CHAIRMAN Resource

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Sent:	Tuesday, November 29, 2016 10:28 PM
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Subject:	[External_Sender] Coping with a Station Blackout

Good morning,

Although I have both operating and construction experience with BWRs, I have only construction experience with a PWR. Therefore these comments are being made limited to BWRs (after having read IAEA-TECDOC-1770, "Design Provisions for Withstanding Station Blackout at Nuclear Power Plants".)

This publication provides comprehensive information about how to most probably have AC power when you really need it. This is important. Still, I believe a few more additions and clarifications are in order when discussing coping. Let me try to make them now.

In the beginning, (of modern day commercial nuclear power), engineers and designers provided passive safety equipment that would, (could?), work without continuous, or any, AC electricity. I know these plants by the names of Oyster Creek, Nine Mile Point Unit I, Dresden 2 and 3, and Fukushima Dai ichi Unit 1. The passive safety equipment is known either as emergency condensers or isolation condensers. Without taking time to thoroughly explain them, let me just say that the beauty of these systems is in their simplicity. Imagine, upon loss of AC, that the AC powered instrument air compressor stops working, air pressure falls no longer holding one condensate return valve closed. And, as the condensate return valve opens, the emergency/isolation condenser system is automatically placed into service. This happens without any (human) operator action at all.

But, those heat exchangers and the elevated makeup water storage tanks that feed them cost money. Wouldn't it be cheaper to not buy them? About all that takes is a strong conviction that you will never lose safety-related AC for more than 15 minutes or so, maybe a little longer. Then with 2 hr or 4 hr station batteries, you will have the electricity you need to control the steam turbine powered (HPCI & RCIC) pumps that use reactor vessel generated steam energy to pump water back into the reactor vessel as needed.

In either case, you may also have big, AC powered feedwater pump systems, (condensate pump to what we called feedwater booster pump to feedwater pump), that need substantial AC power to run.

Now, let's get started. In my opinion, if the Tokyo Electric Power Company/Fukushima Dai ichi Unit 1 plant's isolation condenser systems had been configured and operated as we ran the Niagara Mohawk Power Corp./Constellation Energy/Exelon/Nine Mile Point Unit I plant's emergency condenser systems, their nuclear fuel <u>would not have been damaged</u> during the March 11, 2011 accident. So, what went wrong there?

Actually, the reference IAEA publication addresses this, although in an indirect way. The "code-words", found on page 7, starting on line 6 say:

"it may be desirable to bypass some non-critical protective features to allow safe shutdown equipment to perform its intended functions during accident conditions."

What those words mean is this: do not protect your isolation condenser system at the expense of your nuclear fuel. At the Tokyo Electric Power Company (now Holdings, Inc.)/Fukushima Dai ichi Unit 1 plant, they saved the isolation condenser system but lost the core.

Next, let's take a look at these words from page 11, starting on line 22.

"A common definition of "SBO coping time" is the time available from loss of all permanently installed AC power sources until onset of core damage."

In these days of powerful computer codes, (MELCOR, MAAP), shouldn't each plant have a known coping time? Say, for instance, it is 6 hours for plant "A". Now here is a big problem to me (and the industry too). Because of certain problems that arise during their accident, the steam driven pumps that would be expected to provide them the 6 hours fail at 4 hours. Clearly, the nuclear fuel will be melting shortly. Where is the guidance to the plant operators on what to do now?

This is not covered in the reference IAEA publication, which I would define as success-path oriented. (It does not cover the possibility of failure.) Yet, didn't we see multiple failures at the Tokyo Electric Power Company Holdings, Inc. Fukushima Dai ichi plants?

(Now pay close attention here, because I feel this is a major point to be made.)

I feel the multiple explosions at the Fukushima plants were made possible by the failure of any site management or procedural control to prohibit delayed water injection into the reactor vessel(s) (after a certain, already calculated amount of time.) What I think happens is that the water molecule disassociates by combining its oxygen with the now very hot metal inside the reactor vessel and freeing the hydrogen to be an explosion threat.

It is time for the industry to stop acting like we will never be in this position: Fukushima shows us that we already were.

Now let me make another point. Your nuclear fuel has melted and some has left the reactor vessel. (At simulator training, we called it "core on the floor"), although a lot may be clinging to the (control rod drive mechanism handling) carrousel beneath the reactor vessel.

Doesn't it make sense to reduce very high radiation fields from the ex-vessel corium with water for shielding by flooding up the primary containment to some predetermined level? And doesn't that require that the drywell be vented in a hardened and reliable way?

So why the continued delay by the industry in installing it?

Let me finally note that you can't flood up the primary containment if you have already blown it up. So, above, I did not take time to stress the need, especially anticipating core melt conditions, to protect at least the bottom part of the primary containment. This would be done, in part, by NOT HAVING RUPTURE DISKS in the primary containment vent path.

So there are some thoughts to consider.

Thank you,

Tom Gurdziel
Member, ASME

Although, in the past, I may have mentioned that, at the time I earned my fully unrestricted Senior Reactor Operator license, I had to successfully pass all requirements for the Reactor Operator license, I do not believe I have ever mentioned that my shift job was as a Shift Technical Advisor, the training for which I also received.
