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October 10, 2017

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U.S. Nuclear Regulatory Commission

James A. Isom, Senior Reactor Operations Engineer
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U.S. Nuclear Regulatory Commission

SUBJECT: Nuclear Jenga (a.k.a. Industry Self-Assessments in NRC ROP Baseline Inspection Program)

Dear Mr. Gody and Mr. Isom:

The Union of Concerned Scientists (UCS) was involved in the development of the Reactor Oversight Process (ROP). I attended the workshop facilitated by Mike Johnson in fall 1998 where the ROP was crafted. I served on the NRC's Pilot Program Evaluation Panel chaired by Frank Gillespie that formally monitored the ROP's pilot implementation. And as recently as my presentation in the NRC Office of Research's seminar series last month, I had repeatedly pointed to the ROP as one of the best things the NRC has done. Whether the concern is aging nuclear reactors, shrinking operating and maintenance budgets, management focus on production over safety, or whatever, the ROP functions as the public's safety net against harm caused by these and other causes.

I joined UCS shortly after a March 1996 TIME magazine cover story reported on the NRC's oversight at Millstone. Needless to say (but not needless to type), TIME did not describe how the agency should be awarded a Nobel Prize for its stellar focus on nuclear safety.

I attended the January 30, 1997, Commission briefing on Millstone and heard Bruce Kenyon, President and Chief Executive Officer of Northeast Utilities (NU) state:

> *So the picture that I think characterized the Northeast Nuclear situation, particularly the Millstone situation, was one of deteriorating performance, low standards, falling further and further behind the industry, a growing backlog of important work not accomplished, unclear accountabilities as to who should fix what, a lack of understanding of the true problems, increase in employee concerns with some high profile cases not well handled, growing supervisor and manager frustration, and thus, in spite of many efforts and many programs to try and address that, the organization, at least at the time I arrived, was as close to a dysfunctional organization as I have ever encountered.* (NRC transcript ML15140A624)

As Mr. Kenyon remarked about NU being "as close to a dysfunctional organization as I have ever encountered," I wondered how the NRC's oversight efforts failed to have noticed the writing on the wall.

A check of the Systematic Assessment of Licensee Performance (SALP) ratings from NUREG-1214, Rev. 14 (October 1996) showed Millstone Unit 2 to have declining performance but Millstone Units 1 and 3 to have solid "middle of the pack" ratings.

PLANT NAME: MILLSTONE[3]
REGION: 1

UNIT	RPT	ASSESSMENT PERIOD	OPS	MAINT	ENG	PS[1]
1/3	08/94	04/04/93 - 07/09/94	2	2	2	2
1/3	10/93	02/16/92 - 04/03/93	2	2	2	1/2/2
1/3	08/92	12/16/90 - 02/15/92	2	2	2	2/2/2
1	05/91	06/16/89 - 12/15/90	1	1	2	2/1/1
3	05/91	10/16/89 - 12/15/90	2	1	2	2/1/1
1	04/90	01/01/88 - 06/15/89	1	1	2	2/1/1
3	04/90	06/01/88 - 10/15/89	2	1	2	1/1/1

PLANT NAME: MILLSTONE[3]
REGION: 1

UNIT	RPT	ASSESSMENT PERIOD	OPS	MAINT	ENG	PS[1]
2	08/94	04/04/93 - 07/09/94	3	3	2	2
2	10/93	02/16/92 - 04/03/93	2	2	2	1/2/2
2	08/92	12/16/90 - 02/15/92	2	2	2	2/2/2
2	05/91	06/16/89 - 12/15/90	1	2	2	2/1/1
2	04/90	01/01/88 - 06/15/89	1	2	1	1/1/1

A few days later, I attended the February 4, 1997, Commission briefing[1] on another troubled nuclear plant, Maine Yankee and heard David Flanagan, Chairman of the Maine Yankee's Board, state:

> *As I indicated earlier, Maine Yankee has been a low-cost provider in a high-cost region and that's been an important factor to the benefit of the New England economy. We have wanted to*

[1] Remember that there's no charge for admittance to Commission briefings or to the National Zoo, both along Metro's Red Line. Remember also that the zoo is a longer walk from the Metro station.

run the plant as efficiently as we could, at the same time meeting the expectations of our industry and our regulators.

Commissioner, we had, until the last year, we had been under the impression that we were meeting those expectations, that the level of expenditures was consistent with our obligations to the NRC and to the industry.

As I say, I think we did not keep up with the state of the art and we were too isolated from, maybe, from what was going on in the rest of the country. But I'll tell you, personally, since I became chairman, I have gone to every SALP exit interview, I've gone to every INPO exit so that I could hear, unfiltered, whether there were any concerns that we should be addressing.

The management was making recommendations based on their judgment of what was needed to operate the plant safely. The objective indicators we were getting from outside were consistent with the recommendations and they were operating the plant in a way that was making a significant contribution to the economy of our state. So if one of those factors had changed, in fact, you know, some people at the NRC have said don't -- we don't want to judge you by your words, we want to judge you by your actions. (NRC transcript ML15141A353)

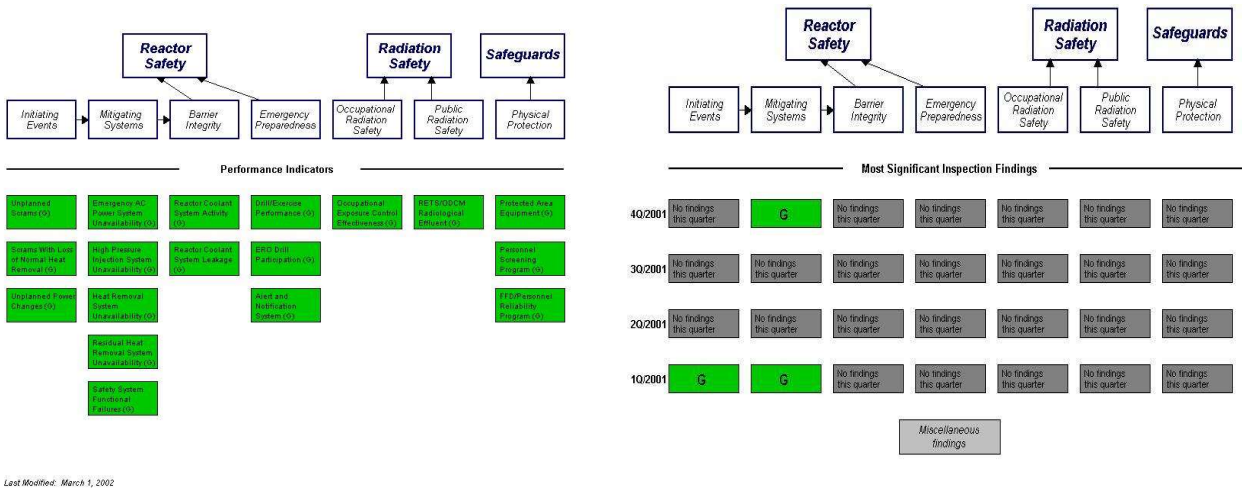
The SALP ratings from NUREG-1214 Rev. 14, October 1996 showed Maine Yankee to be a better performer than Millstone.

PLANT NAME: MAINE YANKEE
REGION: 1

UNIT	RPT	ASSESSMENT PERIOD	OPS	MAINT	ENG	PS[1]
	10/95	02/06/94 - 08/26/95	1	2	1	2
	03/94	06/28/92 - 02/05/94	1	2	2	1
	11/92	03/01/91 - 06/27/92	1	2	2	2/2/1
	06/91	11/01/89 - 02/28/91	1	1	2	2/2/2
	05/90	08/01/88 - 10/31/89	1	1	2	2/2/2
	01/89	02/01/87 - 07/31/88	1	1	2	3/1/2

That apparently "okay" and even above average performers could have collected so many unresolved safety problems as to require longer than a year to remedy them was a key factor in the effort that resulted in SALP being replaced by the ROP. The ROP sought to narrow the gap between perception (by both licensees and NRC) of safety levels and actual safety levels.

The ROP did not entirely eliminate the performance perception gap (PPG) as vividly demonstrated by Davis-Besse's performance indicators (left) and NRC inspection findings (right) from the first quarter of 2002:



At the time these grades were posted, Davis-Besse was shut down for refueling. The reactor would remain shut down for nearly two years as numerous safety shortcomings were remedied. Along the way to restart, the NRC issued Red, Yellow, and multiple White findings for problems that existed at the time of the good grades and for many months during reactor operation.

While the ROP's infamous miss cannot be ignored, neither can other evidence be ignored that puts this miss in context. Best I can tell, U.S. reactors have remained shut down longer than a year 52 times as safety problems were corrected. This table from UCS's 2015 report *No More Fukushimas: No More Fort Calhouns* lists the 52 year-plus reactor outages.

Year-Plus Nuclear Reactor Outages

Reactor	Date Outage Began	Date Outage Ended	Outage Length (years)
Fermi Unit 1	10/5/66	7/18/70	3.8
Palisades	8/11/73	10/1/74	1.1
Browns Ferry Unit 2	3/22/75	9/10/76	1.5
Browns Ferry Unit 1	3/22/75	9/24/76	1.5
Surry Unit 2	2/4/79	8/19/80	1.5
Three Mile Island Unit 1	2/17/79	10/9/85	6.6
Turkey Point Unit 3	2/11/81	4/11/82	1.2
San Onofre Unit 1	2/26/82	11/28/84	2.8
Nine Mile Point Unit 1	3/20/82	7/5/83	1.3
Indian Point Unit 3	3/25/82	6/8/83	1.2
Oyster Creek	2/12/83	11/1/84	1.7
St. Lucie Unit 1	2/26/83	5/16/84	1.2
Browns Ferry Unit 3	9/7/83	11/28/84	1.2
Pilgrim	12/10/83	12/30/84	1.1
Peach Bottom Unit 2	4/28/84	7/13/85	1.2
Fort St. Vrain	6/13/84	4/11/86	1.8
Browns Ferry Unit 2	9/15/84	5/24/91	6.7
Browns Ferry Unit 3	3/9/85	11/19/95	10.7
Browns Ferry Unit 1	3/19/85	6/12/07	22.2
Davis-Besse	6/9/85	12/24/86	1.5
Sequoyah Unit 2	8/22/85	5/13/88	2.7
Sequoyah Unit 1	8/22/85	11/10/88	3.2
Rancho Seco	12/26/85	4/11/88	2.3
Pilgrim	4/11/86	6/15/89	3.2
Peach Bottom Unit 2	3/31/87	5/22/89	2.1
Peach Bottom Unit 3	3/31/87	12/11/89	2.7
Nine Mile Point Unit 1	12/19/87	8/12/90	2.6
Surry Unit 2	9/10/88	9/19/89	1.0
Palo Verde Unit 1	3/5/89	7/5/90	1.3
Calvert Cliffs Unit 2	3/17/89	5/4/91	2.1
Calvert Cliffs Unit 1	5/5/89	10/4/90	1.4
FitzPatrick	11/27/91	1/23/93	1.2
Brunswick Unit 2	4/21/92	5/15/93	1.1
Brunswick Unit 1	4/21/92	2/11/94	1.8
South Texas Project Unit 2	2/3/93	5/22/94	1.3
South Texas Project Unit 1	2/4/93	2/25/94	1.1
Indian Point Unit 3	2/27/93	7/2/95	2.3
Sequoyah Unit 1	3/2/93	4/20/94	1.1
Fermi Unit 2	12/25/93	1/18/95	1.1
Maine Yankee	1/14/95	1/18/96	1.0
Salem Unit 1	5/16/95	4/20/98	2.9
Salem Unit 2	6/7/95	8/30/97	2.2
Millstone Unit 2	2/20/96	5/11/99	3.2
Millstone Unit 3	3/30/96	7/1/98	2.3
Crystal River Unit 3	9/2/96	2/6/98	1.4
Clinton	9/5/96	5/27/99	2.7
LaSalle County Unit 2	9/20/96	4/11/99	2.6
LaSalle County Unit 1	9/22/96	8/13/98	1.9
D.C. Cook Unit 2	9/9/97	6/25/00	2.8
D.C. Cook Unit 1	9/9/97	12/21/00	3.3
Davis-Besse	2/16/02	3/16/04	2.1
Fort Calhoun	4/9/11	12/21/13	2.7

Only 2 of the 52 outages (Davis-Besse and Fort Calhoun) began after the ROP was adopted in 2000. 50 year-plus outages across 34 years (2000 minus 1966) equates to a rate of 1.47 year-plus outages per calendar year. 2 year-plus outages across 17 years (2017 minus 2000) equates to a rate of 0.12 year-plus outages per calendar year. Whatever the reason(s), a marked decrease in the frequency of year-plus reactor outages is positive from both a nuclear safety and a financial performance perspective.

I contend that because the ROP assesses performance in more discrete areas than SALP had done and reports out the assessments more frequently than SALP had done, the ROP detects declining performance before they grow to epidemic proportions. Equally important, the ROP's baseline inspection program applies equally across the entire fleet of operating reactors. In other words, the reactors perceived to be top performers receive the same suite of baseline inspections as the reactors perceived (or demonstrated) to be not-the-top performers. Thus, the baseline inspection program avoids the self-fulfilling prophecy: *We don't inspect Reactor X because we believe it to be a superior performer. We believe Reactor X to be a superior performer due to lack of inspection findings to the contrary.*

Now, due in large part to the tangible performance gains the ROP and its baseline inspection program have achieved, the nuclear industry seeks to tamper with success. Among other proposed tampering is the notion of replacing the NRC's design engineering and other team inspections with self-assessments conducted by the licensees with the results mailed to the NRC. But, so far at least, the industry does not want to have all NRC design engineering inspections replaced by self-assessments. No, the industry confines that replacement to only those sites perceived to be top performers.

It's like Nuclear Jenga where the industry pulls a block out of the ROP, hoping that the block being removed, along with all the other blocks already removed, doesn't cause the whole things to topple over.

After one block is removed, the stack of blocks may remain standing.

But Nuclear Jenga, if it's played like real Jenga, does not end after the removal of a block, two blocks, or even more blocks. Nope, the blockheads continue removing blocks until the stack crashes down.

Has anyone ever played or watched a Jenga game that ended in a tie? There's always a loser. Will Americans be the losers in Nuclear Jenga?

The design engineering inspections, and other team inspections within the ROP's baseline inspection program, must always be conducted by the NRC. Mr. Flanagan told the Commission that his company felt Maine Yankee was performing well enough and suggested that misconception was due to the company having become isolated from the rest of the country. Mr. Kenyon told the Commission that his company had become nearly dysfunctional, suggesting that this malady both caused the under-performance at Millstone and prevented it from being recognized internally pre-TIME cover story.

The NRC's baseline inspection program provides independent assessments. These independent assessments guard against misconceptions caused by isolation, dysfunctionality, and any number of other impairments. While the baseline inspection program may not be the sole or even the primary reason that year-plus reactor outages have dropped to 0.12 per calender year from 1.47 per reactor-year before the ROP, they almost certainly have contributed significantly to this outcome. It would be unwise and

imprudent to tamper with success by pulling blocks out of the ROP Nuclear Jenga-wise until nuclear safety crashes down.

When an audit flag is raised or an individual is chosen for a randomly-selected audit, does the Internal Revenue Service permit these individuals to conduct self-audits and simply mail the IRS the results? No, that would be stupid.

Do local law enforcement agencies save money by curtailing traffic control duties and have drivers write themselves tickets for speeding tickets and driving under the influence? No, that would be stupid.

Will the NRC allow nuclear plant owners to save a few bucks by replacing NRC design engineering inspections, which seem to have contributed to substantial safety and financial performance gains, with self-assessments? We'll see.

If so, how big a price will Americans pay for nuclear plant owners saving a dollar or two playing Nuclear Jenga?

Sincerely,

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