Transformation Success: Narrowing the Gap Between Perception and Reality

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NRC has demonstrated proficiency at responding swiftly and effectively to unanticipated safety and security challenges (e.g., PWR CRDM nozzle cracking in spring 2001 and 9/11 later that year)

NRC can successfully apply that capacity to future challenges such as those listed in SECY-18-0060

BUT, and it's a big BUT:

Transformation success depends on keeping the gap between perception and reality as narrow as possible.

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

52 year-plus outages to restore safety levels to acceptable levels, 50 on NRC's watch

Source: UCS report No More Fort Calhouns!, February 2015. Online at http://www.ucsusa.org/sites/default/files/attach/2015/03/np-ft-calhouns-full-report.pdf?_ga=2.196753579.62578069.1538585309-730957765.1502383429

Lessons from year-plus reactor outages:

1. Owners were not knowingly operating unsafe reactors, hoping not to get caught.
2. Owners were operating what they perceived to be sufficient safe reactors, but they were not.
3. The gap between perception and reality is reflected by the time required to re-close the gap.
4. 44 year-plus outages during the SALP years (1980-1999), an average of 2.2 per year
5. 2 year-plus outages during the ROP years (2000-date), an average of less than 0.11 per year
6. ROP narrowed the gap between perception and reality, thus preventing uncorrected safety problems from growing to the point where it takes longer than a year to remedy them once detected

Lessons from ROP for transformations:

1. **Unintended consequences and initially correct deferral decisions undermined by changing landscapes need to be detected and corrected in a timely and effective manner.**

2. **Baseline gap-monitoring for non-transformation areas (aka back-burner issues) to guard against undue delays and cumulative effects of non-regulation.**

3. **To maximum extend practical, objective metrics needed to ensure desired outcomes are achieved without unintended consequences.**

4. **ROP is superior to SALP, but not infallible.**

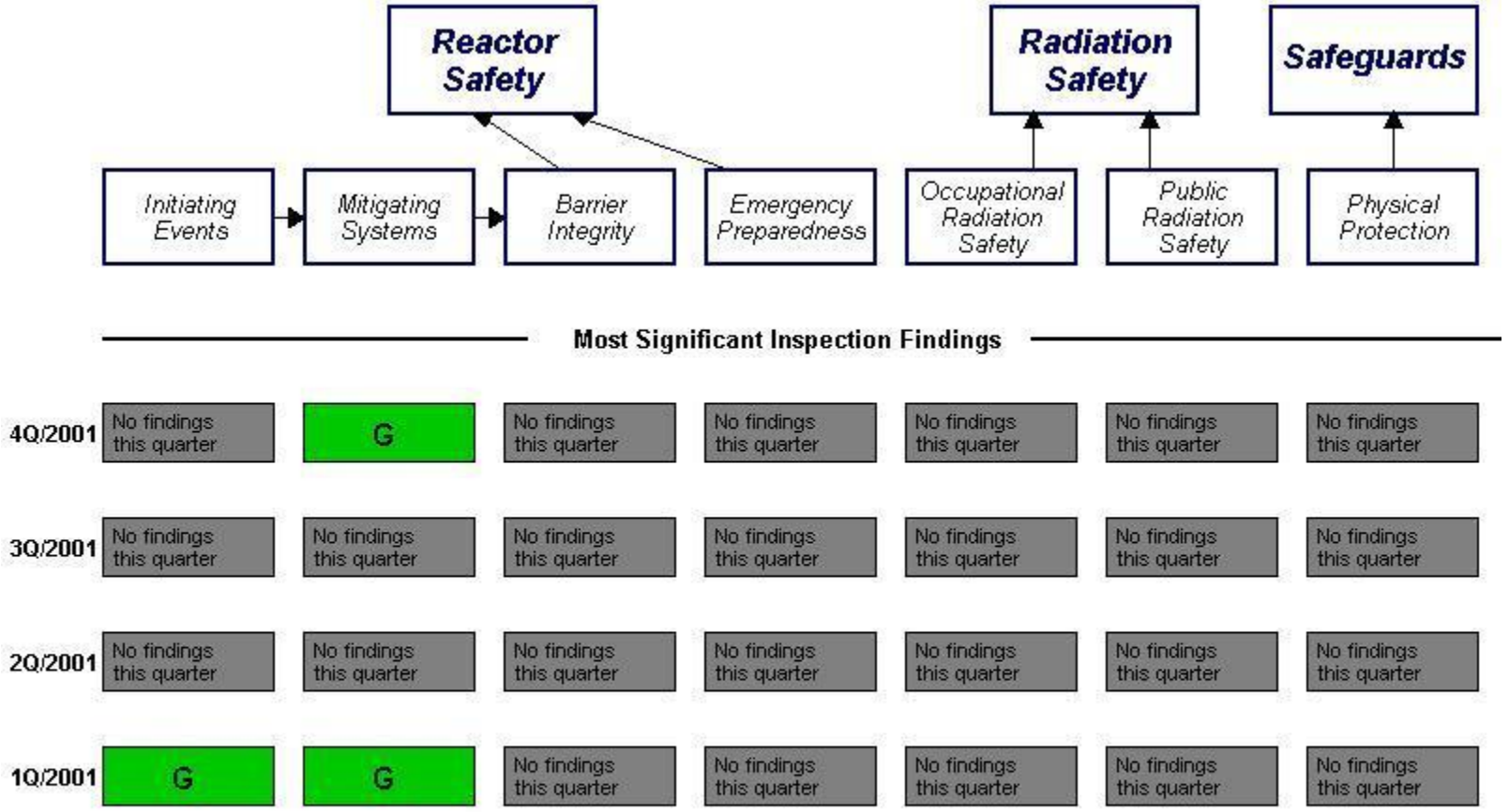
Davis-Besse Perception (SALP)

PLANT NAME: DAVIS-BESSE
REGION: 3

UNIT	RPT	ASSESSMENT PERIOD	OPS	MAINT	ENG	PS[1]
	03/95	07/01/93 - 01/21/95	1	1	1	1
	09/93	12/01/91 - 06/30/93	2	1	1	2/1/1
	04/92	07/01/90 - 11/30/91	2	1	2	2/1/1
	11/90	03/01/89 - 06/30/90	2	2	2	2/1/1
	07/89	01/01/88 - 02/28/89	2	2	2	2/1/1

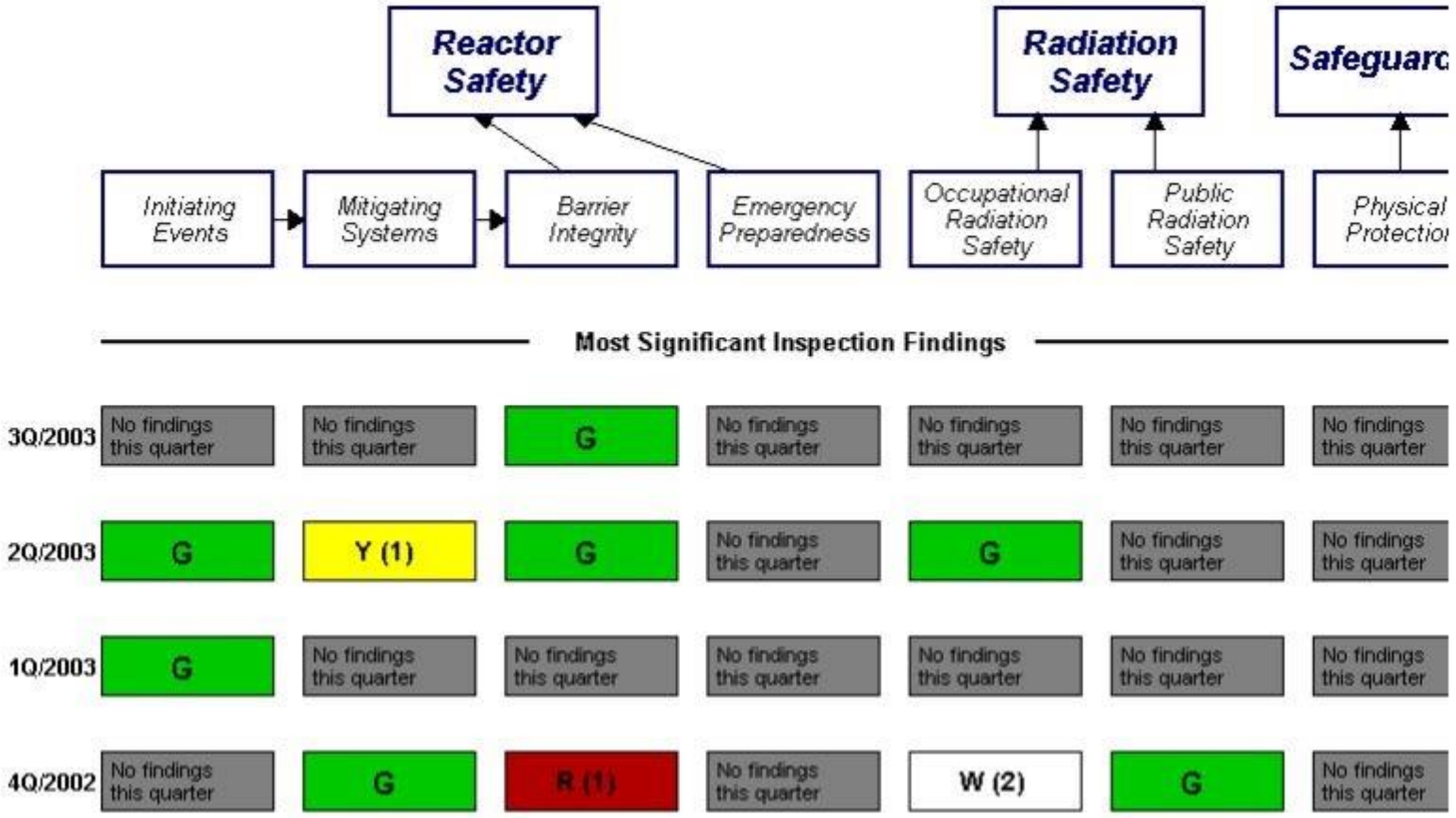
SALP perceived Davis-Besse to be a top performer

Davis-Besse Perception (ROP)



ROP also perceived Davis-Besse to be a top performer

Davis-Besse Reality



Reality showed Davis-Besse to have come closer to accident than any reactor since Three Mile Island

NRC and industry are on the same page (often the same sentence on the same page) for many risk calculations, such as:

1. **Peak cladding temperatures during postulated loss of coolant accidents**
2. **Peak containment pressures during postulated steam line break accidents**
3. **Steam generator tube wall crack growth rates**
4. **Pipe wall thinning rates due to erosion/corrosion**
5. **Safety-related component failures to start and failures to run**

Unless both are wrong, tiny gap between perception and reality

NRC and industry are not in the same book, yet alone on the same page, for high risks

Comparison Between Industry and NRC Risk Estimates				
Event	**Licensee ΔCDF**	**NRC ΔCDF**	**Risk Difference**	**Sources**
ANO flood protection yellow finding	1.44E-05	1.00E-04	594%	ML14329B209
ANO Stator Drop on Unit 1 yellow finding	4.8E-06	6.0E-05	1,150%	ML14174A832
ANO Stator Drop on Unit 2 yellow finding	1.8E-06	2.8E-05	1,456%	ML14174A832
Browns Ferry Unit 1 RHR Valve red findings	1.0E-06	1.0E-04	9,900%	ML111290482 ML111930432
Fort Calhoun flood protection yellow finding	8.4E-07	3.2E-05	3,710%	ML102800342
Fort Calhoun trip relay contactor white finding	1.0E-06	2.6E-05	2,500%	ML111660027 ML112000064
Indian Point 2 steam generator tube leak red finding	6.6E-06	2.85E-05	332%	ML003770186
Monticello flood protection yellow finding	8.92E-07	3.6E-05	3,936%	ML13233A068 ML13162A776
Oconee safe shutdown facility yellow finding	8.0E-06	1.6E-05	100%	ML102240588
Palo Verde voided ECCS suction line yellow finding	7.0E-06	4.6E-05	557%	ML051010009
Watts Bar flood protection yellow finding	8.15E-09	6.35E-06	77,814%	ML13115A020 ML13071A289

Whichever is wrong, massive gap between perception and reality

My prime concern with transformations:

Changes are not occurring in isolation, enabling progress towards desired outcome to be effectively monitored and mid-course corrections implemented, if necessary.

Instead, transformations are proposed concurrent with extensive changes to the ROP and other regulatory constructs.

Can performance shortfalls be readily and reliably detected when the yardsticks are all new without proven track records?

I know the perception is “yes, of course.” But is that also the real answer?

Gap management straw-persons:

1. **Annual self-evaluations by two NRC teams.**

    a) **One team looking for evidence that desired outcomes have been achieved or are on-target to do so.**

    b) **One team looking for evidence of unintended consequences from transformation initiatives and adverse consequences in non-transformation areas.**

2. **Commission briefing and/or ACRS meeting with presentations by both teams**

List of Acronyms

ACRS – Advisory Committee on Reactor Safeguards

CDF – Core damage frequency

CFR – Code of Federal Regulations

CRDM – Control Rod Drive Mechanism

ENG - Engineering

MAINT - Maintenance

NRC – Nuclear Regulatory Commission

OPS – Operations

PS – Plant Support (e.g., training, security, etc._

PWR – Pressurized Water Reactor

ROP – Reactor Oversight Process

SALP – Systematic Assessment of Licensee Performance