**Coalition for a Nuclear-Free Great Lakes * Don't Waste Michigan *
Nuclear Information and Resource Service (NIRS) ***

Summary Report

High-Level Atomic Waste Mishap at Palisades Nuclear Reactor Risks Radioactive Inferno with Casualty Potential of Thousands of Deaths Downwind

Based Upon U.S. Nuclear Regulatory Commission Freedom of Information Act (FOIA) Response Documents

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On March 18, 2006 the Detroit Free Press ran a front page article entitled "Nuclear safety left hanging as crane dangled fuel rods: Michigan incident got warning but no fine," by Hugh McDiarmid, Jr., Free Press Staff Writer. The article revealed a previously unreported October 2005 incident at the Palisades nuclear power plant on the Lake Michigan shoreline in southwest Michigan. According to a U.S. Nuclear Regulatory Commission (NRC) inspection report, a container weighing 110 tons, fully loaded with high-level radioactive waste, dangled for 55 hours from a stuck crane above the reactor's irradiated fuel storage pool. Plant personnel, lacking proper knowledge about the crane, and without permission from plant management, mishandled the crane's emergency brake, increasing the risk of the heavy load crashing, out of control, back down into the pool. The falling container could have severely damaged the pool, draining the cooling water. A radioactive waste fire could have followed, resulting in tens of thousands of cancer deaths from radiation exposure to a distance of 500 miles downwind, according to a separate NRC report.

Internal Palisades and NRC documents, received by NIRS via FOIA, reveal the mistakes that led up to this incident, and the potentially catastrophic consequences that could have resulted.

The Cask Dangle First Comes to Light

The Palisades nuclear power plant is located in Covert, Michigan, on the Lake Michigan shoreline. Living up to the name of its hometown – Covert -- Consumers Energy's Palisades nuclear power plant, with help from the NRC, managed to keep the public in the dark for months about an incident that could have led to a Chernobyl-scale radiation release on the Lake Michigan shoreline. Tens of thousands of people, out to a distance of 500 miles downwind, could have died immediately or due to later cancer, according to NRC reports.

Coalition for a Nuclear-Free Great Lakes, Don't Waste Michigan, and NIRS first learned of the cask dangle on December 21, 2005 while attending an NRC/Palisades technical meeting at NRC's Region III office in Lisle, Illinois. An NRC official revealed that, while lifting a fully loaded waste container out of its storage pool, Palisades experienced a brake engagement which left the cask suspended over the pool from October 11 to 13, 2005. It was also admitted that no event report had been published, thus having kept the public in the dark for over two months at that point.

NIRS filed a FOIA request on January 9, 2006. Although NRC stated that it would respond to the FOIA request in two to four weeks, the FOIA response was not received by NIRS until March 20th, over two months later.

However, a few days earlier, researchers from the Coalition for a Nuclear-Free Great Lakes uncovered an NRC quarterly inspection report issued January 25, 2005 (with an erratum dated February 2, 2006). This NRC inspection report revealed, at page 9:

"The [NRC] inspectors concluded that working outside the bounds of a work package on a crane with a suspended load that if dropped would damage the spent fuel pool warranted a safety significance determination…Had the load dropped, the spent fuel pool could have sustained severe damage. The inspectors were also aware that the individuals involved in the work activity were not fully knowledgeable of the crane's design, operation, and failure modes at the time the work occurred. In order to compensate for the gap in knowledge, the licensee [the owner, Consumers Energy, and operator, Nuclear Management Company] obtained telephonic support from the crane vendor. Therefore, the inspectors concluded working outside the bounds of the approved work package and manipulating the brake release represented an increase in the risk of a load drop. This increase in risk is directly associated with the reactor safety cornerstone objective of the spent fuel cooling system as a radiological barrier."(1)

In other words, the crashing cask, fully loaded with high-level radioactive waste and weighing 107 tons, could have cracked the bottom of the pool and drained out the cooling water. In a matter of hours or less, the years and decades worth of accumulated high-level radioactive wastes stored in the pool could have gotten so hot that it would have ignited into a radioactive conflagration.

The Potentially Catastrophic Consequences Had the Cask Dropped

Another NRC report, NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," published February, 2001, examined just such heavy load drops causing the collapse of the waste storage pool floor. At page 3-16, NRC reports:

"The analysis exclusively considered drops severe enough to catastrophically damage the SFP [spent fuel pool] so that pool inventory [of cooling water] would be lost rapidly and it would be impossible to refill the pool using onsite or offsite resources. There is no possibility of mitigating the damage, only preventing it…The staff assumes a catastrophic heavy load drop (creating a large [cooling water] leakage path in the pool) would lead directly to a zirconium fire. The time from the load drop until a fire varies depending on fuel age, burn up, and configuration. The dose rates in the pool area before any zirconium fire are tens of thousands of rem per hour, making any recovery actions (such as temporary large inventory [of replacement cooling water] addition) very difficult. Based on discussions with [NRC] staff structural engineers, it is assumed that only spent fuel casks are heavy enough to catastrophically damage the pool if dropped."(2)

Given that Palisades is an operating reactor, the wastes in its storage pool are even hotter – radioactively and thermally – than wastes at a decommissioning, or permanently shut down, nuclear power plant. In fact, NRC has reported that "…the possibility of a zirconium fire leading to a large fission product release cannot be ruled out even many years after final shutdown..."(3)

Thus, these NRC reports reveal that a Chernobyl-scale nuclear catastrophe could have occurred on the Lake Michigan shoreline last October. NRC admits that once the cask had cracked the pool and drained the cooling water away, radiation doses near the pool would have killed any emergency responders who approached too near after just a few minutes exposure time. Firemen would have had to sacrifice their lives in any attempt to stop the quickly unfolding disaster. But NRC chillingly stated such an accident must be prevented in the first place, because once it starts, it is impossible to put the deadly radioactive genie back in the bottle.

Palisades' irradiated nuclear fuel rods are clad in zirconium metal. Zirconium, an ingredient in cluster bombs and old-fashioned camera flash bulbs, spontaneously combusts at a high-enough temperature. The thermal heat generated by radioactive decay occurring in Palisades' hotter wastes, more recently discharged from the reactor core, could initiate the fire, which would then likely spread to the entire waste inventory in the pool.

According to the U.S. Department of Energy's February 2002 Environmental Impact Statement for the proposed national high-level radioactive waste dump at Yucca Mountain, Nevada, Palisades currently has over 188 tons of highly radioactive nuclear fuel stored in its pool.(4). Palisades pool thus contains significantly more dangerous and deadly long-lasting radioactive poisons, such as Cesium-137, than were released by the

Chernobyl nuclear catastrophe in 1986.(5) Whereas the shorter lasting radioactive poisons that were present in Chernobyl's reactor core would have decayed away over the years and decades in the Palisades pool, the longer-lived radioactive poisons, such as Cesium-137 (hazardous for 10 to 20 "half lives," that is, 300 to 600 years), would still be present in very large quantities in the Palisades pool.

Alvarez et al. stated "Spent fuel recently discharged from a reactor could heat up relatively rapidly to temperatures at which the zircaloy fuel cladding could catch fire and the fuel's volatile fission products, including 30-year half-life [Cesium-137] would be released. The fire could well spread to older spent fuel. The long-term land-contamination consequences of such an event could be significantly worse than those from Chernobyl."(6)

Citing a United Nations report from 2000, the Alvarez report went on to state that:

"The damage that can be done by a large release of fission products was demonstrated by the April 1986 Chernobyl accident. More than 100,000 residents from 187 settlements were permanently evacuated because of contamination by [Cesium-137]. Strict radiation-dose control measures were imposed in areas contaminated to levels greater than [15 curies per square kilometer, or 555 kilo-Bequerels per square meter] of [Cesium-137]. The total area of this radiation-control zone is huge: [10,000 square kilometers], equal to half the area of the State of New Jersey. During the following decade, the population of this area declined by almost half because of migration to areas of lower contamination."(7)

10,000 square kilometers equals 3,800 square miles, nearly 7% of the total land area of the State of Michigan.

NRC goes on to report in NUREG-1738, in "Appendix 4: Consequence Assessment from Zirconium Fire," that tens of thousands of people could have then died, either promptly from radiation poisoning, or from latent cancers, up to 500 miles downwind. Table A4-7, "Mean [Average] Consequences for the Base Case," shows over 26,800 deaths possible. Table A4-15, assuming a larger population density per square mile, estimates a long-term consequence of 44,900 cancer fatalities downwind.(8)

Palisades and NRC report that the population and population density surrounding Palisades is relatively small. In 2000, 118,667 people were living within 20 miles of Palisades, for a density of 238 persons/square mile; 1,287,558 persons were living within 50 miles of the plant, for a density of 283 persons/square mile.(9) However, it must be pointed out that the bulk of Michigan's second largest city – Grand Rapids – lies outside that 50 mile zone. And the largest cities in Michigan and Illinois – Detroit and Chicago – fall within 500 miles of Palisades. These large populations would worsen casualty rates downwind of a major radiation release from Palisades.

Of course, not only could tens of thousands of people have died from radiation poisoning and cancer, but Michigan's entire tourism and agricultural industries could have been ruined, as

well. And Palisades is located on the shore of Lake Michigan, whose waters -- and the waters of the Great Lakes downstream into which Lake Michigan flows -- provide drinking water for millions of people in the U.S. and Canada. Thus, the consequences of a large radiation release from Palisades would be dire indeed.

Despite this, the NRC quarterly inspection report stated "because the actions by the worker did not result in any load motion and both crane brakes remained set, NRC management determined the finding to be of very low safety significance."(10)

Incredibly, NRC has let Palisades off with a slap on the wrist. It's not unlike the Davis-Besse nuclear power plant near-meltdown in 2002 near Toledo, in which the NRC's own inspector general reported that both NRC and the nuclear utility put company profits over public safety. In that case, we almost lost Toledo. In this case, we almost lost west Michigan, and Lake Michigan as well.(11)

Coalition for a Nuclear-Free Great Lakes also uncovered an NRC event report from October 12, 2005 – the exact timeframe for the cask dangle – revealing that "Portions of the Palisades Plant Process Computer (PPC) including the Emergency Response Data System (ERDS) became inoperable due to failure of a plant inverter…"(12)

This begs the question, could this computer failure have been yet another straw to break the camel's back that day, resulting in a radiological catastrophe downwind and downstream of Palisades?

Citing many of the NRC documents previously referenced, The Detroit Free Press reported the Palisades cask dangle, and its potentially catastrophic consequences, on March 18, 2006.

Revelations from NRC's FOIA Response to NIRS

NRC's "Partial" FOIA response, although dated March 8, 2006 – two full months after the FOIA request was made – did not reach NIRS until nearly two weeks later. NRC and Palisades internal documents reveal that many mistakes led up to the cask dangle, and also that other short cuts on safety could have made the incident event more dangerous.

For example, on October 6, 2005 – just five days before the cask dangle – NRC granted Palisades an exemption from "Criticality Accident Requirements" for loading of independent spent fuel storage installation casks. This despite NRC's admission that "NMC's [Nuclear Management Company's, Palisades operator] request for exemption…proposes to permit NMC to perform spent fuel loading, unloading, and handling operations related to dry cask storage without being subcritical under the most adverse moderation conditions feasible by unborated water." NRC also assumed that the spent fuel would be kept in "a geometrically safe configuration," and that "appropriate, conservative criticality margins during handling and storage of spent fuel" would be applied.(13)

But the cask dangle involved a container whose lid had not yet been bolted shut. If the cask had dropped into the pool, the waste within could have fallen out, forming a critical mass. The still-fissile components in the waste – uranium-235 and plutonium-239 – could have caused a nuclear chain reaction in the pool. This would be all the more likely if unborated water were added to the pool – such as to replenish cooling water in the event of a pool leak from the cask drop. Boron in the pool water serves as an anti-criticality measure.

Palisades upgraded its irradiated nuclear fuel storage pool crane to "single-failure-proof" in June, 2004, just 16 months before the cask dangle incident. NRC, in granting the crane upgrade, stated "[s]ince the new main hoist for the upgraded crane is of the single-failure-proof design, the cask drop analysis is no longer required for load drops from the main hoist. As a result of the impact-limiting pads previously installed in the spent fuel pool to protect the pool structure from the postulated transfer-cask-drop accident during dry fuel storage operations is being eliminated." Thus, as the crane was upgraded, the pool was allowed to lose a layer of protection against a cask drop. Was this to free up more space in the pool, so that more waste could be stored there? However, in allowing the impact-limiting pads to be removed, NRC was assuming that Palisades would provide proper "training and qualification of crane operators," as well as "inspection, testing and maintenance of cranes." But it was just such failures that led to the cask dangle.

An internal Palisades documents reveal that "[crane vendor] Ederer procedure 260 was apparently used a reference, but not followed completely to determine torque value for the EATL [energy absorbing torque limiter, an emergency brake]." It also revealed that "OE [operational experience] from Big Rock [a Consumer's Energy nuclear power plant in Charlevoix, MI that permanently shut down in August 1997] showed similar occurrences from an improperly set EATL that needed additional adjustments. This had occurred twice on a crane of the same design as Palisades."(14) So, despite previous company experience with just such crane malfunctions, the "lessons learned" were not enough to prevent the incident at Palisades. And despite a company pledge to NRC in its Final Safety Analysis Report, that "[t]he design and construction of the [irradiated fuel handling] system includes interlocks, travel and load limiting devices and other protective measures to minimize the possibility of mishandling or equipment malfunction that could cause damage to the fuel and potential fission product release,"(15) internal company documents reveal an alarming lack of understanding of the crane.

In an internal Palisades document tellingly titled "Intent of WO [Work Order] Task Exceeded During Troubleshooting," the team sent to inspect the stuck crane and its dangling cask admitted:

"The team members had all been trained to perform mechanical inspections of cranes. In this training, components are visually inspected and mechanically inspected using a number of techniques and tools. While being pre-job briefed, the team heard 'Go and perform a normal mechanical inspection you have been trained to perform." The actual

intent for the inspection approved by the Event Response Team was to perform a visual inspection on the mechanical components to determine if anything was broken. With this disconnect, the team performed a normal mechanical inspection which was outside the intended inspection approved by the Event Response Team…Although we all thought the information we were gathering was within the steps of the Work Order, we failed to consider the severity of the consequences if our troubleshooting caused the load to slip or fall into the Spent Fuel Pool. This is why we set up an Event Response Organization during problems like this – to allow an open forum to recommend tests and troubleshooting activities with full consideration of how these activities will affect the plant/health and safety of the public." [emphases added]

Despite the intention of Palisades management that "they wanted a visual inspection with no components touched," Palisades employee Chad Main wrote in a memo dated 10/11/05 entitled "Troubleshooting on Spent Fuel Pool Crane L-3" that, per crane manufacturer Ederer's instructions over the phone, "[t]o verify the emergency brake was set, Ederer recommended the nitrogen bottle valve be opened and the brake release moved very slowly to remove a small amount of tension on the brake mechanism. This was done and the actuator moved approximately 2 mm." Thus, Palisades workers partially overrode the emergency brake on the crane from which dangled a 107 ton cask fully loaded with high-level radioactive waste, which, if dropped, could have caused a radioactive inferno killing tens of thousands downwind.

The NMC document lists "Vague and Incorrect Guidance…Ineffective Communication…[and] Over Confidence" caused the human error despite the "sensitivity of the suspended load." The document concludes by saying "The team supervisory oversight was given two days off without pay due to not following the Event Response Team instruction."(16)

See on the next page a photo of the Palisades cask during its dangle over the irradiated nuclear fuel storage pool, dated 10.11.2005 at 15:03 Eastern Daylight Time.(17) "…the cask was approximately four feet out of the water,"(18) meaning that 11 feet remained underwater. The crane remained stuck and the cask dangled above the irradiated fuel storage pool for 43 hours, from 5:30 am on 10/11/2005 till 12:28 am on 10/13/2005.(see footnote (26) below, p. 6) Although Palisades site leadership, NRC, NMC's reactor fleet, and the Institute for Nuclear Power Operations (an industry self-policing regulatory body) received word about the cask dangle, the public was kept in the dark for over two months, and documentation was not made available to the public by the NRC till five months later.(19) The cask, weighing about 107 tons, contained 32 irradiated nuclear fuel assemblies, nearly 13 tons worth of high-level radioactive waste.(20)

The inspection team must not have read the work order carefully, because it clearly states "[r]emote visual to be performed" and "perform a visual inspection of mechanical equipment associated with the main hoist on l-3 crane." Further on, the Work Order makes explicit "Do not perform any movement of the L-3 crane" and a "WARNING" about the resetting of the emergency brake potentially causing "uncontrolled movement of the Main Hoist drum…" Further warnings that "caution and

conservatism during the test or evolution, particularly when uncertainties are encountered…[and] Verification that adequate margins of safety are to be maintained when interlocks and protection systems are bypassed," was also discussed, but went unheeded and were in fact violated. Despite admitting that "a MAE (maintenance avoidable error)" had occurred, Palisades inspection team answered "No" to the question "Are any Action Requests or Lessons Learned Warranted?"(21)

So what caused the emergency brake to engage in the first place? Palisades reports that "Prior to 10/11/2005 the EATL [energy absorbing torque limiter] was last set in August 2005…The as-left set-point was 175 ft-lbs. Review of the work order could not validate that Ederer Procedure 260 was utilized or the EATL was tested for repeatability after its setting was applied. The target set point was 186 +/- 18 ft-lbs…The low as-found EATL break away torque value confirms that the EATL is a credible cause for the emergency brake actuation. Discussions with the crane vendor Ederer indicated that EATL slippage from a 93 ton load would be equivalent to an EATL set-point of 121 ft-lbs, which is sufficiently close to the as-found set-point of 140 ft-lbs when consideration is given to the additional loading experienced due to the dynamic affects of a moving load."(22)

"Why did this occur?" NMC asks itself. Its answer: "Review of the work order from August 2005 shows that the break-away torque setting may not have been done correctly. It appears that they may have only adjusted the setting once, yet the procedure in the vendor's manual requires multiple evolutions."(23)

Despite the Ederer crane representative's improper instructions to manipulate the emergency brake during the cask dangle, an internal NMC document reveals that "[the crane] Vendor does not recommend adjusting the EATL with a load suspended" and suggested precautions and "conservative measures consistent with the nature of the load being handled." This document again mentioned that "Big Rock [Point nuclear power plant in Charlevoix, MI] experienced several emergency brake set incidences...The conclusion was that even when the EATL was set within the vendor recommended range (186+/-ft-lbs) the EATL caused emergency brake sets with the crane heavily loaded," apparently during emptying of the storage pool of high-level wastes into dry casks as part of Big Rock Point's decommissioning. However, news of those incidents was not, to this author's knowledge, ever made readily accessible to the public or the media by NRC or the company. And it appears the company did not learn lessons from Big Rock Point, at least not sufficiently enough to prevent a repeat of a cask dangle at Palisades. An important question regarding the Big Rock Point cask dangles is, was the Ederer crane there single-failure-proof, and were safety precautions such as the emergency brake overridden improperly as occurred at Palisades in Oct., 2006?(24)

NMC admitted that "The former L-3 crane…main hoist was not designed as single-failure-proof." But "In 2002/2003, NMC modified the L-3 crane to increase the rated load capacity to 110 tons and incorporate single-failure-proof technology." Luckily, this 2006 cask dangle had not occurred several years earlier, for a cask drop would have been much more likely then. Another important question to answer about the Big Rock

Point cask dangles in Nov. 2002 – before or after the crane at Big Rock was made single-failure-proof? Did Palisades upgrade its Palisades crane to single-failure-proof because of its cask dangles at Big Rock Point?(25)

In its "Root Cause Analysis Report: Crane operator heard loud noise during lift with L-3 crane," Nuclear Management Company admits that "[t]he EATL [Energy Absorbing Torque Limiter] is the last-line-of-defense for overload." It goes on:

"Completion of the annual PM crane inspection activities in August 2005 resulted in the EATL being adjusted. The 'as-found' condition was not recorded at that time. In a telephone interview the vendor representative, who was here in August, indicated the as found condition on August 5th was '…well over 200 ft-lbs.' The acceptable setting range of the EATL is 168-204 ft-lbs. With the acceptance criteria not met, the vendor, with the assistance of an inexperienced plant repair person, reset the EATL. The plant PM procedure and the referenced section of the vendor procedure procedure did not contain steps to reset the EATL. The vendor considered the activity to be routine as he had done it several times. Once the EATL had been set within the acceptance criteria, at 175 ft-lbs, the vendor did not proceed to recheck the torque setting as the procedure known to him did not require it, and in his experience, it was not required to verify the setting. According to the vendor, due to the torque imparted on the reduction gearing from the main hoist motor shaft to the hoist drum it requires two to three workers, working in unison on the torque wrench and motor hoist brake, to prevent kickback of the wrench in accomplishing this task."[emphases added](26) Note that only two workers, not three, each with significant gaps in their knowledge of proper procedure, were assigned to the job.

NMC concluded:

"Investigation into the cause for the EATL not being set at 175 ft-lbs, as was recorded in August, identified that plant procedure direction for checking the EATL setting was inadequate and that no direction existed for adjusting the EATL setting. The Plant's Administrative Service Management procedure had not been implemented to ensure a plant staff member understood the activities that the vendor was performing, and that the vendor was made aware of the plants (sic) process and expectations. Other factors also influenced the cause of the EATL being set incorrectly including: The word orders contain deficiencies. Work proceeded beyond what was detailed in the procedure. The plant staff was not knowledgable of the crane components and has relied on the vendor to complete the annual inspection activities. Additionally, error precursors including high heat and humidity and time pressure influenced the outcome."[emphasis added](27)

NMC reports that "A crane vendor representative noted that the EATL is the last-line-of-defense for overload." And the explanation for the 43 hour dangle before the cask was lowered back down to the pool floor included: "Several factors contributed to this longer than expected time including a general lack of knowledge related to L-3 operation and components related to its single-failure proof design…The system engineer and backup system engineer, who were involved with the shop testingt and acceptance testing

of the crane in 2002 and 2003, are no longer employed by NMC. Ownership of the crane in Outage Management is with its second owner since the beginning of 2004. Maintenance support is dependent on vendor support from Ederer Inc."[emphasis added](28)

A number of follow-on mistakes were made. The as-found EATL setting of "well over 200-pounds (sic)…was not recorded in the [Work Order], not was it entered into the corrective action system…Additionally, another Ederer representative brought to the plant on 10/12/05 agreed, based on his experience that repeating the EATL check is needed to verify its setting. A post maintenance test (PMT) of the EATL, as was specified in the work order, required a verification the EATL works properly. To complete the PMT a validation test should have included a retest of the EATL torque setting. The target set point for the EATL is 186 +/- 18 ft-lbs (168-204 ft-lbs). The work order summary does not maintain a PMT. There is no indication an adequate PMT was done." In addition, "there is no indication in the [Work Order] that the torque wrenches" used to check the EATL setting were properly calibrated.(29)

NMC goes on "The implication in the CAP [corrective action plan] is there is a relationship between setting the EATL and the failure of the diaphragm of the air canister. This is unclear communication that appears to be due to inadequate knowledge of the crane components…It is apparent that the repair of the air canister was believed to be, in part, repair of the EATL. This is not the case. This knowledge deficiency resulted in vague direction in the [Work Order]."(30)

Again referring to the faulty setting of the EATL in August 2005, NMC reports "No provisions were made fro placekeeping or step signoffs on the vendor procedure and neither were used to denote steps were completed…Since there is no specific direction in either of the [Work Order] documents the conclusion is that the EATL was set only by the experience of the vendor. Work outside the direction of a procedure or work order is not within our processes…the FIN repair-worker assigned to assist the Ederer representative on August 5 identified that he was assigned the…task…but had no knowledge of the crane brake operation as he had not previously worked on the equipment. This was a first time task for the FIN repair-worker. He sat down with the vendor and questioned what the task was, and got some understanding of the job, but was dependent on the vendor for direction.(31)

Citing more crane vendor errors both before and during the cask dangle incident, NMC reports "Deficiencies are evident in meeting all these service manager administrative requirements in August [2005] and additionally in March and during the latest vendor assistance from Ederer on October 12 and 13."(32)

The crane vendor and Palisades communicated poorly prior to the August 5, 2005 EATL setting. "This PMT step may not have provided clear direction to the vendor who was unfamiliar with the plant process requirements…This lack of clear direction points to a knowledge deficiency of the EATL operation…There is no indication the checklist was reviewed on August 5th when the EATL was reset. Interviews have indicated the PJB [pre-job briefts] was minimal on August 5…The as found condition of the EATL, per

interview with the vendor, was the setting '…was well over 200 ft-lbs.' This exceeded the acceptance criteria…Work activities did not stop at this point. The 'as-found' condition was not documented in the work order nor was an action request initiated. Work proceeded under the direction of the vendor representative to reset the EATL…this was outside the [Work Order] and procedure guidance that was directing the work activity."(33)

Heat, humidity, stress, and the desire to finish the job as soon as possible in order to leave for vacation contributed to the errors:

"The temperature and humidity up on the crane trolley near the ceiling was said to be very hot and it was humid…The vendor indicated it was hot and that he perspired heavily while working on the crane trolley that day. There were no ice-vests worn. The FIN repair-worker indicated it was extremely hot and humid and protective clothing was an issue from a heat stress standpoint. The personnel involved did not initiate any actions to address heat stress that would have addressed ice vest requirements or stay time restrictions if any were needed…The vendor representative had been onsite for two days prior to commencing work on the crane. On August 3rd the crane was not in the correct spot to access and work was stopped that day. On August 4th the failed diaphragm, in the air canister that failed on March 17, was replaced. On August 5th work was done on the crane that included replacing the rebuilt air canister and checking and resetting the EATL with the vendor representative. Additionally, on Friday August 5th the vendor had a plane reservation to return home and it was perceived he was anxious to leave on time as his vacation was to begin."[emphases added](34)

NMC admits that "Dependence on vendor experience due to plant staff lack of knowledge may be prevalent in other cases."(35)

Incredibly, "Because BRP [Big Rock Point] is not an operating unit it did not submit any operating experience to this issue." This despite a cask dangle at Big Rock on an Ederer crane on Nov. 6, 2002. In addition, "On August 15, 2003 while attempting to lift the BRP Reactor Vessel and place it in a shipping container the Containment Building Crane, an Ederer X-SAM single-failure-proof crane, malfunctioned."(36)

Insuring that the public could not demand that industry learn from these repeated mistakes, NMC reports that "There was no report required to the NRC."(37) This, when false fire alarms and plant management personnel changes are required to be reported to NRC!

Internal NRC emails show that NRC officials were aware of the potential of a cask drop. Magdalena Gryglak wrote to Jamnes Cameron on 10/11/05 that "We were just briefed on the potential cask drop…Based on some older documents, before the crane was upgraded to single failure proof crane, the licensee determined that if the cask were to be dropped, there would be significant damage to the pool and flooding could result…" It seems that the removal of the impact-limiting pads from the bottom of the pool, mentioned above, would only make such pool damage worse.(38)

An NMC document reveals that "All unnecessary personnel were removed from the Spent Fuel Pool Floor," during the cask dangle.(39)

NRC's Mary Jane Ross-Lee, emailing Eric Benner and Carla Roque-Cruz "Re: Palisades," on 10/11/05, shows that Palisades cover up of the incident begin immediately: "the licensee was trying to find out if this event is reportable or not." It seems in NRC's estimation it was not, given how they helped the company keep the public in the dark for months on end. And, despite Ross-Lee assuring her NRC colleagues that "the cask has its own source of cooling," Nuclear Management Company felt the need to "Take temperature of the cask every 4 hours," as well as to "Collect sample and determine boron concentration of SFP [spent fuel pool] and cask every 48 hours...[and] Develop plan to sample cask for Boron concentration." Apparently, NRC's exemption on boron concentration safeguards granted just five days earlier lowered safety margins during this cask dangle incident. NMC also initiated evaluating "the need to whether to refill cask with Spent Fuel Pool Water," apparently to insure adequate boron concentration to prevent nuclear criticality, and cool enough water to prevent waste fuel overheating. Other precautions were taken as well, such as ordering that "No Continuous Work allowed in Auxiliary Building." NMC also had personnel "Analyze Worst Case Condition – Dropped Load" and prepared a "L-3 [crane] Contingency: Preparations for Potential Damage w/Heavy Load Drop."(40)

In order to ensure that they could observe the lowering of the cask once the stuck crane was addressed, NRC officials made sure that all shifts at Palisades would be covered by an NRC official even throughout the wee hours of the night. However, they failed to report the incident for many months, keeping the public in the dark.(41)

Internal NRC emails also expressed concern about boron concentrations. "They should continue to monitor pool boron concentrations…and maintain provisions to identify, mitigate and terminate the consequences of a boron dilution accident as required by our exemption…Keep us informed, especially if there are any plans to add makeup water to the cask." A boron dilution accident could occur if unborated water were added to the pool or dry cask in order to maintain cooling. The risk, however, would be that the unborated water would provide sufficient neutron moderation that a nuclear chain reaction could occur in the still-fissile waste.(42)

It is not entirely clear why NRC reported the cask was "13 feet off the pool floor" during the dangle. Most pools are around 40 feet deep, so the bottom of the cask in that typical situation would have been 29 feet above the pool floor. The higher above the pool floor, the more force the cask would have delivered to the pool floor if dropped. NRC patted itself on the back, saying "The Region-based inspectors and the resident inspectors have been working very well together to provide coverage of this issue." Did they mean "covering up" of this issue, because they kept it quiet for months.(43)

On Wednesday, March 29 the Cook nuclear power plant dropped a 35 ton missile block 15 feet onto the reactor cavity floor. Again, NRC held that the incident was not

reportable. It would not have been reported by NRC until the next quarterly inspection report about Cook. But an anonymous source notified Dave Lochbaum of Union of Concerned Scientists. Lochbaum wrote to the NRC Region III Office of Public Affairs:

"Good Day:

An industry colleague informed me about an incident that happened recently at DC Cook Unit 2 that's making the rounds inside the industry. I find zero information about it on the NRC's website.

Can you confirm any or all of the following:

1) On March 29, 2006, a heavy load was dropped at Unit 2 during refueling.

2) The heavy load was a 35-ton missile shield.

3) The load dropped onto the reactor cavity floor.

4) The load was dropped either because of a rigging problem or a crane failure.

5) A "stop work" was issued by the company in response to the incident.

6) NRC Region III has had more heavy load drops than any other NRC region in the past 12 months."(44)

It is still not clear how much damage was done to the Cook nuclear power plant by this heavy load drop.

In conclusion, with the 20th anniversary of the Chernobyl nuclear catastrophe approaching on April 26th, 2006, it is very sobering to realize that Palisades came all too close to a catastrophic radiation release due to near-drop of a 107 ton cask onto its waste storage pool floor. And that the Cook nuclear power plant, just 30 miles south of Palisades on the Lake Michigan shoreline, actually did drop a heavy load near its reactor vessel, with as-yet incomplete damage assessments.

When combined with the near melt down at Davis-Besse nuclear power plant near Toledo in 2002, it seems that by the grace of God, or by sheer luck, the Great Lakes region has dodged a Chernobyl-scale catastrophe on its very shores.

References:

(1) The NRC quarterly inspection report, covering October 1 through December 31, 2005, is entitled "NRC Inspection Report 05000255/2005012" and is available upon request from Kevin Kamps, NIRS, 301.270.6477x14.
(2) Document available upon request from Kevin Kamps, NIRS, 301.270.6477x14.
(3) NRC NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," published February, 2001, Executive Summary, page Roman numeral x.

(4) DOE's Feb. 2002 Final Environmental Impact Statement for Yucca Mountain is viewable online. See Table A-7, "Proposed Action spent nuclear fuel inventory," and Table A-8, "Inventory Module 1 and 2 spent nuclear fuel inventory," at http://www.ocrwm.doe.gov/documents/feis_2/vol_2/apndx_a/index2_a.htm Calculations, based upon the above tables, showing Palisades' current waste pool inventory available upon request from Kevin Kamps, NIRS, 301.270.6477x14.

(5) Robert Alvarez, Jan Beyea, Klaus Janberg, Jungmin Kang, Ed Lyman, Allison Macfarlane, Gordon Thompson, and Frank N. von Hippel, "Reducing the hazards from stored spent power-reactor fuel in the United States, Science & Global Security, Vol. 11, No. 1, 2003, page 1. See the report at: http://www.princeton.edu/%7Eglobsec/publications/pdf/11_1Alvarez.pdf They report, at page 6: "Inventories of Cs-137 in spent-fuel storage pools. The spent-fuel pools adjacent to most power reactors contain much larger inventories of [Cs-137] than the 2 MegaCuries (MCi) that were released from the core of Chernobyl 1000-Megawatt electric (MWe) unit #4 or the approximately 5 MCi in the core of a 1000-MWe light-water reactor. A typical 1000-MWe pressurized water reactor (PWR) core contains about 80 metric tons of uranium in its fuel, while a typical U.S. spent fuel pool today contains about 400 tons of spent fuel…Furthermore, since the concentration of [Cesium-137] builds up almost linearly with burnup, there is on average about twice as much in a ton of spent fuel as in a ton of fuel in the reactor core."

(6) Alvarez et al., page 6, citing "Exposures and effects of the Chernobyl accident," Annex J in Sources and Effects of Ionizing Radiation, United Nations, 2000, p.472-475. See http://www.unscear.org/pdffiles/annexj.pdf.

(7) Alvarez et al., p. 6, see immediately above at footnote (6).

(8) NRC NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," published February, 2001, Appendix 4, Consequence Assessment from Zirconium Fire; Table A4-7, p. A4-9; Table A4-15, p.A4-15.

(9) NRC NUREG-1437, Supplement 27, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding Palisades Nuclear Plant, Draft Report for Comment, Feb. 2006, Section 2.2.8.5, Demography, p.2-56, citing Nuclear Management Company, LLC, Applicant's Environmental Report-Operating License Renewal Stage, Palisades Nuclear Plant. Docket No. 50-255. Covert, Michigan (March, 2005).

(10) The NRC quarterly inspection report, covering October 1 through December 31, 2005, entitled "NRC Inspection Report 05000255/2005012," p.9.

(11) Hubert T. Bell, NRC Inspector General, "NRC's Regulation of Davis-Besse Regarding Damage to the Reactor Vessel Head," Case No. 02-03S, Dec. 30, 2002, at http://www.nrc.gov/reading-rm/doc-collections/insp-gen/2003/02-03s.pdf .

(12) NRC event report, Event Number 42053, Event Date 10/12/2005, Event Time 17:09 EDT. This condition persisted till 05:00 10/13/2005, or nearly 12 hours.

(13) Letter from L. Mark Padovan, Project Manager, Section 1, Project Directorate III, Division of Licensing Project Management, Office of Nuclear

Reactor Regulation, NRC, to Mr. Paul A. Harden, Site Vice President, Nuclear Management Company, LLC, Palisades Nuclear Plant, dated Oct. 6, 2006, see especially p. 4.

(14) Palisades "L-3 SFP [Spent Fuel Pool] Crane Operation Action Plan," undated.

(15) FSAR Chapter 9 – Auxiliary Systems, Fuel Handling and Storage Systems, Revision 24, Page 9.11-1 of 9.11-26, undated.

(16) Nuclear Management Company, A/R 01000753: Intent of WO Task Exceeded During Troubleshooting, 4 pages, undated.

(17) Pictures of Palisades cask, 7 pages, undated.

(18) NMC, Work Order: L-3 Contingency Dry Fuel Storage 200, 35 pages, undated.

(19) NMC, "Root Cause Evaluation Charter: CAP/RCE0100065901 Crane Operator Heard Loud Noise during Lift with L-3 Crane," 1 page, 10/17/2005.

(20) See Footnotes (4) and (19) above.

(21) See footnote (18) above.

(22) NMC, Manager Sponsor Darrel Turner, "Validation of Cause/PMT Load Test Considerations w/handwritten notes," 1 page, undated.

(23) NMC, A/R 01000980, "Break-away Torque Setting out of Spec (Low) for L-3 SFP Crane," 1 page, undated.

(24) NMC, "L-3 Spent Fuel Pool Suspended Load Recovery," 2 pages, undated.

(25) NMC, "Maintenance History of L-3, Spent Fuel Pool Crane," 2 pages, undated; also see footnote (26) below, p. 14.

(26) NMC, Root Cause Analysis Report, NCE0100065901, "CAP01000659, Crane operator heard loud noise during lift with L-3 crane," 58 pages, undated.

(27) See footnote (26), p. 3.

(28) See footnote (26) pgs. 6-7.

(29) See footnote (26), p. 8.

(30) See footnote (26), p. 9.

(31) See footnote (26), p. 10.

(32) See footnote (26), p. 11-12.

(33) See footnote (26), p. 11.

(34) See footnote (26), p. 12.

(35) See footnote (26), p. 16.

(36) See footnote (26), p. 18.

(37) See footnotes (26), p. 20.

(38) Email, M. Gryglak to J. Cameron, Subject: Palisades crane, 2 pages, 10/11/05.

(39) Action Request Report, Number 01000626, Crane operator heard loud noise during lift with L-3 crane, 1 page, 10/11/2005.

(40) NRC email, and NMC, Event Response Plan: L-3 Spent Fuel Pool Crane, 5 pages, 10/12/05.

(41) Email, J. Ellegood to C. Lipa/J. Cameron/L.M. Padovan, Subject: Schedule for lowering load, 2 pages, 10/12/2005.

(42) Email from Robert Taylor to Mark Padovan regarding Palisades Dry Storage Cask Suspended in Air, 1 page, 10/13/05.

(43) Email, J. Cameron to M. Phillips, Subject: FOR YOUR ACTION: Palisades EDO Bullet, 3 pages, 10/14/05.

(44) Email from Dave Lochbaum, UCS, to NRC RIII OPA, 3/30/2006; Hugh McDiarmid, Jr., "Concrete shield falls in nuclear plant mishap," March 31, 2006.