

April, 2000

Comments Concerning Indian Point Nuclear Generating Unit 2

Public Citizen's Comments to The U.S. Nuclear Regulatory Commission on The Petition Pursuant to 10 CFR 2.206 Concerning Indian Point Nuclear Generating Unit 2

April 7, 2000

Good afternoon, my name is James Riccio. I'm with Public Citizen's Critical Mass Energy Project. My task this afternoon is to brief you on the history of steam generator tube failures here in the U.S. and to demonstrate why we believe this history indicates that the NRC should not allow Indian Point 2 to restart unless and until it replaces the nuclear reactors steam generators.

While the economics of steam generator replacement are questionable and may place the future operation of Indian Point 2 in jeopardy, this should not be a concern of this panel or this agency. Steam Generator tube degradation has already contributed to the early retirement of several nuclear reactors including: Portland General Electric's Trojan reactor in Oregon, Maine Yankee Atomic Power Company's Maine Yankee reactor and Commonwealth Edison's Zion Units 1 & 2 in Illinois.

Although originally designed to last the life of the plant, steam generators have been replaced at nearly two dozen nuclear power plants since the 1980s. Steam generator tube degradation is not only a financial risk to the utility but more importantly a safety risk to the surrounding communities. When degraded steam generator tubes go undetected, they may break, initiating a potentially disastrous sequence of events. The rupture of as few as ten steam generator tubes could result in the meltdown of the reactor fuel rods, potentially releasing catastrophic amounts of radiation into the surrounding communities.

Unfortunately, the Nuclear Regulatory Commission (NRC) staff continues to find that cracks in steam generator tubes may go undetected 40 to 60% of the time. In a November 1992 memo, which had been withheld from public disclosure, the NRC's Director of Nuclear Reactor Regulation reported that "**steam generator tube rupture events appear to be unavoidable.**" According to the NRC, spontaneous tube ruptures have occurred at a rate of approximately one every 2 years for the last 20 years, while tube failures that were incipient and self-identifying through excessive steam generator tube leakage just prior to rupture have occurred at a rate of approximately one per year.

A review of the following history will show that NRC regulation has been unable to

adequately address the issue of steam generator tube ruptures. The nuclear industry's efforts to detect potential tube ruptures have been ineffectual. The steam generator tube ruptures to date have shown that the myriad causes of steam generator tube degradation have gone unchecked, that inspection methods are insufficient to preclude further ruptures and that tube rupture is often accompanied with degradation to other tubes, raising the possibility of a multiple tube rupture.

A Brief History of Steam Generator Tube Problems at U.S. Nuclear Reactors

1975: The U.S. nuclear industry experienced its first steam generator tube rupture at Point Beach Unit 1 in Wisconsin. The steam generator tube rupture occurred in less than 5 years operation. Subsequent inspection revealed that 127 tubes had degraded wall thickness greater than 60%. The steam generators at Point beach were Westinghouse model 44's with mill-annealed Alloy 600 tubing and were replaced in 1984. These are the same steam generators that are still installed at Indian Point 2.

1976: Surry Unit 2 reactor located near Williamsburg, Virginia, experiences the second steam generator tube rupture at a U.S. nuclear plant. The steam generator tube rupture occurred in less than 4 years operation. Subsequent inspection of nine U-bend sections of the steam generator tubes revealed a 4.5 inch crack, four of the other eight pulled tubes revealed cracking that was undetectable with inspection techniques available at the time.

1978: The NRC designates steam generator tube integrity as an Unresolved Safety Issue and plans were established to evaluate the safety significance of degradation in PWR steam generators.

1979: Prairie Island Unit 1 near Minneapolis, MN experienced a spontaneous tube rupture caused by a loose part in the steam generator. NRC issues Information Notice 79-27 Steam Generator Tube Ruptures at Two PWR Facilities, documenting the accident at Prairie Island as well as a similar accident at the Doel 2 nuclear reactor in Belgium. Both reactors were Westinghouse 2-loop plants. The Prairie Island accident released approximately 30 curies of radiation into the environment.

1982: The Ginna reactor located near Rochester, NY experienced a spontaneous tube rupture caused again caused by a loose part in the steam generator. The steam generator tube rupture occurred in less than 5 years of operation. Inspections in April of 1981 revealed eddy-current indications that were not interpreted as needing plugging. The Ginna accident released 90 curies of radiation into the environment. Had there been any damage to the core of the reactor, the bypass of the containment would have provided highly radioactive fission materials a direct pathway into the environment.

1982: Consolidated Edison sues Westinghouse over the Indian point 2 steam generators. **Every utility, with the exception of the Tennessee Valley Authority, that has purchased a Westinghouse reactor has subsequently sued the**

corporation over problems with their steam generators.

1984: Fort Calhoun, near Omaha, NE, experienced a spontaneous tube rupture. The ruptured tube had been included in the last steam generator tube inspection and occurred after less than 10 years of operation. Re-evaluation of the data from that inspection revealed a 99% through wall defect where the tube eventually ruptured.

1987: North Anna Unit 1 near Fredricksburg, VA experienced a spontaneous tube rupture. The rupture was caused by a 360 degree through wall crack and occurred after less than 10 years of operation. The plants technical specifications did not require much inspection of the area that eventually ruptured because it was on the cold-leg side of the steam generator. Thus in the previous inspection only 13% of the tubes in this area were inspected. The tube that eventually ruptured was not among the 13%.

1988: NRC Commissioner Kenneth Rogers acknowledges that multiple tube ruptures can lead to a meltdown of the nuclear reactor:

The concern is with sudden multiple tube failures- common mode failures. For example, such failures could come about by having essentially uniform degradation of the tubes. Degradation would decrease the safety margins so that, in essence, we have a 'loaded gun,' an accident waiting to happen. Under those conditions, a pressure transient or a seismic event could rupture many tubes simultaneously. That could allow primary coolant to enter the secondary system and the resulting high pressure to lift the relief valves that are outside containment on the steam line, thus permitting primary water to by-pass containment and communicate with atmosphere directly, resulting in a LOCA (loss of coolant accident)

1988: NRC issues Information Notice 88-31: Steam Generator Tube Rupture Analysis

Deficiency acknowledging that if the break location becomes uncovered, a direct path might exist for fission products contained in the primary coolant to be released to the atmosphere. The licensee further concluded that the offsite dose consequences exceeded those calculated in the Updated Final Safety Analysis Report (UFSAR) because tube uncovering could produce a direct path for fission product release.

1988: Indian Point 3, located 35 miles from New York City, experiences an incipient tube rupture after 13 years of operation. A 120 gallon/hour leak developed over a two and a half hour period. This amount of leakage was 7 times the technical specification limit. Subsequent inspection revealed a 250 degree circumferential crack.

1989: McGuire Unit 1, located near Charlotte, NC, experienced a spontaneous steam generator tube rupture after less than 8 years of operation. The rupture was caused by stress corrosion cracking involving multiple sites along the tube. Prior to the rupture,

primary to secondary leak rate had been low. The rupture released approximately 30 curies of radiation in to the environment.

1989: Beaver Valley Unit 2, located near Pittsburg, PA, experiences an incipient tube rupture due to wear caused by loose parts. The subsequent inspection revealed that the loose part had removed 97% of the tube wall. Three adjacent tubes were also damaged with wear 62 to 97% through the tube wall.

1990: Duke Power Company sues Westinghouse over the steam generators in the four reactors at Oconee and Catawba stations. Duke alleged that Westinghouse had hidden problems with Inconel or Alloy 600 since 1964. Internal Westinghouse memoranda were cited by Duke in support of their allegations:

An August 17, 1964 Westinghouse memo stated, "Mr. Simpson was informed that he was not to inform anyone with the exception of his boss of the inconel corrosion problem, to prevent a hold on steam generator production."

A June 11, 1968 Westinghouse memo contained the following hand written note: "What do we tell them at this stage? That the alloy is crumbling before our eyes or that service experience is so far good?"

1990: Maine Yankee, located near Bath, ME experiences an incipient tube rupture. The licensees staff re-analyzed their steam generator data from 1988 and found the indication that may have been the precursor to the accident.

1991: An ACRS letter to NRC Chairman Selin states "(t)he sudden rupture of steam generator tubes due to a transient such as a steam line break or seismic event needs to be precluded."

1992: McGuire Unit 1 and Arkansas Nuclear One, Unit 2 both experience incipient tube ruptures. In both instances, inspections in the previous year missed indications of tube wear that exceed the 40% through wall threshold.

1992: Precipitating Portland General Electric's (PGE) decision to close the Trojan reactor in Oregon, Mr. Hopenfeld filed a differing professional opinion (DPO) regarding an NRC decision to allow the nuclear reactor to operate with seriously degraded steam generator tubes. The issue was that "a main steam line break (MSLB) outside containment could trigger a multiple steam generator tube failure which could then result in a core melt because of depletion of coolant inventory." NRC documents leaked to the Union of Concerned Scientists revealed that the risk of a meltdown at the Trojan reactor was 300 times greater than the NRC's Safety Goal standard. Trojan was eventually shutdown and PGE sued Westinghouse rather than replace the steam generators.

1992: In a memo, which had been withheld from public disclosure, the NRC's Director of Nuclear Reactor Regulation reported that "steam generator tube rupture

(SGTR) events appear to be unavoidable." The memo also points out that NRC regulation is less stringent than other countries. "Regarding steam generator tube inspection programs, it is clear that the U.S. lags behind the major European countries in terms of scope of inspection.... Further, the leak rates allowed were reported to be consistently much lower than that allowed by U.S. Technical Specifications."

1993: Palo Verde Unit 2 located near Phoenix, AZ experienced a spontaneous tube rupture after less than seven years of operation. A month prior to the tube rupture the licensee had observed an increasing trend in radiation monitoring activity. NRC's Augmented Inspection Team later determined that the licensee's monitoring method had been inaccurate and had caused the leak rate to be underestimated by a factor of ten.

1994: An ACRS letter to NRC's Executive director for Operations, James Taylor notes that Mr. Hopfenfeld's Differing Professional Opinion "appears to warrant further consideration. This issue has not yet been resolved& "

1994: Maine Yankee was shut down in July due to steam generator tube cracks that had been present since 1990 but had gone undetected. The Maine Yankee Atomic Power Company claimed that, even with the circumferential cracks, the steam generator tubes could have withstood a worst-case accident. Whether Maine Yankee's assertions were true or in fact it violated the NRC's requirements for steam generator tube integrity has never been determined. After attempting unsuccessfully to find a buyer for Maine Yankee, the utility retired the reactor.

1995: NRC issues Generic Letter 95-03: Circumferential Cracking Of Steam Generator Tubes to notify addressees about the recent steam generator tube inspection findings at Maine Yankee Atomic Power Station and their safety significance. Later that year the NRC issued Generic Letter 95-05, Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking. The alternate repair criteria allows a greater number of tubes with crack indications to remain in service.

1995: Ms. Connie Hogarth filed a 2.206 petition with the U.S. Nuclear Regulatory Commission requesting that the operating licenses for Indian Point Nuclear Generating Units 2 and 3 be suspended until the licensees have completed the actions requested by Generic Letter 95-03.

1996: NRC denies Ms. Hogarth's 2.206 petition stating that due to "the steam generator inspections required by their technical specifications, both Indian Point Nuclear Generating Units 2 and 3 are required to monitor primary-to-secondary leakage to ensure that, in the event that steam generator tubes begin to leak, operators will be able to bring the plant to a depressurized condition before a tube ruptures."

The NRC acknowledged that stress corrosion cracking of the Indian Point Unit 2 steam generator tubes was first detected during the 1993 refueling outage. However, Unit 2 steam generator tubes that showed signs of circumferential cracking have been removed from service.

1996 Commonwealth Edison retires the Zion Unit 2 reactor rather than replace the steam generators. Zion Unit 1 is shut down five months later. The reactors operated for less than 24 years.

1997: NRC issues Information Notice 97-79: Potential Inconsistency In The Assessment Of The Radiological Consequences Of A Main Steam Line Break Associated With The Implementation Of Steam Generator Tube Voltage-Based Repair Criteria. The notice states that Commonwealth Edison's Braidwood reactor miscalculated the accident consequences of a main steam line break when it applied for license amendments to implement the new repair criteria. The notice goes on to acknowledge that other licensee had made the same mistake in their license amendment requests.

1998: NRC kills plans for a steam generator rulemaking and a proposed generic letter, instead deferring to the Nuclear Energy Institutes 97-06. The staff was leaning toward rulemaking and the generic letter because reactor technical specifications were not adequate to ensure safety from new, more severe form of steam generator tube degradation.

1999: NRC staff grants Indian Point 2 a license amendment that allows Consolidated Edison to forego steam generator tube inspections required by their technical specifications. This was supposed to allow a one time exemption from the 24 month inspection interval and removed the requirement that the NRC approve the Indian Point 2 steam generator inspection program.

2000: Indian Point Unit 2 is forced to shut down on February 15th due to a steam generator tube failure. NRC later acknowledged that both Con-Ed and the NRC staff had mishandled the 1997 steam generator tube inspection and that the 1999 license amendment was based upon faulty analysis.

How this agency can allow aged nuclear plants to forgo steam generator tube inspection is beyond me. I know that Indian Point 2 is not alone in this regard, the NRC has allowed many other reactors to skip inspections through several regulatory loop- holes. Does the NRC really want gamble with the prospect that the first multiple tube rupture at a U.S. nuclear reactor will occur 35 miles from New York City?

Considering the steep cost of steam generator replacement and the uncertainty of recouping the investment in a competitive market, Consolidated Edison may decide

not to replace their steam generators and either attempt to sell or retire the reactor. However, the prospect of nuclear reactors limping along with seriously degraded steam generators is neither in the interest of the nuclear utilities nor in the interest of public health and safety. That is why I'm asking that the NRC not allow Consolidated Edison or any other owner to restart Indian Point 2 unless the steam generators have been replaced.

I thank you for your time and consideration of this most important issue.