Union of Concerned Scientists

Status of Fukushima Lessons

July 31, 2014

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Good morning. Thank you for soliciting our views on this topic.

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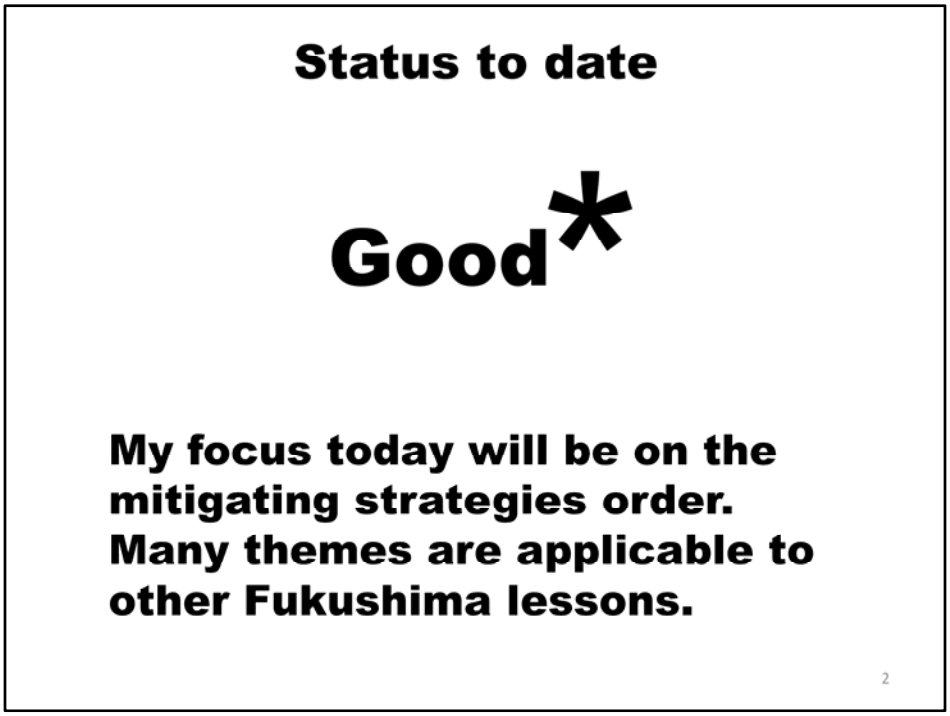

Overall, we'd rate progress to date as Good, although with a fairly large caveat.

My remarks today will focus on the mitigating strategies order but the themes apply more broadly.

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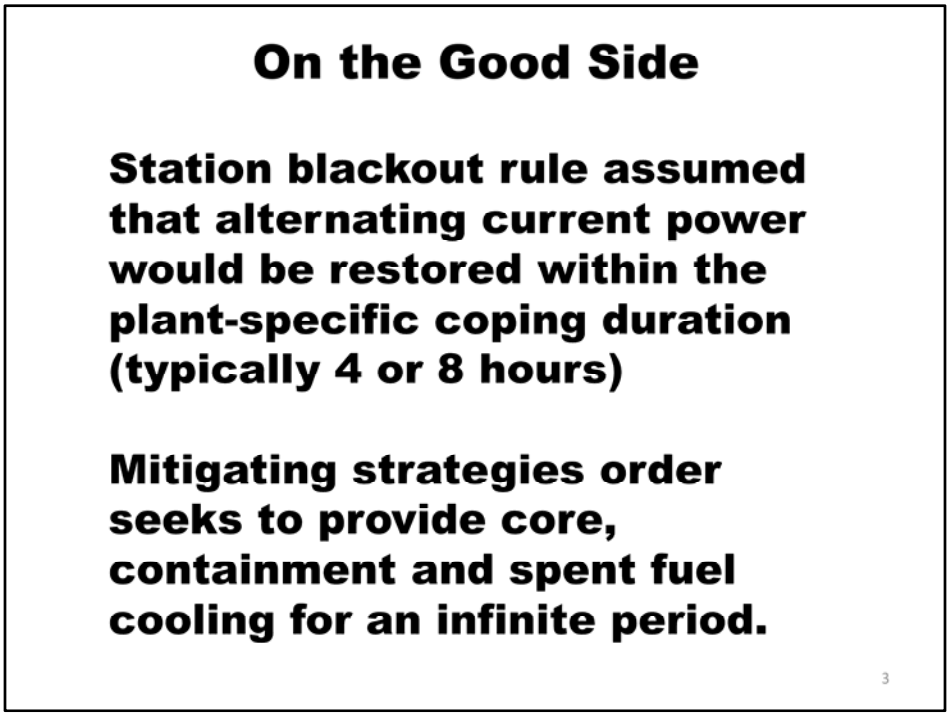

The station blackout rule assumed that either the offsite power grid or onsite emergency diesel generators would be restored within hours. It provided no protection against power outages lasting longer than the assumed coping duration.

A strength of the mitigating strategies order is that it relies on no subjective duration.

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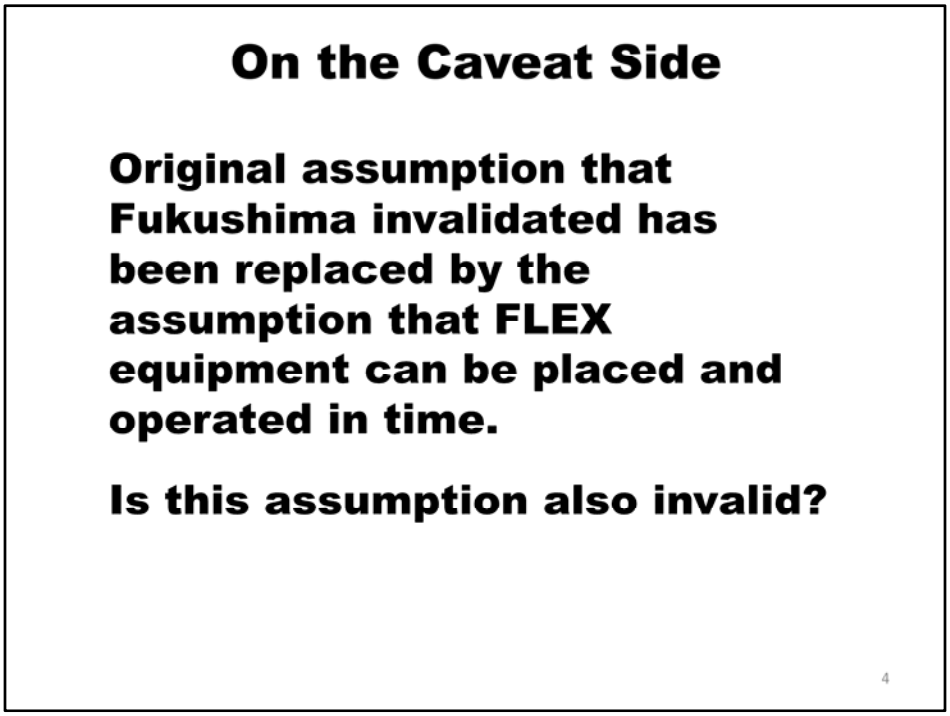

But have we solved the problem or just swapped problems?

The mitigating strategies order assumes that FLEX will be deployed in time to prevent core damage.

UCS is not convinced that the order's assumption is valid.

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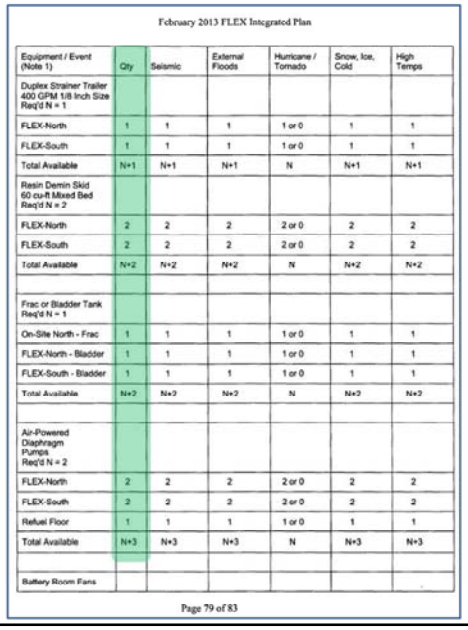
On the Good Side



February 2013 FLEX Integrated Plan

Equipment / Event (Note 1)	Qty	Seismic	External Floods	Hurricane / Tornado	Snow, Ice, Cold	High Temps
Duplex Strainer Trailer 400 GPM 1/8 Inch Size Req'd N + 1						
FLEX-North	1	1	1	1 or 0	1	1
FLEX-South	1	1	1	1 or 0	1	1
Total Available	N+1	N+1	N+1	N	N+1	N+1
Resin Demin Skid 60 cu-ft Mixed Bed Req'd N = 2						
FLEX-North	2	2	2	2 or 0	2	2
FLEX-South	2	2	2	2 or 0	2	2
Total Available	N+2	N+2	N+2	N	N+2	N+2
Frac or Bladder Tank Req'd N = 1						
On-Site North - Frac	1	1	1	1 or 0	1	1
FLEX-North - Bladder	1	1	1	1 or 0	1	1
FLEX-South - Bladder	1	1	1	1 or 0	1	1
Total Available	N+2	N+2	N+2	N	N+2	N+2
Air-Powered Diaphragm Pumps Req'd N = 2						
FLEX-North	2	2	2	2 or 0	2	2
FLEX-South	2	2	2	2 or 0	2	2
Refuel Floor	1	1	1	1 or 0	1	1
Total Available	N+3	N+3	N+3	N	N+3	N+3
Battery Room Fans						

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In general, FLEX provides at least N+1 widgets or connections when N is required for success.

Source: ML13063A063

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My apologies to Entergy for drafting Pilgrim to illustrate our points. My Pilgrim-specific comments generally apply to all operating reactors.

A potential strength of FLEX is in providing at least N+1 options when N is required for success.

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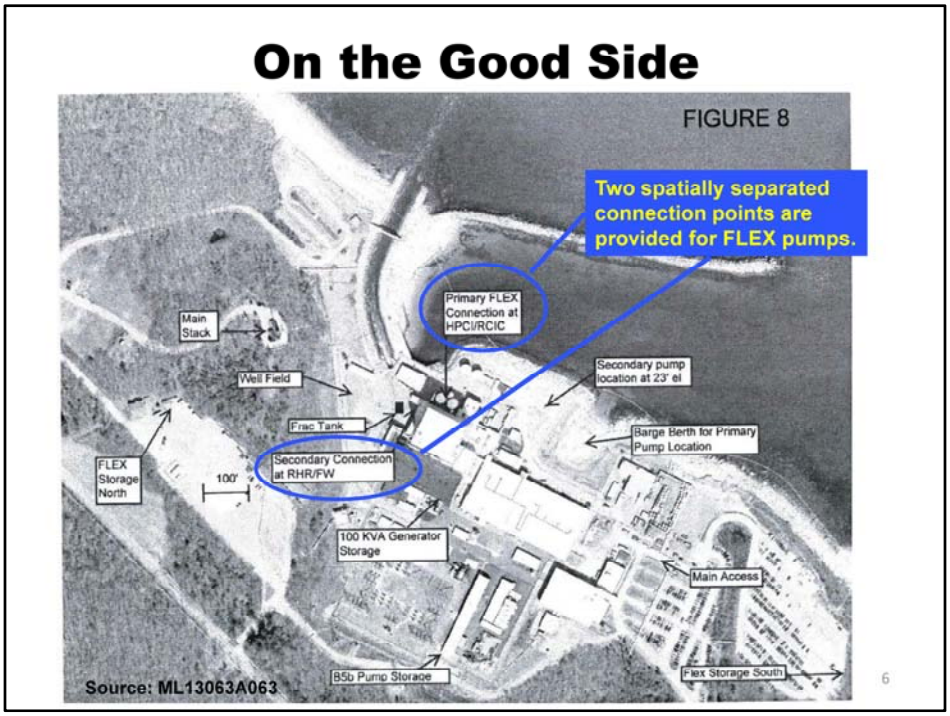

This map of the Pilgrim site shows that multiple points are envisioned for connecting FLEX's makeup pumps.

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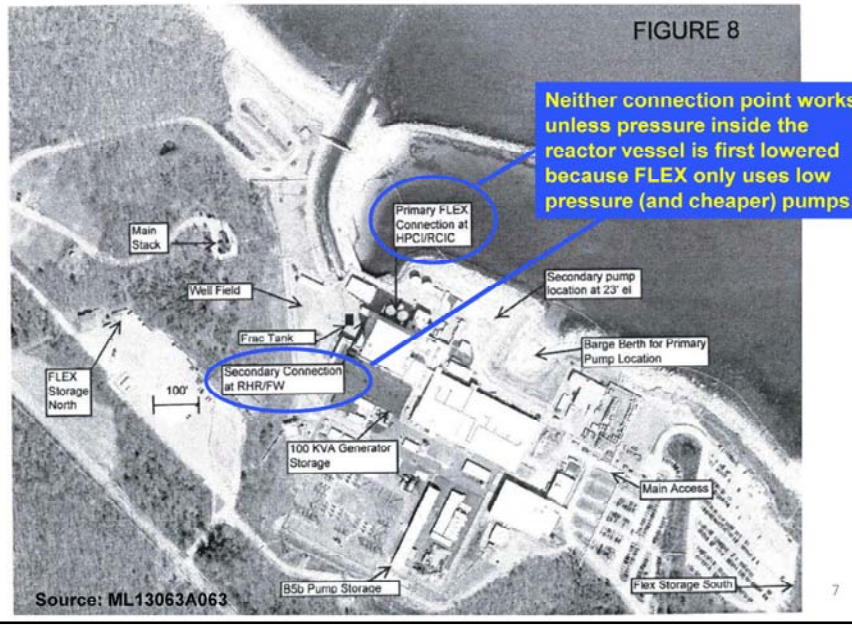
On the Caveat Side



But even a dozen connections could be useless because <u>none</u> of the FLEX pumps can provide high pressure makeup. The reactor pressure <u>must</u> be reduced by non-FLEX methods for FLEX's teeny tiny pumps to work.

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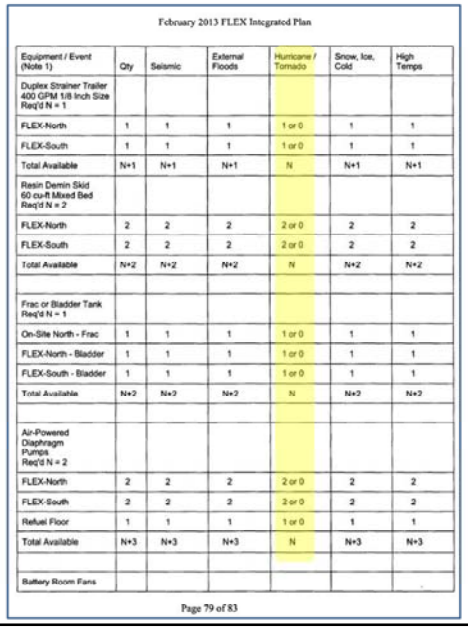
On the Caveat Side



February 2013 FLEX Integrated Plan

Equipment / Event (Note 1)	Qty	Seismic	External Floods	Hurricane / Tornado	Snow, Ice, Cold	High Temps
Duplex Strainer Trailer 400 GPM 1/8 Inch Size Req'd N + 1						
FLEX-North	1	1	1	1 or 0	1	1
FLEX-South	1	1	1	1 or 0	1	1
Total Available	N+1	N+1	N+1	N	N+1	N+1
Resin Demin Skid 60 cu-ft Mixed Bed Req'd N = 2						
FLEX-North	2	2	2	2 or 0	2	2
FLEX-South	2	2	2	2 or 0	2	2
Total Available	N+2	N+2	N+2	N	N+2	N+2
Frac or Bladder Tank Req'd N = 1						
On-Site North - Frac	1	1	1	1 or 0	1	1
FLEX-North - Bladder	1	1	1	1 or 0	1	1
FLEX-South - Bladder	1	1	1	1 or 0	1	1
Total Available	N+2	N+2	N+2	N	N+2	N+2
Air-Powered Diaphragm Pumps Req'd N = 2						
FLEX-North	2	2	2	2 or 0	2	2
FLEX-South	2	2	2	2 or 0	2	2
Refuel Floor	1	1	1	1 or 0	1	1
Total Available	N+3	N+3	N+3	N	N+3	N+3
Battery Room Fans						

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0 < N and nature rather than the NRC's assessment determines the outcome.

Source: ML13063A063

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Entergy's analysis for Pilgrim shows that a tornado could disable all of the FLEX equipment. Having more equipment that workers cannot use is not the proper goal here.

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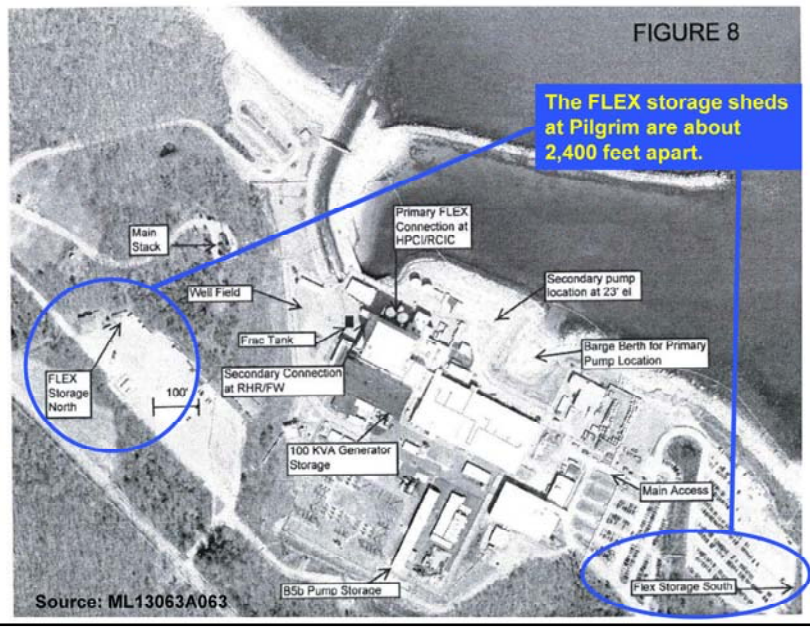
On the Good Side



To guard against a tornado affecting both FLEX storage locations, Entergy positioned them more than a stone's throw apart.

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On the Caveat Side

NRC *assumes* that "Should one storage area be lost, the surviving storage area has adequate equipment."

Tornado that devastated Moore, OK must not have been aware of the 2,400 foot rule.

Disaster Picture: FEMA

Source: ML13225A587 10

The NRC assumed that one and only one location will be compromised by extreme weather.

Apparently, the tornado that devastated Moore, Oklahoma did not know about this 2,400 foot rule when it destroyed far larger portions of that city.

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On the Caveat Side

February 2013 FLEX Integrated Plan

Equipment / Event (Note 1)	Qty	Seismic	External Floods	Hurricane / Tornado	Snow, Ice, Cold	High Temps
(Note 5) Req'd N = 2						
FLEX-North	1	1	1	1 or 0	1	1
FLEX-South	1	1	1	1 or 0	1	1
Batt Room, Staged	2	2	2	2	2	2
Total Available	N+2	N+2	N+2	N+1	N+2	N+2
Small Diesel Generator, 120/240 VAC 1-PH Req'd N = 1 - 12 kW Req'd N = 2 - 6 kW						
FLEX-North	3	3	3	3 or 0	3	3
FLEX-South	3	3	3	3 or 0	3	3
Total Available	N+3	N+3	N+3	N	N+3	N+3
Debris Removal Wheel Loader On-Site, Req'd N = 1	N	N	N	N	N	N

Notes:

1. The Tornado Event is the most limiting and potentially results in only "N" FLEX Equipment available, including the loss of the B.5.b Pump, but this event has no potential to drain the SFP, which is the basis for the primary SFP Spray capability of the B.5.b Pump in accordance with 10 CFR 50.54(hh) for Security-Related Events. All other events will result in at least "N+2" FLEX Pumps available, each of which has the same capability as the B.5.b Pump and can provide SFP Spray at the same flow rates and conditions. The B.5.b requirement includes a SFP makeup rate of at least 500 GPM and SFP Spray requirement of 250 GPM and is not based on a particular leakage or boil-off makeup rate, it is the required spray flow needed to prevent exposed spent fuel from reaching the oxidation temperature after a SFP draindown. This B.5.b capability is not compromised in any way by the simultaneous deployment of FLEX Equipment. For all ELAP and LUHS Events, "N" FLEX Pumps provide the required capacity for Core Cooling, Containment Heat Removal, and SFP Makeup Water.

N+3 = N when only one debris remover is provided, unless events are "tidy" and only deposit debris in designated places.

Source: ML13063A063

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Entergy claims to have N+3 capabilities. But N+3 may only equal N unless extreme weather cooperates by only cluttering up one small area.

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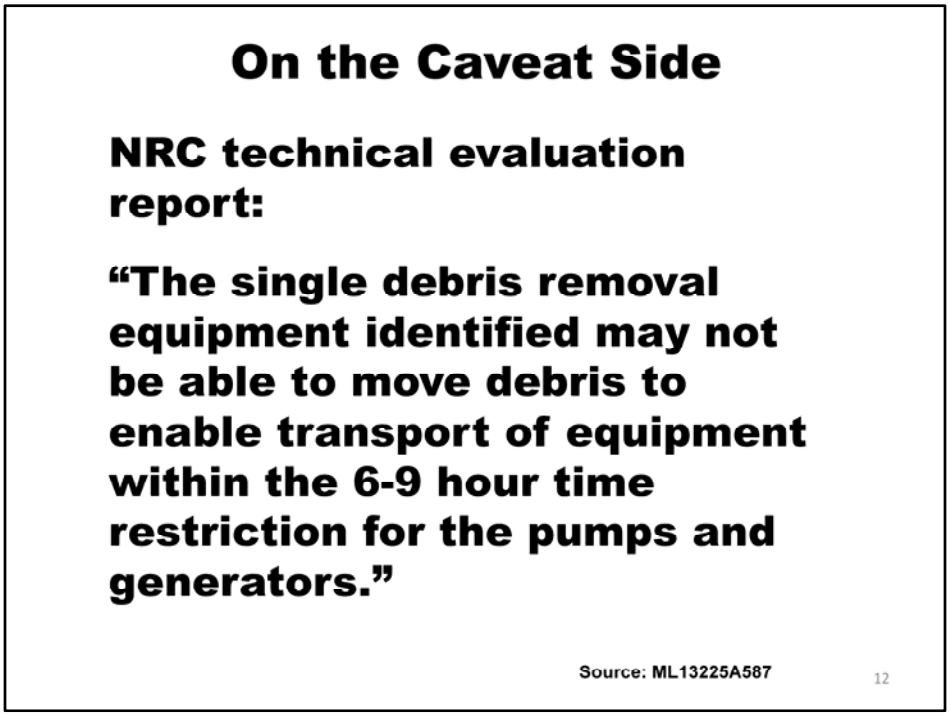

As the NRC's review of Entergy's plan noted, the N debris remover may not be able to free up the N+1, N+2, and N+3 equipment in time.

The Japanese word for this situation may be Fukushima.

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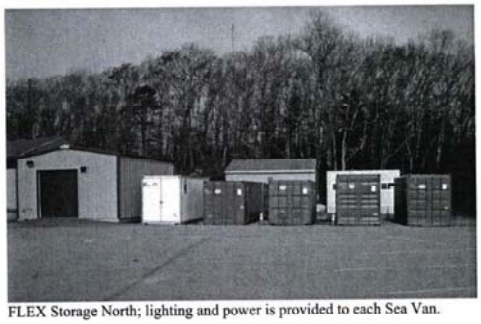
On the Good Side

February 2013 FLEX Integrated Plan

Attachment 5
PNPS FLEX Equipment Storage Sea Vans

PNPS will be storing FLEX equipment in Sea Vans at two separate locations at the opposite extremes of the Owner Controlled Area (approximately 1800ft geographically separated). The locations are also at the higher elevations on the site, a minimum of 30ft above mean sea level. The North Storage Area is partially established and is as shown in the photos below. The Sea Vans are supplied with AC power for equipment heaters and lighting, one Sea Van is environmentally controlled, and the others ventilated. The site storage is located and arranged to also support equipment testing, operability, and provide for rapid deployment.



FLEX Storage North; lighting and power is provided to each Sea Van.

Equipment over and above that provided for B.5.b is now onsite.

Source: ML13063A063

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Another strength of the mitigating strategies order is that considerably more equipment is now staged onsite. Workers have more options.

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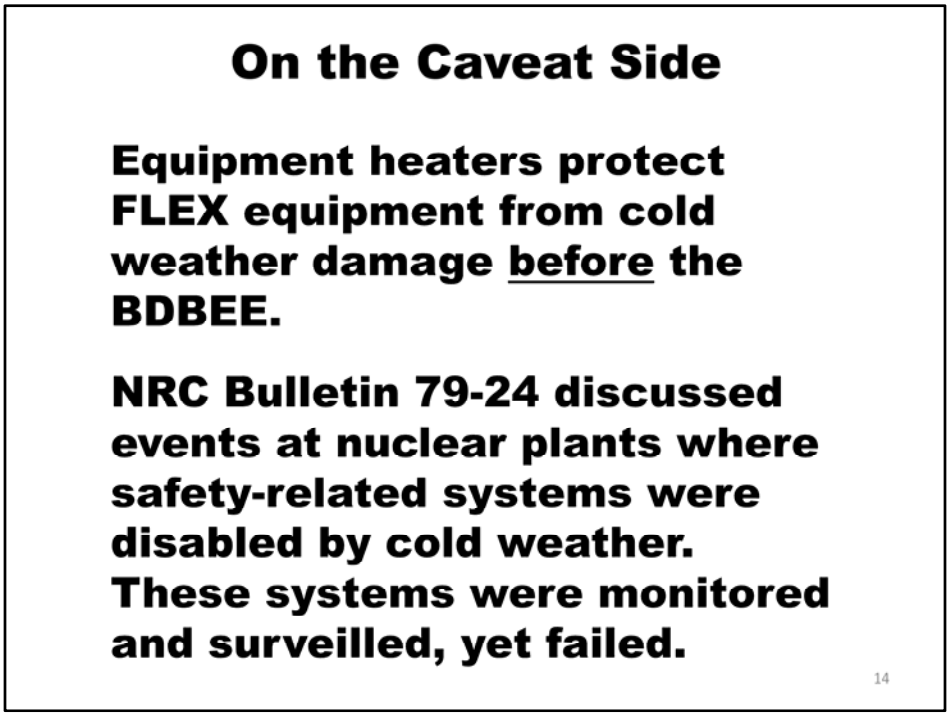

But will that equipment be damaged before the need arises?

There are no regulatory requirements to monitor the storage shed heaters or to fix them within some timeframe if one happens to notice that they are broken.

Monitored and tested safety equipment has been disabled by cold weather, but NRC assumes that unmonitored and untested equipment somehow avoids this outcome.

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On the Caveat Side

NRC requires that workers periodically check air inlet and outlet ventilation ports for dry casks for blockage, but not for FLEX storage pods.

Source: NRC Flickr Gallery

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Regulatory requirements have workers periodically inspecting the air inlet and outlet ports for dry storage systems for ventilation flow obstructions.

But NRC assumes that FLEX's unmonitored storage sheds at the same site are somehow immune to such blockage mechanisms.

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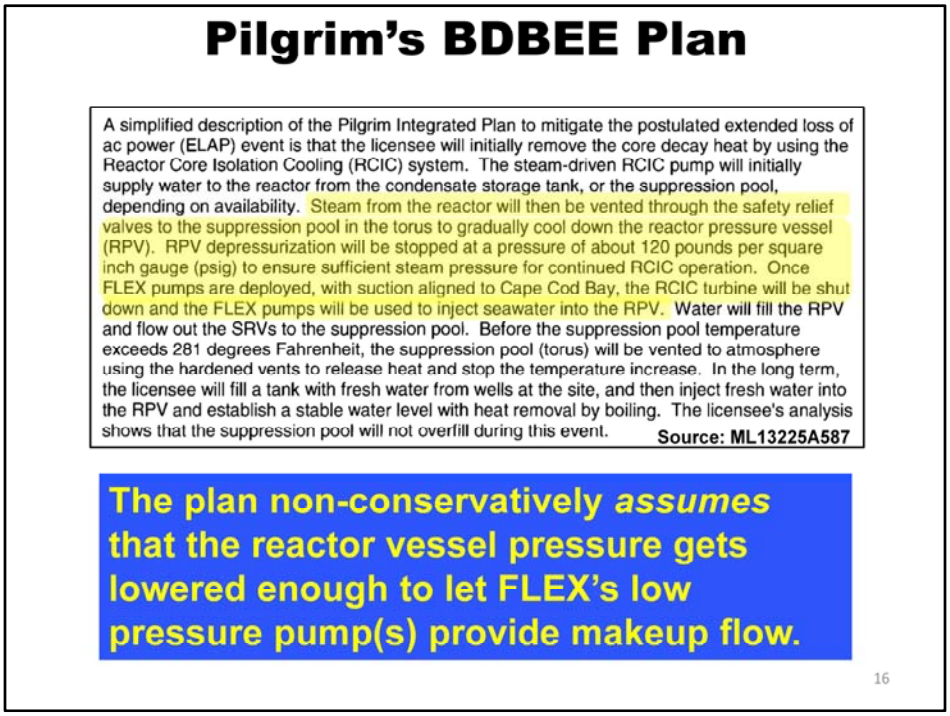

This is the NRC's summary of Pilgrim's plan developed in response to the mitigating strategies order.

As previously noted, the plan non-conservatively assumes that the reactor pressure is somehow lowered to allow the little bitty FLEX pumps to work.

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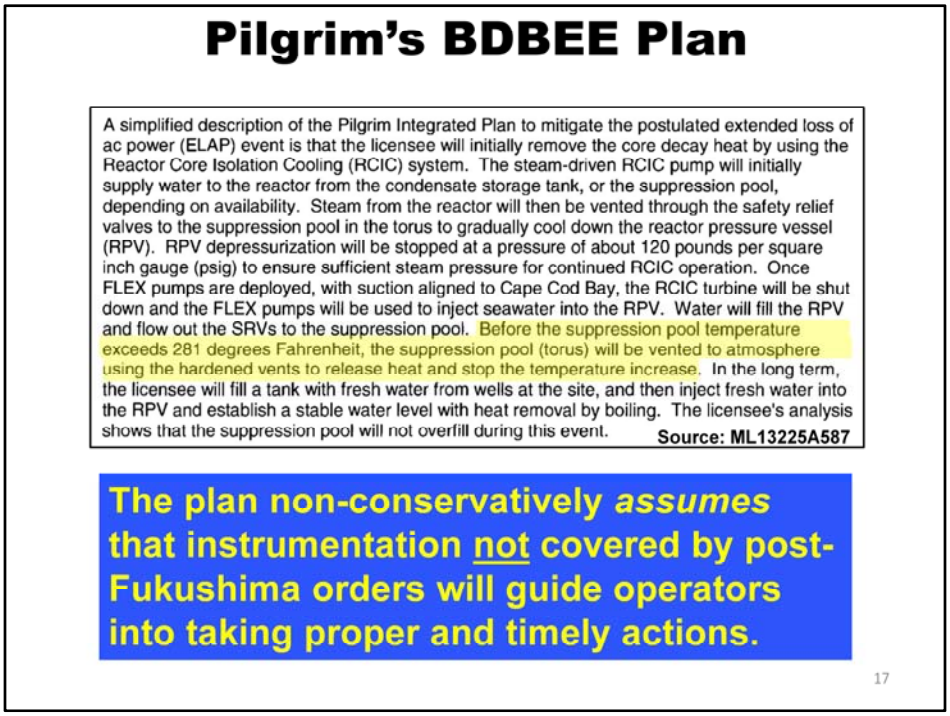

And the plan non-conservatively assumes that plant instrumentation not covered by any of the NRC's post-Fukushima reliability orders somehow continues to work just fine and guides the operators into taking proper and timely mitigating actions.

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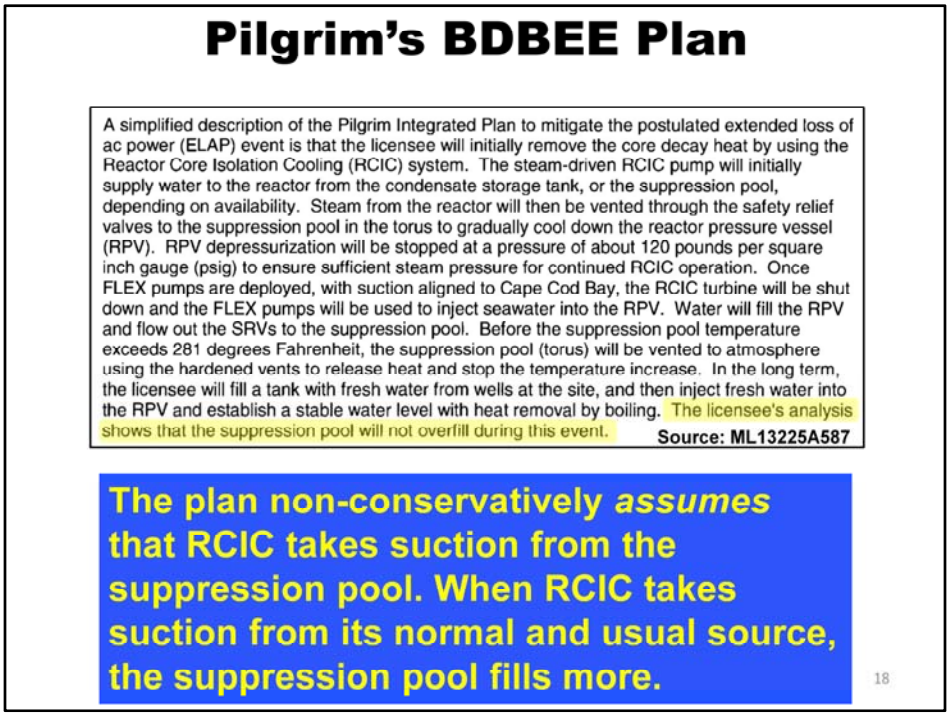

The plan also non-conservatively assumes that the reactor core isolation cooling system, called RCIC, will only draw water from the suppression pool and provide it to the reactor vessel for core cooling. This water will return to the suppression pool as steam flowing through the relief valves.

When RCIC draws water from its normal source, the condensate storage tank, the suppression pool will fill up much faster.

But somehow RCIC is magically re-aligned to its non-preferred supply source and the very bad outcome of the suppression pool overfilling is conveniently averted.

This assumption is non-conservative and non-flexible.

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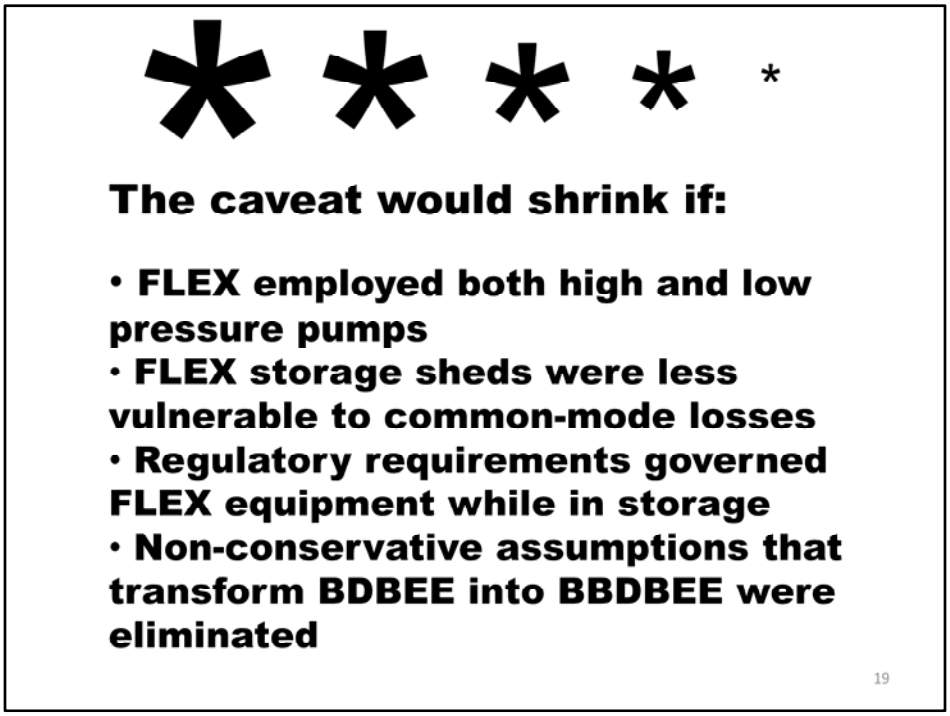
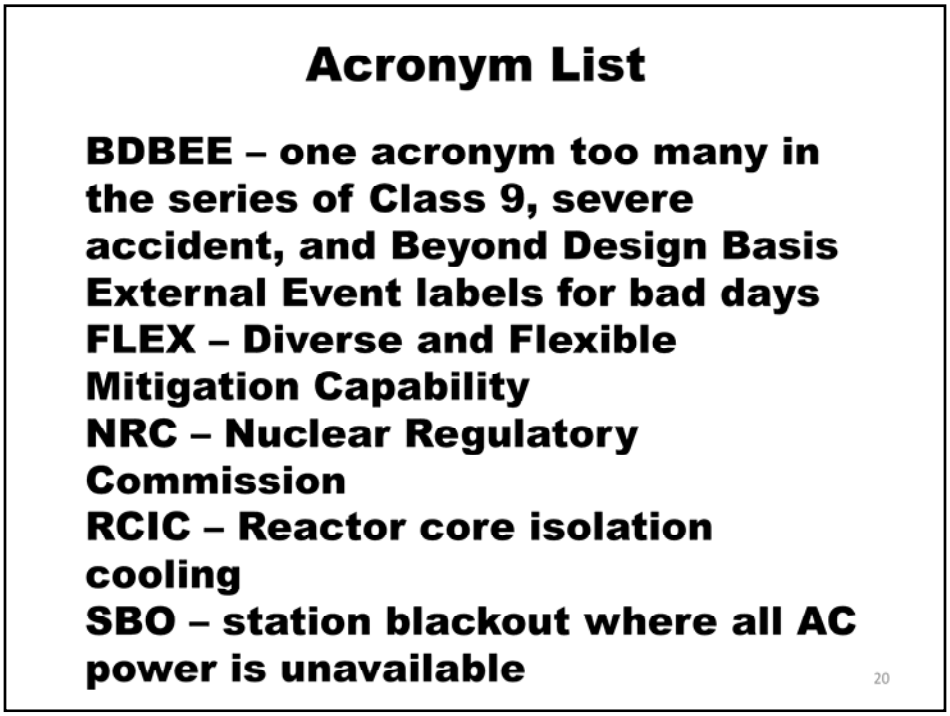


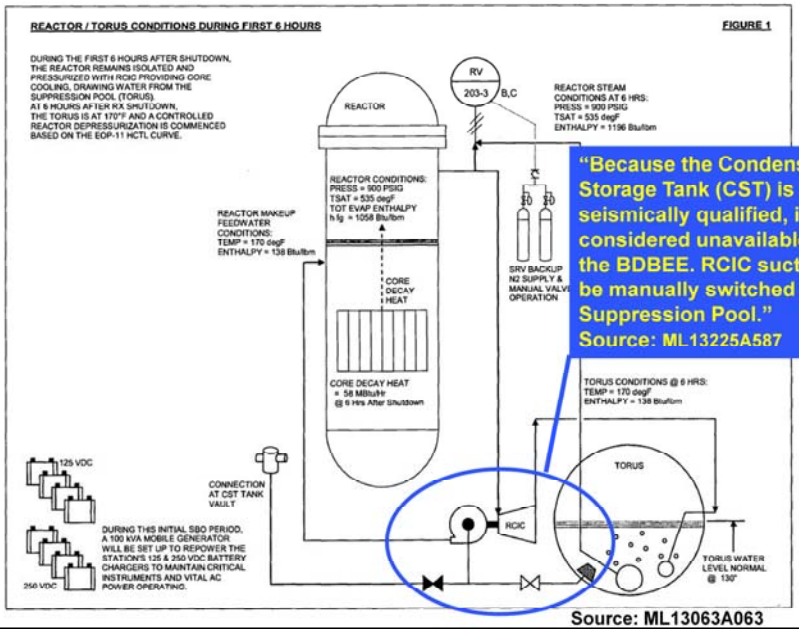
The mitigating strategies order would be better if it resulted in pumps that would work under both high and low reactor pressure conditions, if these pumps and collateral equipment were stored in locations less susceptible to common-mode losses, if regulatory requirements ensured sufficient monitoring of equipment while in storage, and if many non-conservative assumptions were eliminated that transform beyond design basis external events into barely beyond design basis external events.



Yogi Berra may have had this situation in mind when he said, "It's déjà vu all over again." Two decades ago, the NRC mandated hardened containment vents be provided on boiling water reactors. After Fukushima demonstrated that this safety upgrade would not work during the very accident in which it would most likely be needed, the NRC mandated that the old hardened containment vents now be made reliable. Two years ago, the NRC mandated that mitigating strategies be provided for all nuclear power reactors. Will it take another disaster before the NRC then mandates that the old mitigating strategies be made reliable? That answer is literally in your hands. Thank you.

Backup Slides

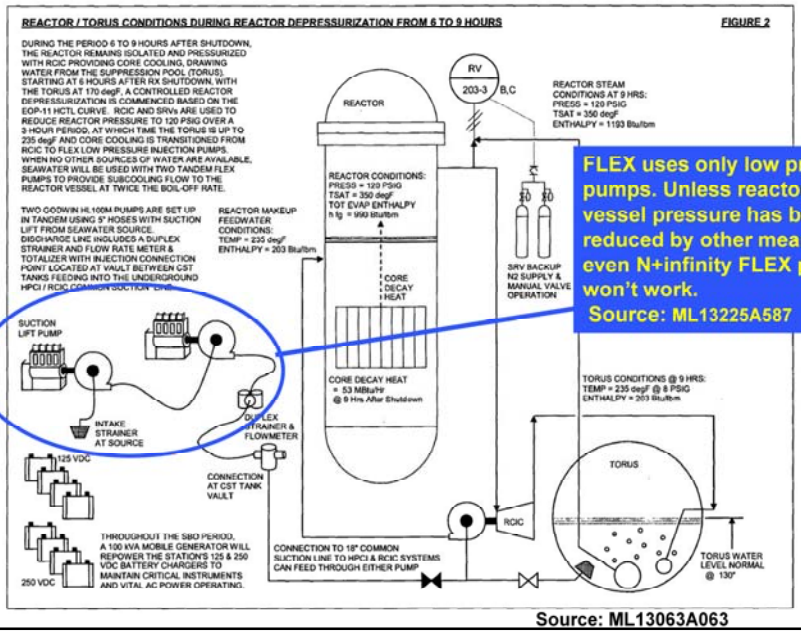
Pilgrim's BDBEE Plan



"Because the Condensate Storage Tank (CST) is not seismically qualified, it is considered unavailable for the BDBEE. RCIC suction will be manually switched to the Suppression Pool."
Source: ML13225A587

Source: ML13063A063

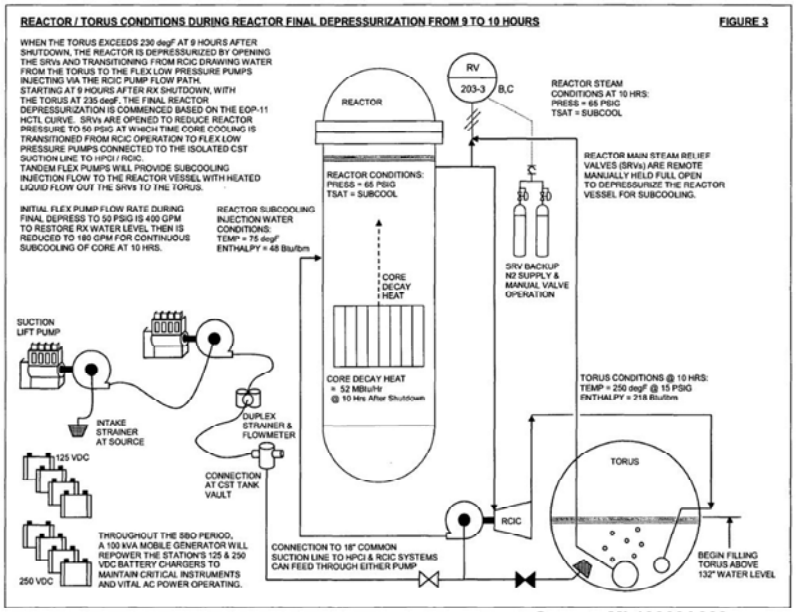
Pilgrim's BDBEE Plan



FLEX uses only low pressure pumps. Unless reactor vessel pressure has been reduced by other means, even N+infinity FLEX pumps won't work.
Source: ML13225A587

Source: ML13063A063

Pilgrim's BDBEE Plan



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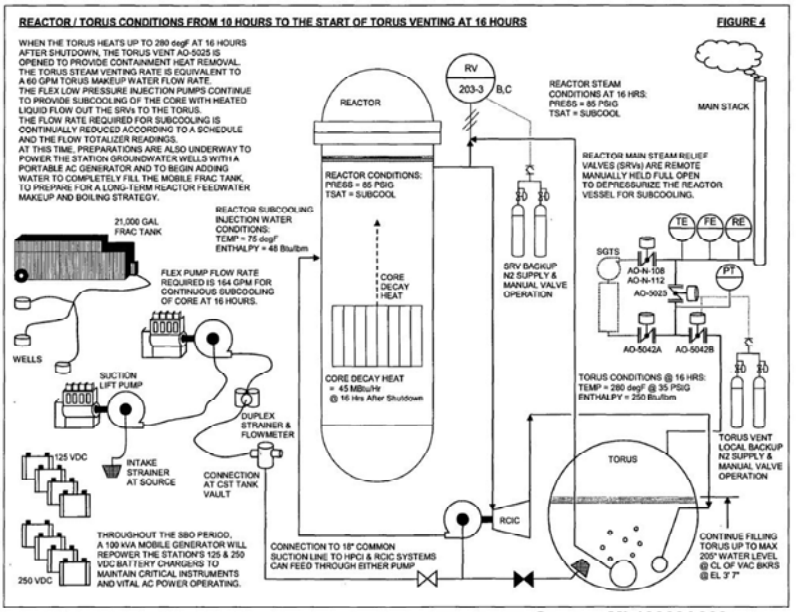
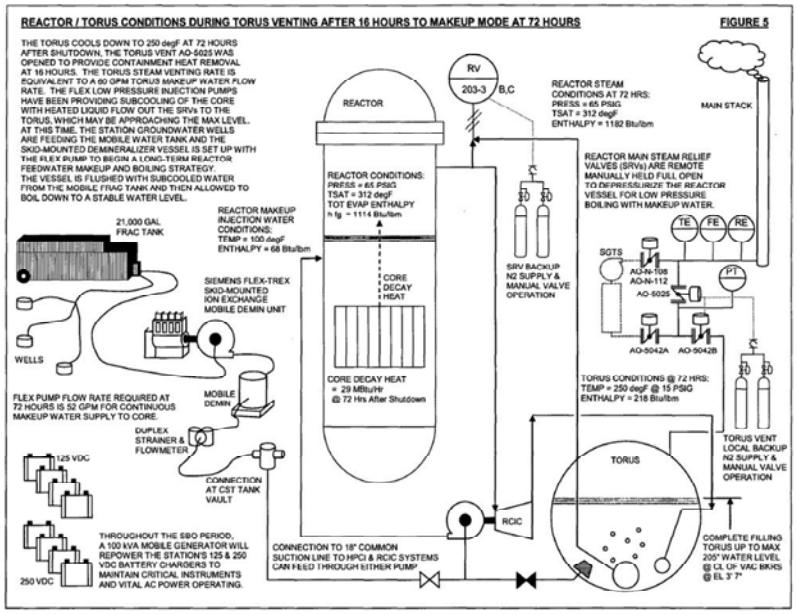
Source: ML13063A063

Pilgrim's BDBEE Plan



Source: ML13063A063

Pilgrim's BDBEE Plan



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Source: ML13063A063