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Joosten, Sandy

From:	Vinod Arora [vinnie48in@gmail.com]
Sent:	Friday, April 19, 2013 12:27 AM
To:	CHAIRMAN Resource; Leeds, Eric; Borchardt, Bill; R4ALLEGATION Resource; Lantz, Ryan; Benney, Brian; Hall, Randy; Howell, Art; Dorman, Dan
Subject:	NRC Chairman is humbly requested that OIG, NRC conduct an inquiry concerning the NRC'S handling of issues associated with the San Onofre steam generator tube rupture described below.

HAHN Baba April 19, 2013 at 12:02 am *Your comment is awaiting moderation.*

Sincere Thanks to NRC Chairman, Mr. Victor Dricks, Mr. Cale Young, Mr. Ryan Lantz, Mr. Randy Hall and entire NRC Staff. Thanks to NRC for posting this blog.

San Onofre NRC/SCE/MHI/Public Awareness Series – Please excuse me for any computer or human performance grammatical or spelling errors.

Preface: It is the legal and moral duty of every United States government official and politician to ensure that public safety is not endangered, whether, it is gun violence, terrorist attacks or radiological accidents. But, that does not seem to be case with NRC preliminary approval of San Onofre proposed License Amendment to Operate Unit 2 at 70% reduced power.

Recommend Action: Office of the Inspector General (OIG), U.S. Nuclear Regulatory Commission is requested to conduct an inquiry concerning the NRC'S handling of issues associated with the San Onofre steam generator tube rupture. This inquiry is required to address concerns raised by 8.4 Million Southern Californians, Numerous Safety Experts and Public Organizations and members of the Congress (Senator Barbara Boxer and Congressman Rd Markey) as a result of some of the issues described below.

Conclusions: It appears that NRC commission has not given proper time to NRC Brilliant NRR and RES Staff to study and evaluate the significant adverse consequences of San Onofre Unit 2 Restart reduced power experiment. The problems with Unit 2 Restart are intentionally buried in reams of worthless paper submitted by SCE and its consultants. It appears that NRC Commission under pressure from Edison Management and Lobbyists has hastily indicated approval of proposed SCE License Amendment with an attempt to bypass the Public Hearing. NRC and SCE want to subvert the Legal Process for questioning by Safety Experts to challenge the fallacies of the SCE License Amendment documents. From the review of NRC Office of Inspector General, Fukushima Task Force, Davis-Besse, Three Mile Island and SONGS Units 2/3 Reports, it appears that NRC is not following its own rules and Lessons Learnt from operating experience of radiological accidents.

San Onofre defectively-designed and degraded 21st Century Safest and Magical Unit 2 floating anti-vibration structure is subject to collapse under adverse consequences of fluid elastic instability, flow-induced vibrations, high cyclic fatigue and Mitsubishi Flowering Effect caused by anticipated operational transients and main steam line breaks even with Unit 2 at reduced power. In San Onofre replacement steam generators, the relative motion between the tubes and the anti-vibration bars (AVBs), the tube support plates, and the retainer bars have resulted in unprecedented tube-to-tube wear and fatigue due to adverse phenomena described above. These adverse phenomena can produce relatively quick tube failures when the stresses generated during severe vibrations of tubes are sufficiently large.

As described in Unit 2 Return to Service Report, Attachment 4, MHI Document L5-04GA564, Appendix 16, page 459 of 474, MHI used a finite element model ("FE"), to conclude that the tubes were subjected to a stress of 4.2 ksi (kilopounds per square inch) . Consequently, MHI concluded that the stress on the tube due to in-plane vibration is under fatigue limit (13.6 ksi) and the structural integrity of the tube is confirmed from the view point of fatigue due to in-plane vibration (page 470 of 474). A review of the MHI report indicates that results are based on two erroneous assumptions. The source of MHI's error has resulted from how MHI has calculated the increase in the local stress at geometrical discontinuities (notches), which are formed when two metal surfaces come in contact during vibration. Since the worn surfaces of the tubes inside the steam generators cannot be seen, MHI made two incorrect key assumptions, which are inconsistent with the observation that both the tube and the supporting bar are worn into each other. First, MHI assumed that the ASME endurance limit could be applied directly to the notched tube surfaces. Since it is commonly known that surface roughness significantly reduces fatigue life and since the ASME data is for smooth polished surfaces, this assumption would underestimate the amount of fatigue damage. Secondly, when using the Peterson chart, MHI assumed an unrealistically large fillet radius and consequently derived a low concentration stress factor. Large radii would decrease the local stress and cause the tube to fail at a higher level of stress, thereby increasing its fatigue life. Only by using these two, arbitrary, non-conservative assumptions was MHI able to conclude that Unit 2 did not suffer any fatigue damage. When these assumptions are corrected, the opposite conclusion is reached, which is that the tubes will be susceptible to failure from fatigue.

MHI states, "MHI did analyze the potential for fatigue failure of the RSG tubes under operating conditions and determined that fatigue was not a credible tube failure mechanism because the stresses sustained by the tubes due to in-plane vibration are well below the stresses that would cause fatigue failure. The analysis that supports this conclusion is contained in Appendix 16 to the "Tube wear of Unit-3 RSG – Technical Evaluation Report." Westinghouse, AREVA, SCE and Intertek have failed to address the synergic effects of tube-to-tube wear and high cycle fatigue induced cracks. NRC Brilliant NRR and RES Staff has completely missed this aspect of tube failure, because they are under political time pressure to approve the Restart of Unit 2. Hence, the NRC Commission has failed to fulfill its exclusive responsibility for enforcing radiological health and safety requirements for 8.4 Million Southern Californians. The proposed SCE license amendment does not meet the qualification criteria under 10 CFR 50.92.

Let us discuss why the proposed SCE license amendment does not meet the qualification criteria under 10 CFR 50.92 based on a very basic and fundamental understanding of physics, vibrations, stresses and heat transfer.

Nucleate Boiling Region – In this region of the steam generator, the saturated feedwater picks up energy from the hot reactor coolant tubes and begins to boil. The initial heat transfer process in the tube bundle is called the nucleate boiling. The tubes remain wetted, and small bubbles rapidly form and break away from the surface of the tubes. Nucleate boiling provides a large heat transfer coefficient because of the turbulence resulting from the bubble formation. Most of the primary-to-secondary heat transfer occurs in this region of the tubes – continued below.

Film Boiling Region – Nucleate boiling continues until enough water is vaporized to allow a blanket of high dry saturated steam to form on the tubes; this condition is known as film boiling. The steam blanket forms gradually as the steam quality reaches higher values. It becomes fully developed within a very short axial distance of the tubes. The steam quality and vapor fraction in the film boiling region are 100%.

Nucleate boiling (steam bubble formation is at the tube interface) takes place when the surface temperature of the tube is hotter than the saturated steam-water fluid mixture temperature by a certain amount but where the heat flux is below the critical heat flux. Nucleate boiling occurs when the surface temperature is higher than the steam saturation temperature (TS) by between 7.2 °F to 54 °F. The critical heat flux is the peak on the curve between nucleate boiling and transition boiling. In case of Unit 3, the temperature difference was 75 °F (Departure from Nucleate Boiling) and it was film boiling or very high dry devastating steam (in-plane fluid elastic instability, vapor fraction ~ 99.6-100%) in the Unit 3, four percent region of tube-to-tube wear. In case of Unit 2, the temperature difference was 67 °F and it can be described as some state between nucleate boiling and transition boiling and production of moderate dry steam (out-of-plane random vibrations, vapor fraction ~ 98.5

%) in the region of tube-to-AVB wear. It is highly conceivable, that this moderate dry steam in Unit 2 on the way up from the high region of tube-AVB wear exited the tube bundle as very high dry devastating steam due to additional steam flows, but did not do the damage as Unit 3 because of wider tube clearances in the upper most U-bends.

Steam saturation temperature is a function of steam pressure. Higher the steam pressure, higher the steam saturation temperature and vice-versa. At lower steam pressure, you can produce more heat and more megawatts. This is basic Intermediate College physics and heat transfer knowledge, which SCE and MHI Engineers knew but chose to ignore it by refusing to lower void fraction as described in the MHI Root Cause Analysis. You know why, because it would have produced less heat (less profits for SCE), delayed construction of SGs by modification of SG components, increased the fabrication cost, triggered a lengthy NRC Review, and forced shutdown of old steam Generators costing more money, downtime, inspections and tube plugging.

Nucleate boiling prevents fluid elastic instability and formation of high dry steam. Now SCE and MHI are blaming each other and are coming out with thousands of pages of faulty and unconvincing analysis and trying to wash their ignorance and sins by blaming faulty computer modeling, contact forces and manufacturing errors. It appears that NRC Commission is watching the whole show with sleepy eyes, and rose-colored glasses with blinders, and telling 8.4 Million Southern Californians not to worry. What is in this Billions of Dollars and Public Safety Poker Game for NRC Commission? Like NRC Brilliant Staff is already not in trouble with 8.4 Million Southern Californians with NRC Commission show of favoritism towards SCE. Based on NRC Inspector General and Congressman Ed Markey's Reports, one is likely to conclude that NRC Officers, who are favorable to for the low performance of Unsafe and INPO 4 Utilities, like SONGS, expect to find a lucrative consulting assignment with a Utility after retirement.

Let us get back to Film Boiling and examine what it will do to Unit 2 SG tubes at 70% power operations in case of a main steam line break. Due to main steam line break event with failure of the main steam isolation valve to close, the steam generator u-tube bundle will be depressurized and the pressure will be atmospheric. From High School physics, everybody knows, that at atmospheric pressure, steam saturation temperature is 212°F. With tube surface temperature at 600°F, the temperature difference between the hot tubes and secondary environment would be approximately 400°F. Steam line break event will cause automatic trip of the reactor, turbine, reactor coolant and feedwater pumps. With the feedwater pumps trip, the U-tube bundle will be uncovered for a period of 10 minutes due to shrinking of SG water level. Now the difference between sub-cooled feedwater temperature of 400°F and tubes temperature is conservatively 150°F. Therefore, feedwater will instantly flash to steam and create high energy jet impingement on tubes. In other words, in a matter of less than 1 minute, the entire SG will develop film boiling region or would be full of 100% high dry steam, and tubes would beginning to experience the adverse consequences of fluid elastic instability, flow-induced vibrations, high cyclic fatigue and Mitsubishi Flowering Effect. Who knows and can predict the short-term and long-term cancerous effects of offsite radiation doses exceeding the Federal Limits caused by a potential radiological accident in Unit 2.

SONGS Unit 3 RSGs' unprecedented tube failure and massive tube and AVB/TSP degradation occurred due to fluid elastic instability, flow-induced random vibrations, Mitsubishi Flowering Effect and high cyclic fatigue under the following unique circumstances:
(1) U-tube bundle areas with high dry steam, double in-plane velocities (> 56 feet/sec, Dr. Pettigrew and others, 2006-2011) compared with out-of plane velocities assumed (28 feet/sec) to have been used in William Krotiuk 2002 Report NUREG-1919 TH calculations and predicted by Outdated Out-of-Plane Westinghouse /NRC /MHI /AREVA ATHOS Computer Models,
(2) Lack of positive in-plane restraints and zero damping,
(3) Large number of SONGS Unit 2 RSG U-bends with tube clearances of only 0.05 inches (Design 0.25 inches, Industry Norm > 0.25 inches),
(4) Excessive number of tubes with narrow tube pitch to tube diameter,
(5) Low in-plane frequency tubes and retainer bars compared with MHI SGs' higher in-plane frequency tubes

and retainer bars,
(6) SONGS' tubes being much longer than Westinghouse Model 51 steam generators (Average length of heated tube = 730 inches) and other MHI SGs,
(7) MHI RSGs' unique floating tube bundle with degraded Retainer Bars can collapse due to 100% tube uncovery for 10 minutes under MSLB SG Depressurization, Multiple SGTR SG over-pressurization and lifting of SG Relief Valves, Combination of MSLB and SGTR Conditions, Release of 100% RCS Iodine to Environment,
(8) Large amount of uncertainties and unverified assumptions in MHI, AREVA, Westinghouse and Intertek's contact force (zero for in-plane vibrations), wear rate and tube stress calculations (4.6 ksi versus 16-17 ksi) and computer modeling, and,
(9) Incomplete tube inspections in SONGS Unit 2. Incubating macroscopic circumferential cracks caused by fluid elastic instability, flow-induced random vibrations and high cycle thermal fatigue are extremely difficult to detect and be accurately sized by nondestructive evaluation techniques including X-ray, ultrasonic, and eddy current based bobbin coil probes, mechanically rotating pancake coil (RPC), etc., which have been used in 170,000 SONGS Tube inspections. State-of-the-art systems: Zetec MIZ-80 iD system, Tecnatom TEDDY+, Circular TE and TM, transmit-receive eddy current array probe C-3 and other specialized radiographic probes capable of detecting sub-surface cracks caused by high cycle thermal fatigue have not been used in the 170,000 SONGS Tube Partial and Limited Inspections as shown below for Unit 2 due to access problems in the most problematic innermost sections of the U-Tube Bundle, the high cost, lack of availability of highly specialized tools and contractors, radiation doses, and time considerations in a rush to start Unit 2. The inspection scope defectively designed and degraded SONGS Unit 2 RSGs should have covered 100% hot leg and cold leg tube inspections, 100% of dents or dings, 100% of tube inspections in the tight radius U-bends, 100% area of the Top of the Tube Sheet and Tube Support Plates.

So from the above basic theory of nucleate and film boiling, we conclude that proposed SCE License Amendment (1) Would involve a significant increase in the probability of an accident previously evaluated in the SONGS FSAR; or, (2) Create the possibility of a new or different type of accident previously evaluated in the SONGS FSAR; or, (3) Would involve a significant reduction in the required margin of safety by operating Unit 2 at 70% power without adequate repairs or replacement.

Margin of safety is related to the confidence in the ability of the fission product barriers to perform their design functions during and following an accident. These barriers include the fuel cladding, the reactor coolant system, and the containment system. As demonstrated above, these barriers would be significantly challenged by operating the Unit 2 at 70% power due to a main steam line break or other anticipated operational transients. The margin of safety will be drastically reduced and NRC cannot ensure that SCE plant operators would be able to protect adequately the health and safety of the public. Therefore, the proposed changes involve a significant reduction in a margin of safety.

SCE License Amendment has not described the changes in plain English so that it can be understood by 8.4 Million Southern Californians without detailed knowledge of nuclear plant design and operation. SCE License Amendment has not identified and discussed the previously causes of San Onofre Unit 3 accident that are affected by the proposed changes in Unit 2 and requested by NRC in Confirmatory Letter and NRR Request for Additional Information (RAI). Despite repeated requests, NRC AIT Team has not looked in detail regarding the consequences of operational differences between Units 2 & 3 on the root causes of the unprecedented Unit 3 tube-to-tube wear and No tube-to-tube wear in Unit 2. NRC AIT Team has not charged to date SCE and MHI for their negligence and mistakes in the design and fabrication of replacement steam generators, subverting the regulatory process and endangering the safety of 8.4 Million Southern Californians by putting Production/Profits over Safety. Thanks...