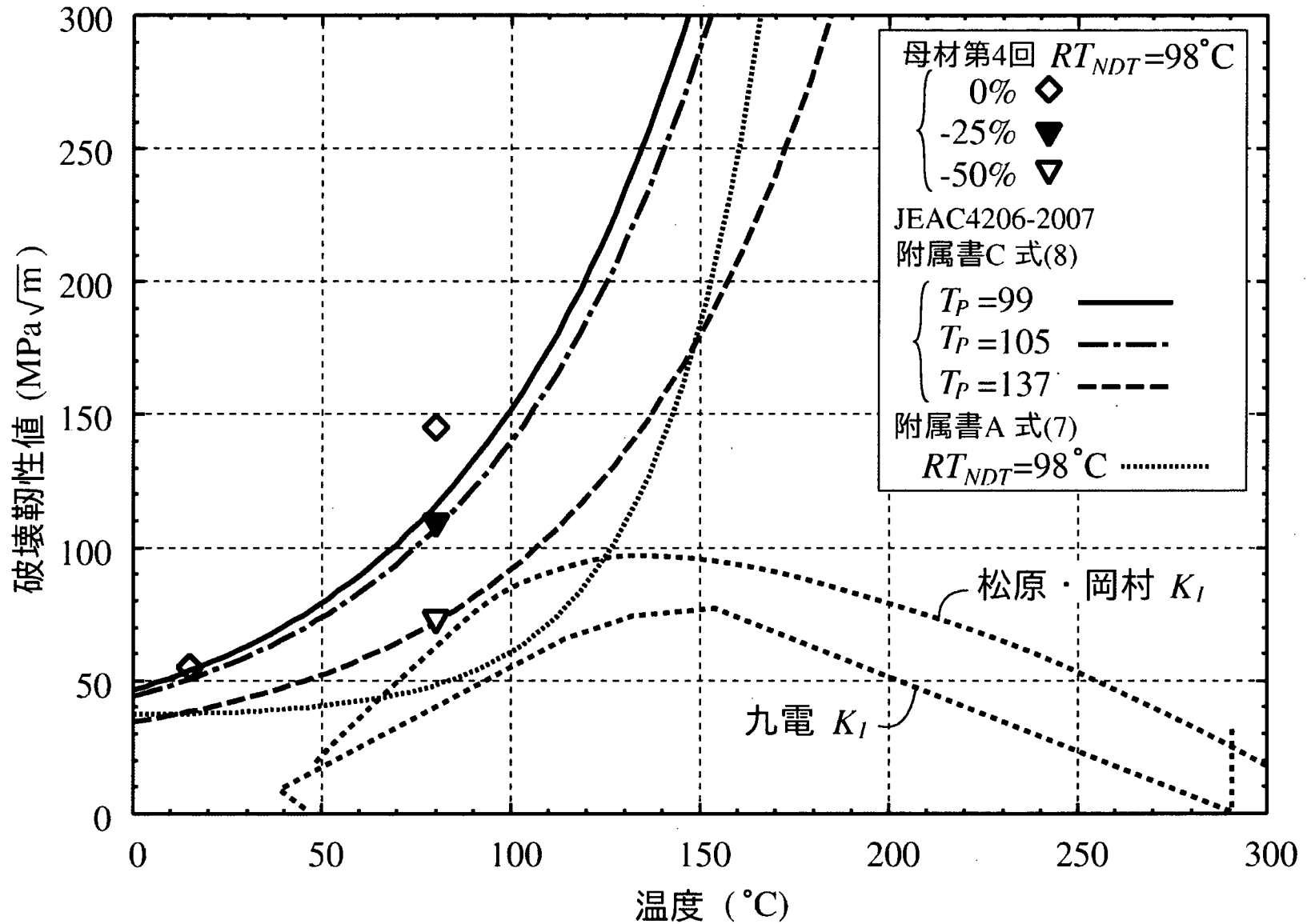


図5 玄海1号機PTS評価についての筆者らの考察結果。JEAC4206-2007附属書C・附属書A、文献(17)・(20)を用いた

Part II

Discussion and Issues in the “NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors”

Hiromitsu Ino

Launch of the “NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors”

Last November the Nuclear Industrial and Safety Agency (NISA) initiated the NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors. As it turned out, I was invited to become a member of the committee. Hitherto, NISA has ignored our ideas. I decided to participate in the Hearings because I believed it was necessary to have a forum in which to communicate our thoughts about the issue of aging nuclear power plants, in particular concerning the extraordinary embrittlement of the Genkai-1 plant. However, these Hearings are, as their name implies, a forum in which committee members' views are heard and debate takes place, but in the end NISA takes responsibility for writing the report. I was aware of this limitation when I decided to become a committee member.

The following three issues have been considered during the Hearings:

(1) Assessment of the aging of individual plants:

Technical assessment reports on ageing have to be submitted to NISA for nuclear power plants that have been in operation for over 30 years, and every 10 years after that. If the review confirms their safety they can continue to operate. Assessment reports were submitted for Ikata Unit 2 (commenced operation 19 March 1982) and Fukushima Daini Unit 1 (commenced operation 20 April 1982) for the first time last year. A 40-year report was also submitted for Mihama Unit 2 (commenced operation 25 July 1972).

(2) Relation between aging and the Fukushima Daiichi accident:

This refers to consideration of the question of whether aging (deterioration of equipment and materials) contributed to or exacerbated the Fukushima Daiichi accident.

(3) Cause of the greater than predicted embrittlement of Genkai-1:

Consideration of how to interpret the results of the monitoring tests of the Genkai-1 ductile-brittle transition temperature (DBTT), which exceeded the predicted 98°C, and whether the equation for predicting embrittlement is appropriate.

So far 16 meetings of the NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors have been held (mid-June 2012). NISA's intention was to disband the committee at the end of March 2012, but due to the delay in the establishment of the new

Nuclear Regulatory Commission, the Hearings are continuing unchanged.

Theme (1) relates to life extensions for aging nuclear power plants and was the province of the Aging Countermeasures Examination Committee Working Group of the Agency for Natural Resources and Energy (ANRE), which is part of the Ministry of Economy, Trade and Industry (METI). After the Fukushima accident occurred on March 11, 2011 this working group was disbanded and the role was shifted to the NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors.

Consideration of Ikata-2 has already finished and NISA has announced the conclusion that it is possible to extend operation. Regarding Fukushima Daini-1, an investigation was carried out into whether or not a state of cold shutdown has been safely maintained. The debate about Mihama-2 is approaching the final stages. The life extension of Mihama-2 impinges on the amendment to the regulations, which states that in principle the period for which nuclear power plants may be operated is 40 years calculated from commencement of operation. However NISA is of the opinion that these are separate issues. It says, "The technical assessment of aging ... is a matter required by law ... which must be solemnly undertaken." It compiled an investigation report which accepted a life extension beyond 40 years based on the argument that "if a new system which limits operation to 40 years comes into effect, regardless of the results of the technical assessment of aging, just those reactors which clear the new standard to be established in the future will be able, as an exception, to have their lives extended." My proposals that these Hearings should debate the details of how to close down aging reactors such as these with advanced irradiation embrittlement and that a conclusion should be deferred until a new nuclear regulatory agency is established were not included.

Theme (2) is already finished. A report was compiled (February 16, 2012) which said, "The conclusion was that it is difficult to believe that aging of equipment contributed to or exacerbated the accident." However, "The assessment of the effects of aging was a desktop assessment, so it is necessary to carry out further studies in future through on-site confirmation, etc." The contents are sloppy, based on technical assessment methods of aging and past results, and simply adding on an assessment of the 3.11 seismic movement. The original draft drew the conclusion, "It is believed that [aging] did not cause or exacerbate the accident." However, even committee members besides myself expressed the view that this was odd. They pointed out that without even seeing the scene of the accident such a conclusion was premature, and that it was unclear whether the object of the investigation was clarification of the causes of the accident or future improvement. Consequently these words were deleted and replaced by the underlined words above.

Theme (3), which relates to irradiation embrittlement in Genkai-1 and

whether the existing prediction equation is appropriate, is the issue that interests me most. Debate about the cause of the high DBTT (98°C) observed in the Genkai-1 pressure vessel monitoring tests revolved around two theories: [i] was it caused by poor quality pressure vessel material or a bad manufacturing method, or [ii] was it because the embrittlement prediction equation does not accurately reflect reality in the high irradiation range?

Kyushu Electric claimed that the results of chemical analysis of the steel materials showed that there were no irregularities and that uniformity was maintained. They also claimed that examinations carried out by the Central Research Institute of Electric Power Industry (CRIEPI) and others into micro-organization in the monitoring samples showed a good correlation between embrittlement and the formation of impurity clusters, so there was no abnormal embrittlement. However, to confirm the accuracy of this judgment and form a conclusion about whether or not the material of the pressure vessel is sound, instead of getting a research organization like CRIEPI, which is part of the nuclear industry, to assess the samples, they should be given to fair and trustworthy university researchers to examine their micro-organization.

To support Kyushu Electric's claim, a report entitled "Preliminary Consideration towards Improvement of the Accuracy of the Embrittlement Prediction Method" jointly produced by CRIEPI and the Federation of Electric Power Companies (FEPC) was submitted to the eighth meeting (February 22, 2012, document 10). It concluded that it is not necessary to change the thinking behind the embrittlement model and the reaction rate equation, which form the basis of the current prediction equation, and that the variation from reality arose due to the lack of data in the high irradiation range. Further, by giving importance to the high irradiation range data (applying a weighting) and resetting the parameters of the equation (impurity cluster formation rate equation coefficient) the Genkai-1 data fit was improved. In fact, however, the fourth data point of 98°C is still above the standard deviation margin and the second and third data points drop below, making the curve look very suspicious. In other words, they were unable to draw a meaningful curve connecting the third (56°C) and fourth (98°C) data points.

It is problematic that in order to improve the fit in the high irradiation range the coefficients for the reaction rate equation etc. were greatly changed. These reaction rate equations are the master equations that determine the whole method, so for the parameters to change greatly depending on the data sets that are used indicates the brittleness of the model itself. The reliability of the embrittlement prediction equation model, which is the basis of JEAC4201-2007, is therefore called into question. The problem goes beyond the Genkai Nuclear Power Plant. It extends to all aging nuclear power plants.

Looking at the diagram in which NISA compared the prediction equation for aging nuclear power plants with the observed data (Hearing number 5, 23 January 2012, document 2), a large gap between the predicted figure and the observed figure can be seen in the high irradiation region. It is a fact that the prediction equation is unable to predict reality. However, the inaccuracy for Genkai-1 is particularly striking. The inaccuracy for other reactors is within 20°C, but the data from the fourth monitoring sample for Genkai-1 is out by 42°C. Besides the fact that the embrittlement prediction equation does not match the pressure vessel of Genkai-1 (see [ii] above), we must consider that the extraordinary embrittlement is due to the materials or the manufacturing method ([i]).

Another surprising thing was that when we investigated CRIEPI's embrittlement prediction equation, we discovered an elementary but important error in the equation itself. This prediction equation expresses changes in the micro-organization, namely the formation of impurity clusters and lattice defect clusters, which are the cause of irradiation embrittlement, as a reaction equation set, by tracing impurity atoms (copper atoms, etc.) and point flaw reaction (combination and disappearance) processes, and relating this to the rise in DBTT. This can be said to be an epoch-making change, compared to the rough and ready 2004 equation that just tried to fit the data, ignoring the rate of irradiation. However, there was a vital error in the reaction rate equation.

The main cause of irradiation embrittlement is the formation of copper clusters (or impurity clusters in general). In the model there are two types, irradiation induced clusters and irradiation promoted clusters. Irradiation induced clusters are accumulations of copper atoms in lattice defects caused by neutron irradiation. The rate of formation is proportional to the concentration of copper atoms and the rate of diffusion of copper atoms (the speed at which they move). Physically this is an appropriate assumption. However, CRIEPI's report says, "Because the formation of irradiation-enhanced clusters is a process in which copper atoms that exceed the solid solubility limit form a nucleus together, it is described by the square of the quantity of copper above the solid solubility limit and also the square of the diffusion coefficient." It must be said that this is a mistake. Because two (or more) copper atoms come together to form a cluster, it is appropriate to think that it is proportional to the square of the concentration of copper atoms, but it is a mistake to say that it is proportional to the square of the dispersion coefficient. **Footnote** Because two atoms move, at first sight it might seem that it would be proportional to the square of the speed, but that is not the case. Whether one atom is moving or stationary at one point, the rate at which they come together is the same. This can be proved mathematically. For example, the chance of two people meeting in a crowd in a stadium is the same whether one of the two is moving or stationary.

As stated above, there is an error in the basic model of CRIEPI's

Comment [T1]: 07/04 – This is corrected according to Prof. Ino's comments and is OK now – we should just add a footnote as in the yellow highlight below.

【照射促進クラスター形成】=A×(固溶限を越える銅の量×その拡散係数)²

The equation is: Formation rate of irradiation-enhanced clusters = A × (quantity of copper above the solid solubility limit × its diffusion coefficient)²

Where "A" is some coefficient or constant??

I think it's a good idea to give this equation as a footnote, for clarity.

prediction equation. Naturally, any arithmetical calculation using this equation will produce the wrong result. Since the JEAC4201-2007 embrittlement prediction equation includes this fundamental error, it is a useless equation for predictions.

In addition to the abovementioned brittleness of the embrittlement prediction equation, a mistake in the derivation of the equation itself was discovered. The JEAC4201-2007 embrittlement prediction equation must be discarded. The current situation is that there is no reliable prediction equation.

Is Genkai-1 Pressure Vessel Sound? NISA's Predictable Assessment

At the 12th Hearing, held on March 29, NISA submitted a draft report entitled "Concerning Neutron Irradiation Embrittlement of Reactor Pressure Vessels (Draft)" (referred to hereon as "Draft Report") (17). The purpose was to bring to a close the debate since January this year about "the cause of embrittlement in excess of predictions in the Genkai-1 reactor." I strongly opposed the Draft Report and listed the problems. In the end the report was not finalized in March as planned and debate continued.

I strongly opposed the report because even though the reason why a high DBTT of 98°C was observed was hardly explained, the conclusion was drawn that the pressure vessel of Genkai-1 was sound, and the fact that the DBTT failed to agree with predictions was blamed on flaws in the prediction equation. Furthermore, NISA concluded that the pressurized thermal shock (PTS) assessment carried out by Kyushu Electric was appropriate and that the pressure vessel was in sound condition. However this type of assessment is totally inappropriate.

Figure 4 shows the results of Kyushu Electric's PTS assessment (18). The curve that looks like a mountain in the bottom right hand corner is called the PTS state transition curve (K_I curve). In the case of a sudden large loss of coolant (Loss of Coolant Accident = LOCA), the Emergency Core Cooling System (ECCS) kicks in and coolant is fed into the reactor. The K_I curve shows the change over time in the force (strictly speaking the stress intensity factor K_I) applied under those circumstances to the leading end of cracks that are presumed to exist in the inner surface of the pressure vessel. As a result of inserting cooling water, the temperature of the internal surface drops. At the same time a temperature difference arises across the thickness of the pressure vessel and tensile stress is applied to the inner wall. Eventually the temperature difference of the pressure vessel becomes smaller and the value of the K_I curve decreases towards the bottom left.

Kyushu Electric Power Company's PTS Assessment

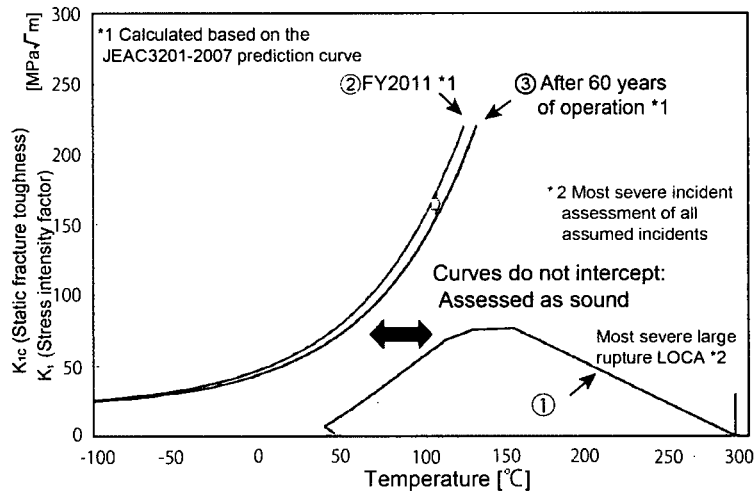


Figure 4: Kyushu Electric's Pressurized Thermal Shock (PTS) Assessment for Genkai-1 Pressure Vessel.

On the other hand, the curve rising to the right from the bottom left of Figure 4 is called the fracture toughness transition curve (K_{IC} curve). It shows how the fracture toughness K_{IC} changes depending on the temperature. If the material becomes brittle the curve shifts to the right. How is this curve derived? Besides Charpy shock test specimens, specimens are placed inside the pressure vessel to measure fracture toughness. These are extracted and the fracture toughness is measured at various temperatures. A curve is drawn as an envelope around the bottom limit of the measurements, in other words below which there is no data. In the Japan Electric Association's standard JEAC4206-2007 this curve is derived using the following equation:

$$K_{IC} = 20.16 + 129.9 \exp [0.0161 (T - T_p)] \dots (C8)$$

Parameter T_p is determined so as to draw an envelope around the measured data (i.e. so that all the data falls above the curve).

As the amount of neutron irradiation increases, the fracture toughness reduces and breakage due to embrittlement occurs at higher temperatures. In order to derive a fracture toughness transition curve that corresponds to amounts of irradiation embrittlement other than those given by the measurement test specimens, with the measurement data on the horizontal axis the curve is shifted an amount ΔT_{KIC} parallel to this axis in the higher temperature direction. In that case, $\Delta T_{KIC} = \Delta RT_{NDT}$ is said to hold. ΔRT_{NDT} is the difference in the DBTT (the amount by which DBTT shifts). In other words, it is assumed that if the temperature at which the fracture toughness value was measured is shifted by the same amount that the DBTT increased, the same fracture toughness value will

be obtained. There is no theoretical basis for this relationship, but since it more or less works experimentally, JEAC4206 used this assumption.

Theoretically, an enveloping curve can therefore be drawn using all the observed test data from the first to the fourth test at Genkai-1, as well as data measured before irradiation. Also, for an arbitrary amount of neutron irradiation, a fracture toughness transition curve (C8) can be drawn. In this way the two curves in Figure 4 show the current K_{IC} curve and the K_{IC} curve 60 years after commencement of operation for estimated amounts of irradiation of the inner surface of the pressure vessel.

According to NISA's draft, "The fracture toughness measurement for accumulated irradiation equivalent to that in 22 years from now (60 years from commencement of operations) was approximately double (over 50°C in terms of temperature) the critical stress intensity factor. This fracture toughness measurement is a directly measured value not related to the accuracy and correlation equations of the prediction method. Even bearing in mind that in general there is a variation of $\pm 25\%$ in fracture toughness for materials within the transition temperature range, it was confirmed that at this point in time there is sufficient margin for operation of Genkai-1." (p. 11)

Is this true?

The first problem is the qualification, "Even bearing in mind that ... there is a variation of $\pm 25\%$ in fracture toughness." Is not the variation in the fracture toughness larger within the transition temperature range? Is it not said that it is from double to half? If there is a variation of 50% in the 80°C measurement of the fourth monitoring test, what will happen to the K_{IC} curve? I drew this in Figure 5. The result is that the K_{IC} curve approaches much closer to the K_I curve.

The second problem follows on from the above quote, "In regard to the variation in the monitoring measurement values, although the measurements each time are few in number, they are carried out continuously for fracture toughness for temperatures which take into account the increase in temperature (which can be thought of as the DBTT) for each monitoring test and it is considered rational to take the overall lower limit." This is on page 11. This sentence refers to a shift in the fracture toughness ΔRT_{NDT} based on the abovementioned assumption that $\Delta T_{KIC} = \Delta RT_{NDT}$. However, I submitted an opinion (19) to the Hearings with an analysis that specifically showed that for Genkai-1, at least, this assumption does not hold. It is unacceptable that NISA compiled this draft with no reference to my analysis.

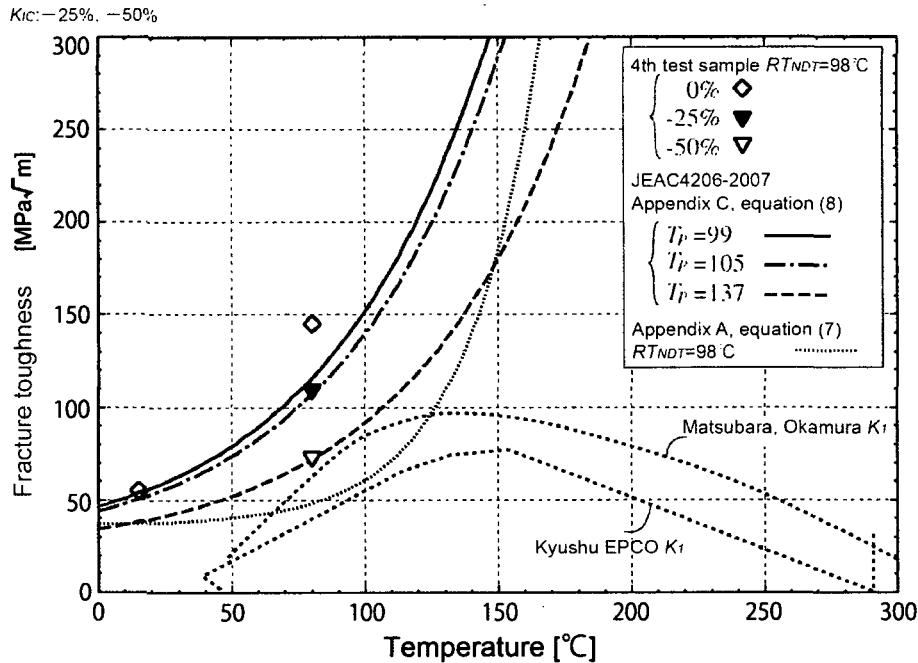


Figure 5: Results of Authors' Examination of Genkai-1 Pressurized Thermal Shock (PTS) Assessment. JEAC4206-2007 Appendix C and Appendix A, using references (17) and (20).

If this assumption does not hold, the shifted data point is not valid and the only two data points that can be used to draw the K_{IC} curve are those from the fourth monitoring test. With such limited data it is hard to claim that a reliable value for fracture toughness can be derived. I therefore presented the curve in Figure 5 taking into account a variation of 50%.

However, in appendix A to JEAC4206-2007 there is a rule about what should be done "in the case where the value for fracture toughness is not derived." This is an instruction to use the following equation to derive the K_{IC} curve from the DBTT values.

$$K_{IC} = 36.48 + 22.78 \exp [0.036 (T - RT_{NDT})] \dots (A7)$$

Figure 5 shows the curve derived by inserting the fourth monitoring test values for DBTT $RT_{NDT} = 98^{\circ}\text{C}$ into equation A7. This curve approaches almost to the point of touching the stress curve K_I . If the curves were to cross that would mean the pressure vessel would break.

Next I would like to consider the PTS state transition curve (K_I curve), which shows the size of the stress arising. Are Kyushu Electric's calculations sufficiently conservative? The assumption in JEAC4206 is for a semi-elliptical 10mm deep and 60mm long crack in the inner surface. It calculates the stress applied to the leading edge of this crack (stress

intensity factor K_I). Figure 4 shows the PTS state transition curve derived by Kyushu Electric for Genkai-1. According to document 20 presented to the Hearings by Kyushu Electric, for the PTS assessment the most severe large rupture LOCA (loss of coolant accident) is assumed. Kyushu Electric said that it is a conservative assessment in which, without considering the temperature conditions of the inner surface or mixing with cooling water, the temperature would fall in steps from 291°C to 27°C. (Kyushu Electric gave a confusing explanation implying that the temperature of the inner surface also falls in steps.)

On the other hand, in Figure 5 the K_I curve referred to as 'Matsubara and Okamura' shows the results of a PTS assessment for a pressure vessel of the same dimensions as Genkai-1 (plate thickness 168mm, diameter 3.37) (21). It is a diagram showing the case of a 10mm deep crack (a ratio of crack depth to plate thickness of 0.06). This curve gives a much larger K_I curve than the curve in Kyushu Electric's assessment. Matsubara and Okamura's paper assumes a sufficiently long crack, so compared to assuming a crack of 60mm length the values are rather large, but that variation is about 15% based on stress calculations (personal correspondence from Dr. Aono). Even if that amount is subtracted it is above Kyushu Electric's K_I curve. There is therefore a possibility that Kyushu Electric's assessment is not sufficiently conservative in regard to pressure conditions, etc.

On this point, committee member Meshii said that the K_I curve changes greatly depending on the heat transfer coefficient h of the inner surface. If the equation is taken as $h=1\text{kW/m}^2\text{K}$ the result is close to Kyushu Electric's analysis, but if it is taken as $h=2\text{kW/m}^2\text{K}$ the result is about the same as the Matsubara and Okamura analysis, and for $h=\infty$ it crosses the K_{Ic} curve. From this result, Meshii concluded, "The PTS assessment carried out by Kyushu Electric was judged to be close to realistic, but not so conservative that it was not necessary for variation in the fracture toughness value to be taken into account." (22). He is saying that the curve in the assessment is at the limit and that Kyushu Electric's analysis does not have sufficient leeway.

Seen in this light, the conclusion in NISA's draft report (17) that it has been confirmed that Genkai-1 is "sound enough" in regard to pressurized thermal shock must be seen as lacking foundation. At the sixteenth meeting of the Hearings NISA submitted a new draft (23) which to some extent took into account the various critical views expressed. Debate on this draft is set to begin. However, even though the wording is slightly changed and the data reinforced, the arguments and the conclusion in this draft are the same as before. The conclusion that the Genkai-1 pressure vessel is sound was there from the beginning. The new draft does no more than add all sorts of considerations.

For reactors with such extreme irradiation embrittlement that the

Comment [T2]: I think there needs to be another sentence after this to explain what is meant in terms of Figure 5 – where the two curves intersect (K_I and R_{tNDP}) and the fact that this looks very dangerous.

conclusion concerning whether or not they are safe varies depending on the analytical method and point of view, there is no other way to ensure people's sense of security than to make a decision to shut these reactors down.

Destruction of the pressure vessel due to embrittlement is an accident that must not be allowed to happen. If the pressure vessel is destroyed the nuclear fuel will be spread over a wide area and there will be no way of cooling the nuclear fuel to remove the decay heat. Emergency response fire trucks and power supply trucks will all become ineffective. Reactors with even a small risk of being destroyed due to embrittlement should be shut down.

A bill to wind up NISA and NSC and establish a new Nuclear Regulatory Commission is now being debated in the Diet. The bill proposed by the government contains a clause saying, "The life of nuclear power plants will in principle be 40 years." This condition allows a life extension of 20 years in exceptional circumstances, so there is the possibility that the 40-year condition will be gutted of meaning. It should state that nuclear power plants will, without exception, be decommissioned after 40 years.

All nuclear power plants that began operations in the 1970s will be over 40 years old by 2019. All these early reactors have numerous problems with manufacturing technology and quality of materials, and they are deteriorating. Of course Tsuruga-1 and Mihama-1&2, which are already over 40 years old, should be closed down, and Genkai-1 and Takahama-1, which have extreme irradiation embrittlement, should be closed down without waiting for them to turn 40.

I would like to express my gratitude to Chihiro Kamisawa (Citizens' Nuclear Information Center) and Yuta Aono (Kyushu University Engineering Faculty) for their assistance with calculations, literature studies and production of diagrams.

References

(17) Nuclear Industrial and Safety Agency, "Concerning Neutron Irradiation Embrittlement of Reactor Pressure Vessels (Draft)," Hearings on Technological Assessment of the Aging meeting 12 document 5, March 29, 2012.

(18) Kyushu Electric Power Company, "Concerning Integrity of the Reactor Pressure Vessel of Genkai Nuclear Power Plant Unit 1", Hearings on Technological Assessment of the Aging meeting 5 document 3, January 23, 2012, p. 10.

The K_{IC} curve in this diagram is a revision of a diagram published on Kyushu Electric's web site in July 2011. Furthermore, the diagram on the website, as noted in the August 2011 issue of *Tsushin*, is an incorrect curve with ductile brittle transition temperature substituted as T_p . However

Kyushu Electric did not acknowledge this and gave a transparent excuse drawing an image freehand for the curve (transcript of meeting 5).

(19) Ino Hiromitsu, Hearings on Technological Assessment of the Aging meeting 11 document 9, March 19, 2012, diagrams 1 and 2.

(20) Kyushu Electric Power Company, "Responses to Committee Member Comments", Hearings on Technological Assessment of the Aging meeting 8 document 6, February 22, 2012, pp. 3-5.

(21) Matsubara **Masaaki** and Okamura **Hiroyuki**, "Method of Assessing Integrity of Reactor Pressure Vessels' Resistance to Pressurized Thermal Shock", Japan Society of Mechanical Engineers, Collected Articles Edition A, Volume 53, No. 488, 1987, pp. 843-847.

(22) **Meshii Toshiyuki**, "Genkai-1 PTS Analysis Calculation", Hearings on Technological Assessment of the Aging meeting 14 document 8, May 9, 2012.

(23) Nuclear Industrial and Safety Agency, "Concerning Neutron Irradiation Embrittlement of Reactor Pressure Vessels (Draft)", Hearings on Technological Assessment of the Aging meeting 16 document 11, June 6, 2012.

Figure 4: Kyushu Electric's Pressurized Thermal Shock (PTS) Assessment for Genkai-1 Pressure Vessel.

Figure 5: Results of Authors' Examination of Genkai-1 Pressurized Thermal Shock (PTS) Assessment. JEAC4206-2007 Appendix C and Appendix A, using references (17) and (20).

Q: My question is, didn't Palisades first violate NRC's PTS safety standards 10 short years into its operations, by 1981? This was documented in the following document: July 8, 1993: "Pressurized Thermal Shock Potential at Palisades: History of Embrittlement of Reactor Pressure Vessels in Pressurized Water Reactors," prepared by Michael J. Keegan, Coalition for a Nuclear Free Great Lakes, Monroe, Michigan (re-published August 3, 2005). In addition, the Associated Press's Jeff Donn pointed to NRC's weakening of PTS safety regulations as his top example of NRC's weakening safety regulations in order to allow dangerously degraded old reactors to continue operating despite the worsening breakdown phase risks, in his four-part series "Aging Nukes," dated June 2011.

Q: Has the NRC Region 3 Staff, NRC's Nuclear Regulatory Research staff, and other relevant staff read Mr. H. Ino's articles appearing in the Citizens Nuclear Information Center-Tokyo newsletter in May/June 2012, and July/August 2012, about reactor pressure vessel embrittlement/PTS risks at Japanese pressurized water reactors? I handed hard copies to every NRC staff member who would take one from me when we met with NRC Chairman Jaczko at the Beach Haven Event Center in South Haven on May 25, 2012.

Q: How many metal coupons or metal capsules are left within the Palisades' reactor pressure vessel? News reports have recently reported that Entergy has said it will pull a capsule or coupon to examine this autumn. How long has it been since the last coupon/capsule examination? Has NRC's assurance of PTS safety at Palisades all been based on computer models since the last coupon/capsule examination, by merely extrapolating expected embrittlement rates, as opposed to actual physical measurements? But Mr. H. Ino's articles in the CNIC-Tokyo newsletter contained the very significant warning that embrittlement predictions were significantly non-conservative. For example, the Genkai-1 reactor pressure vessel had much worse embrittlement than had been previously predicted. How can NRC and Entergy be so sure that Palisades' embrittlement has not reached a dangerous state, since no physical measurements have been taken in so long?

Q: WHY does Palisades have the worst embrittled reactor pressure vessel in the U.S., as NRC's Nuclear Regulatory Research staffer Jennifer Uhle admitted was the case at a public meeting at the Beach Haven Event Center in South Haven on Feb. 29, 2012? Is it due to the impurities in the RPV steel

from its initial fabrication?

Q: Why compare aircraft landing gear to an atomic reactor like Palisades? Besides the very different destructive forces the two objects have to endure (for example, aircraft landing gear are not subjected to 600 degree Fahrenheit temperatures then plunging by hundreds of degrees in a short period of time, as well as 2,000 pounds of pressure per square inch, not to mention the neutron radiation bombardment, like Palisades is and has been for 42 years now?). If landing gear fails on an airplane, some hundreds of people could perish -- if Palisades suffers a catastrophic radioactivity release, many thousands, or even tens of thousands, could die over time, as reported by the NRC-commissioned, Sandia National Lab-conducted 1982 report CRAC-II (Calculation of Reactor Accident Consequences, also known as the Sandia Siting Study or NUREG/CR-2239).

Q: If the reactor pressure vessel at Palisades does succumb to a pressurized thermal shock rupture, will the primary reactor cooling water instantly turn to steam, because the pressure will be relieved? Will it then escape the RPV through the fracture? How could the reactor core be prevented from melting down at that point? Could the meltdown melt through the bottom of the RPV, like happened at Fukushima Daiichi Units 1, 2, and 3? Could the Palisades meltdown even penetrate through the radiological containment structure? Could this cause the casualties and property damages reported in NRC's 1982 CRAC-II report? What about the impacts on Lake Michigan, drinking water supply for 40 million people downstream?

Q: On Sept. 25, 2011, during the loss of power to half the control room at Palisades, the emergency core cooling system was inadvertently activated. However, it did not completely activate. If it had completely operated as instructed, albeit inadvertently, could the pressurized thermal shock on the 100% power level and heat level Palisades RPV have fractured under the sudden temperature plunge, coupled with the high pressure level?

Q: What is NRC's response to the March 29, 1982 (the third anniversary of the Three Mile Island meltdown) warning by its own safety engineer, Demetrios Basdekas, in an op-ed to the New York Times, that the next meltdown in the U.S. could very well be due to an embrittled RPV suffering catastrophic PTS?

Q: Why did the NRC Staff and Office of General Counsel actively oppose

environmental interveners' embrittled RPV/PTS risk contention during the Palisades 20-year license extension proceeding in 2005-2007? As part and parcel of the license extension approval, didn't NRC's ASLB, as well as NRC Staff, require a plan by Entergy by 2011, to deal with Palisades' impending 2014 violation of PTS safety standards? It appears the "plan" was simply to weaken the PTS regulations, in order to allow Palisades to operate past 2014, till at least 2017. Will NRC weaken its PTS regulations yet again, to allow Palisades to operate past 2017, even out to 2031? Will NRC also approve 80 years of operations at Palisades -- out to 2051 -- as the Nuclear Energy Institute has expressed interest recently in applying for permission to do?

Q: Given the badly embrittled status of the Palisades RPV, might this not lead Palisades control room operators and senior management hesitating before activating the emergency core cooling system, for fear of fracturing the RPV? Might this not significantly increase the risks of an overheating accident, and even a meltdown?

Q: On May 25, 2012, 25-30 of us met with NRC Chairman Jaczko and many other NRC staff, including from Region 3 (including Regional Administrator Chuck Casto). Embrittlement of the RPV and PTS risks were a primary subject matter discussed during the meeting. Dr. Barbara J. Pellegrini was one of the concerned local residents who attended. On May 30, she wrote NRC Chairman Jaczko her ideas for how Palisades' RPV embrittlement could be measured, and PTS risks defended against, including consultation with many experts in the field of materials science. NRC never responded to her letter. Why not?

Q: Just now annealing was held forth as a potential solution for the embrittled Palisades RPV. But Consumers Energy floated this empty promise decades ago. Entergy has floated this empty promise years ago now. Now NRC is floating this empty promise. What good is an empty promise, when obviously NRC will never require it to be done, and Entergy does not intend to do it?

Q: Has annealing of an embrittled atomic reactor pressure vessel EVER been done, anywhere in the world? If yes, what were the results? Did it work? Is success guaranteed at Palisades, even if annealing is done? Was that RPV as badly embrittled as Palisades' RPV is? How much would annealing cost at Palisades? Isn't it so very expensive as to be cost-prohibitive for Entergy,

which is currently facing tough economic times, as indicated by UBS Financial analyses, which mentions that several of Entergy's reactors face shutdown THIS YEAR due to such economic reasons (that is, the inability to make a profit, due to exorbitant major safety repair bills)?

Q: Consumers Energy told the Michigan Public Service Commission in spring 2006 that the reason it was selling Palisades to Entergy was that it could not afford the major safety repairs needing to be done, such as on the embrittled reactor pressure vessel. Yet, even after owning Palisades for six years, Entergy has done absolutely nothing to deal with the Palisades RPV embrittlement risks. The public and even decision makers like Michigan Public Service Commission have been victims of a bait and switch. How can NRC let such promises -- that the embrittled reactor pressure vessel would be dealt with -- be broken?

Q: Did the Palisades power uprate which NRC so readily approved worsen the neutron flux on the reactor pressure walls? Did NRC even consider the embrittlement and pressurized thermal shock risks of approving that power uprate?

Q: But how long has it been since the last capsule was removed? Since that last capsule was analyzed, what if the embrittlement has taken place at a much more accelerated rate than NRC's modeling would predict?

Q: Since risk is probability times consequences, isn't it accurate to say that embrittlement/pressurized thermal shock risks are significantly worse than they were in 1971, pre-operations?

Q: What about the synergistic effects of Palisades' many problems? Not only is the RPV the worst embrittled in the US, but Palisades needs the 2nd steam generator replacement in its history, its badly corroded reactor lid is now 6 years overdue for replacement, and a diversity of leaks, breakdowns, and failures have occurred in the past few years. Might not all these problems add up to a catastrophic failure at Palisades? Why doesn't NRC address the totality of all these risks as a whole, as that is the reality of the situation, instead of just one system, structure, or component at a time, in isolation? To the equipment problems, there are the safety culture violations at Palisades.

Q: If capsules were removed in the mid-1990s and 2000s, as NRC just said, that's a decade or two ago. Has NRC simply extrapolated to predict the

severity of embrittlement? What if NRC's understanding is flawed? What if the extrapolation is non-conservative? How can NRC speak with any confidence, if the last physical data collected -- and very few data points at that -- are over a decade old? This is not science. This is guesswork. The safety risks are too high for this lack of science.

Q: Reactor accident risk has gone DOWN because of operator experience and training? I thought Palisades was busted for having a safety culture in complete collapse, just one year ago. Doesn't that increase reactor disaster risks? Has NRC forgotten all about that safety culture problem at Palisades?

Q: Isn't yet another INCREASE in reactor disaster risk at Palisades the sheer 42 year old age? Break down phase risks? The NRC staffer just downplayed reactor risks at Palisades, which is misleading. Another undermining of the NRC

Q: Another undermining of the NRC's flip assurance that reactor operating experience and training is a risk reduction these days at Palisades, is the fact that Entergy, as a cost cutting measure, has cut experienced staff over the past 6 years. In fact, some of the best, most experienced staff at Palisades has been let go. Doesn't this fact increase the embrittlement/PTS risks at Palisades, given the increased risk of reactor problems?

Q: But it's called PRESSURIZED thermal shock! How can you say PRESSURE doesn't add to PTS risks?!

List of organizations opposing 20 year license extension at Palisades nuclear power plant:

Alliance for the Great Lakes, Grand Haven, Michigan
Canadian Coalition for Nuclear Responsibility, Montreal, Quebec, Canada
Citizens Action Coalition of Indiana, Indianapolis, Indiana
Citizens for Alternatives to Chemical Contamination, Mattawan, MI
Citizens for Renewable Energy (CFRE), Lion's Head, Ontario
Citizens Resistance at Fermi Two, Monroe, Michigan
Clean Water Action, Grand Rapids, Michigan
Coalition for a Nuclear-Free Great Lakes, Monroe, Michigan
Don't Waste Michigan, Holland, Michigan
Great Lakes United, Buffalo, New York
Green Party of Michigan, Detroit, Michigan
Green Party of Van Buren County, Bangor, Michigan
Home for Peace and Justice, Saginaw, Michigan
Huron Environmental Activist League, Alpena, Michigan
IHM Justice, Peace, and Sustainability Office, Monroe, Michigan
Indigenous Environmental Network (IEN), Bemidji, Minnesota
International Institute of Concern for Public Health, Toronto, Ontario, Canada
Kalamazoo River Protection Association, Saugatuck, Michigan
League of Women Voters of the Holland Area, Holland, Michigan
League of Women Voters of Michigan, Lansing, Michigan
Lone Tree Council, Bay City, Michigan
Michigan Citizens for Water Conservation, Mecosta, Michigan
Michigan Environmental Council (MEC), Lansing, Michigan
Michigan Interfaith Climate and Energy Campaign/Voices for Earth Justice, Roseville, Michigan
Michigan Land Trustees, Bangor, Michigan
National Environmental Trust, Michigan Chapter, Lansing, Michigan
Nuclear Energy Information Service (NEIS), Evanston, Illinois
Nuclear-Free Great Lakes Campaign, Livonia, Michigan
Nuclear Information and Resource Service (NIRS), Washington, D.C.
Nuclear Policy Research Institute, Washington, D.C.
Nukewatch, Luck, Wisconsin
Palisades Conversion Group, South Haven, Michigan
Public Interest Research Group in Michigan (PIRGIM), Ann Arbor, Michigan
Radiological Evaluation & Action Project, Great Lakes (REAP-GL), Ewen, Michigan
Sierra Club, Michigan Chapter, Lansing, Michigan
Toledo Coalition for Safe Energy, Toledo, Ohio
Transformations Spirituality Center, Sisters of Saint Joseph, Nazareth, Michigan
WAND Michigan (Women's Action for New Directions), Southfield, Michigan
West Michigan Environmental Action Council, Grand Rapids, Michigan

(updated May 18, 2006)