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From: Phoebe Anne Thomas Sorgen [phoebes@earthlink.net]
Sent: Thursday, May 02, 2013 2:59 AM
Subject: public comment re NRC consideration of SCE's restart plan for San Onofre's Unit 2 reactor

Importance: High

Honorable Commissioner:

I am writing to urge you to NOT approve Southern California Edison's (SCE's) restart plan for San Onofre's Unit 2 nuclear reactor in San Diego county, California. Too much has gone wrong there. Shutting it down forever would be the most sensible business decision and it would also be the only sane choice for anyone who cares about public safety.

A San Onofre nuclear power plant safety engineer, who has worked in the nuclear field for 25 years, warned ABC news* that “there is something grossly wrong” with the plant and that it faces the prospect of a full or partial meltdown if it is restarted. Due to broken tubes carrying scalding water, there could easily be a main steam line break, which would cause the nuclear reactor core to overheat and result in a Fukushima-like meltdown.

Need I remind you that in Pressurized Water Reactors like the ones at San Onofre, inside the containment dome, the reactor heats and irradiates -- highly pressurized primary coolant water to over 600 degrees Fahrenheit -- which would be well above boiling at atmospheric pressure, but it's pressurized to about 2200 pounds per square inch, and so it doesn't boil unless the system springs a leak. In that case, it flashes instantly to steam as it exits the leak. If the pressure drops low enough inside the primary loop, it will start to boil, which can lead to vibration problems in the reactor core -- a much worse place for vibration than even in the steam generators. It can also result in massive radiation releases and meltdowns.

The caustic and radioactive primary coolant flows through thousands of dime-thin tubes inside the steam generators. In fact, the surface area of the u-tubes inside the steam generators comprise about 50% of the total area of the "primary boundary" protecting the public and the environment from the radioactive iodine and other poisons which are normally entrapped in the primary loop. The reactor pressure vessel itself, 8 inches thick of high quality steel, is part of the same primary boundary layer as the dime-thin tubes, and operates at the same pressure.

The secondary coolant loop, which flows outside the tubes but inside the steam generators, is at a much lower pressure (more than 1000 psi lower). As it passes by the u-tubes that are carrying the primary coolant inside them, the secondary coolant picks up some of the primary coolant's heat as the two coolant loops race next to each other inside the steam generators. Being cooler and under lower pressure, the secondary coolant loop heats up and turns to steam as it rises past the tubes. At the top of the u-bend it's nearly all steam -- this was part of the problem in Unit 3 -- not enough water for damping. Above the u-bends, the steam runs through a series of swirl vane moisture separators, dryers, and massive pipes until -- with less than 1% water in it -- the steam impinges on the turbine blades which are in a large building outside the containment dome. The turbine spins, generating electricity. After doing the work, the steam is condensed back to water (much of it has already condensed as it impacts the turbine blades multiple times in high- and then low- pressure blade rings). Final condensing is accomplished using a third coolant loop of ocean water (lake water or river water in other reactors, always mixed with dead fish, fish fry, larvae and other large and small sea life). The condensate is then pumped back into the steam generator as "feedwater" to go around again and again and again... if nothing

goes wrong.

San Onofre has two closed loops and one open loop with sea water. The primary loop is highly radioactive. The secondary loop should not normally be radioactive at all, but it often is, slightly. This is because some leakage from each loop is "normal" in the parlance of the nuclear industry.

On January 31st, 2012, Unit 3 (which is not under consideration for restart) sprang a leak, which was a pinhole-sized hole. Enough primary coolant was leaking into the secondary coolant side that regulations required the plant to shut down. The size of leak was growing and had they waited, it could have gotten MUCH worse very fast. Subsequent investigation showed that SCE (and all of Southern California) was lucky that day: The u-tube that failed had a two-foot long wear spot where it had it burst. The tube could have easily ripped completely open (like that oil pipe in Arkansas last month), to the point where its entire contents would have leaked into the secondary coolant loop.

Whenever primary coolant leaks, some of it escapes into the environment, because the radioactive noble gases don't condense when the steam is condensed to water. That leakage was what was measured the day Unit 3 shut down and how they knew they had a leak in the first place. The excess radiation was discovered, not surprisingly, in the turbine room, near where the condenser is located.

But things could have gone much worse for several reasons. One reason is that the damaged tube might have broken off and flung itself against other weakened and damaged tubes, causing them to break off in a cascade of tube failures. The tubes on either side of the tube that ruptured were also highly worn and near their breaking point, even without another tube banging into them under extremely high pressure, and then flailing around.

The NRC needs to develop a plan asap for multiple tube ruptures, as well as for cascades of tube ruptures. During subsequent pressure testing of Unit 3's steam generators after the sudden shut-down last year, 8 tubes failed the tests; which is something that has never happen before in the history of the US nuclear "fleet." Three of those (including the one that had previously leaked) failed at below the expected, routine pressures that might occur during normal operating procedures, such as start-up or shutdown, or during what are known as "design basis accidents" which are accidents the owner/operator of the reactor is required to plan for because it's assumed they will occur somewhere sooner or later, and in many cases (such as a main steam line break) have occurred in the past.

In a multiple-tube rupture, there would be little time act, and no books or experts to guide the San Onofre control room operators. By the time they've figured out what's happening, the reactor's fuel will have become uncovered and a partial meltdown would have started. There may be nothing they could have done. If the ruptures occur because of a main steam line break the control room operators will be very, very busy.

It is because of the extreme amount of tube wear that Unit 3 cannot be restarted without a complete redesign of the steam generators and perhaps five years of just sitting there costing money for the ratepayers while the replacement steam generators -- untested in the field and currently nonexistent -- are designed and built.

Unit 2, on the other hand, suffered only one kind of vibration (known as "flow induced vibration" or FIV) and associated wear damage, but supposedly, Unit 2 did not experience the more damaging kind of vibration that Unit 3 was affected by (known as "fluid elastic instability" or FEI).

One reason Unit 2 should not be restarted is that it most certainly CAN suffer FEI. Despite more than a year of study by "experts," the exact reasons Unit 2 did not suffer from FEI are disputed and in any case, are unprovable without restarting the reactor and seeing what happens at various temperatures, pressures, flow rates and other operating conditions.

SCE insists the reasons for the different wear types and rates between Unit 2 and Unit 3 are subtle manufacturing differences between the two steam generators in Unit 2 and the two in Unit 3. They say these differences altered the flow of the secondary loop enough to prevent FEI in Unit 2. However, what if it was something else? Surely if they really knew what it was, they would know how to control it, and would have asked for a full restart at 100% power for the full fuel cycle of about 22 months. Then they would make some profit. Instead they are asking for 70% power for only 5 months, then they promise to do a thorough inspection. Their calculations say that for at least five months, it will be safe to operate. Their calculations also indicate that wear will continue, and that Unit 2 will be pretty well worn out within the five month period if any of their "worst case" scenarios turns out to be the correct one. Those scenarios are, in their opinion, significantly less likely. So that leaves us with two obvious questions: 1) What if their estimates are wrong? and 2) What if their estimates are right but something goes wrong anyway?

SCE's idea of a "worst case" scenario isn't nearly as bad as things can actually get. They are ignoring several problems.

Not only might they be wrong about what prevented FEI in Unit 2, but FEI will still be possible in Unit 2 if there is a main steam line break with accompanying isolation valve failure. If that happens, the secondary coolant in the steam generator will all immediately flash to steam and rush up and out the generator to the environment. As it rushes past the U-tubes, they will be devoid of the damping effects from the water that would normally have been there (that damping effect was missing in Unit 3).

But that's not the only problem. Another serious fallacy in SCE's restart plan is that there is an improper accounting of the fatigue factor from all the vibration that has occurred and can occur in the steam generators.

Fatigue is difficult to inspect for, difficult to model on computers, and impossible to predict accurately as to size, location, or the time or force it will take for something that has been stressed to subsequently fail.

The way a ductile (bendable) piece of metal becomes fatigued is that it can withstand, for example, millions or maybe even hundreds of millions of small stresses, but large stresses introduce the beginnings of microscopic cracks that grow over time until one day, the crack races through the metal and the metal cleaves along the crack. An important question that needs to be answered before any restart is considered at San Onofre is: Have the metal u-tubes inside the steam generators been overly stressed?

SCE claims they have not. Outside **experts dispute that claim** because their research concludes that the water in the secondary loop (outside the u-tubes) travels at least twice as fast across the tubes as SCE assumes (as the steam rises up the steam generator, it has a horizontal component). The horizontal component is fast enough to bend the tubes out of shape by more than their stress limit.

SCE did 170,000 individual inspections of the 40,000 tubes in units 2 and 3 after the tube rupture in January 2012. But all those inspections (just over 4 per tube) were for external tube wear from rubbing against each other or against tube support plates and other structural components of the steam generators. Fatigue wear was virtually ignored because their calculations assumed the tubes had not been stressed beyond their fatigue limits. Or was it that they didn't want to find what they might have found?

Yesterday another news item about San Onofre came out, about a repair job on a huge pipe in Unit 3 that was leaking. San Diego's 10 News reported -- with photos -- that the pipe **leak was being channeled into a container with a combination of broomstick handles, plastic bags, and tape. A whistleblower at the plant says that the entire plant is rusting out, and cited a long fire main as one of the most rusted and dangerous pipes. *** Pure insanity!**

It's far past time to decommission San Onofre. There's no reason for SCE to wait for NRC approval. If they

obtain approval to restart, the plant can only operate at 35% of its previous output which is not enough to make it a significant source of income for SCE. Since they can only operate one unit which must be shut down frequently for extensive inspections to see if it's wearing out quickly, it cannot provide reliable "base load capacity." (It never actually did provide reliable base-load capacity.) At 70% power, the reactor can still suffer from catastrophic failure caused by station blackouts, fires, earthquakes, tsunamis, sabotage, or many other events. The steam generator problem makes all of these other problems more likely to turn into major catastrophes.

I urge you to tell the SCE that they will NOT be given permission to restart either of their broken reactors. Please, stop this insanity and get them shut down before they shut US down. (Otherwise, I'll have to sic jellyfish swarms on it as at Diablo Canyon. Bless those angelic jellyfish!;)

Sincerely,

Disaster & Fire Safety Commissioner Phoebe Sorgen

*<http://rt.com/usa/san-onofre-nuclear-insider-652/>

*** 10 News: Plastic bags, tape, broomsticks fix San Onofre leak:

<http://www.10news.com/news/investigations/photograph-picture-given-to-team-10-shows-plastic-bags-tape-broomsticks-used-to-fix-leak-at-san-onofre-043013>