U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Seminar: The Other Sides of the Coins
Dave Lochbaum, Union of Concerned Scientists

"The Other Sides of the Coins" seminar will discuss the mission of and activities of the Union of Concerned Scientists (UCS) and explore successes of the Nuclear Regulatory Commission's regulatory activities viewed through the lens of UCS. The seminar will explore recent activities such as Fort Calhoun flood protection, maintenance rule, reactor oversight process, component aging, OIG safety culture surveys, and knowledge management among other topics.

To get credit in iLearn use Course ID_347150.
To register for the Webinar use the following link:
https://attendee.gotowebinar.com/register/8473022805958701569
\- Bridge line No.: 1-800-857-8143 Pass Code: 4592838 Outlook Scheduler

Dave Lochbaum, Union of Concerned Scientists (UCS), Director, Nuclear Safety Project
One of the nation's top independent nuclear power experts. As director of UCS's Nuclear Safety Project, Mr. Lochbaum monitors ongoing safety issues at U.S. reactors, testifies before Congress and the Nuclear Regulatory Commission (NRC), and provides informed analyses of nuclear plant conditions and incidents, such as the March 2011 disaster at the Fukushima Daiichi facility in Japan.

A nuclear engineer by training, Mr. Lochbaum worked at nuclear power plants for 17 years, including many that are similar to the General Electric reactors at the Fukushima plant. He left the industry in the early 1990s after blowing the whistle on unsafe practices and joined UCS in 1996. He then left UCS in 2009 to work for the NRC as a reactor technology instructor and returned to his post at UCS a year later.

Mr. Lochbaum has authored numerous reports, including *The NRC and Nuclear Power Plant Safety in 2010*, the first in a series of reports he produces annually. Over the years he has been cited thousands of times by a wide range of news organizations, including the *Boston Globe, Business Week, Chicago Tribune, Los Angeles Times, New York Times, New Yorker, Rolling Stone, Time, Wall Street Journal, Washington Post, CBS, CNBC, CNN, C-SPAN, Fox, Fox Business, MSNBC, NBC and NPR*. Mr. Lochbaum also co-authored the critically acclaimed book, Fukushima: The Story of a Nuclear Disaster (New Press), which was published in February 2014.

Office of Nuclear Regulatory Research

Union of Concerned Scientists
Science for a healthy planet and safer world

U.S. Nuclear Regulatory Commission
Two White Flint North Auditorium
September 19, 2017, 2:00pm to 3:30pm

Union of Concerned Scientists

The Other Sides of the Coins

Dave Lochbaum
Director, Nuclear Safety Project
dlochbaum@ucsusa.org

September 19, 2017

Past as Prologue

When given the chance to put my two cents in, you probably have heard or read my criticism of the NRC or my whining about some nuclear safety issue.

Nuclear Safety Whine List

THIS LIST INTENTIONALLY BLANK

Past as ~~Prologue~~ Past

Today, I want to speak about the other sides of the coins – when the NRC's efforts result in positive nuclear safety outcomes.

UCS: When and Where

Founded in May 1969 by faculty and students at the Massachusetts Institute of Technology

Headquarters in Cambridge MA, with offices in Washington DC, Berkeley CA, and Chicago IL (and my office in Chattanooga TN)

More: www.ucsusa.org

UCS: Who and What

Current staff of about 180 individuals

Over 30% of staff are engineers, scientists and technical analysts

Staff includes communications specialists, policy analysts, program assistants, lobbyists, economists and development staff

UCS: Why

UCS is anti-nuclear
and pro-nuclear

We're anti-nuclear disaster
and pro-nuclear safety

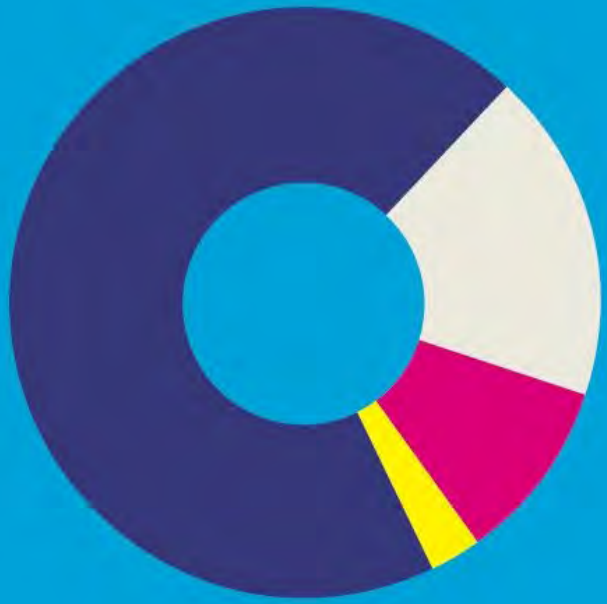
(not sure why any one
would be anything else)

UCS: Our Incomes

Fiscal year ending September 30, 2016

REVENUE

The Union of Concerned Scientists continues to benefit from the generosity of our members (more than 100,000) and foundations, who work in partnership with us to build a healthier and safer world. In fiscal 2016, the majority of our support—69 percent—came from generous individual donors, while support from foundations represented 18 percent of our revenue. Bequests represented another 10 percent of revenue. In addition, we continued the strategic use of our board reserve fund ($3.2 million this fiscal year) to offset risk and support our programs.



69%
MEMBERSHIP & CONTRIBUTIONS

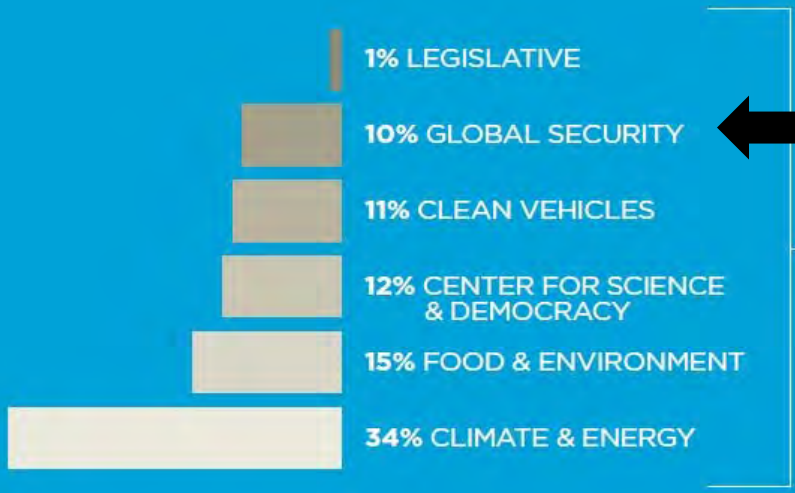
18%
FOUNDATIONS

10%
PLANNED GIFTS

3%
INVESTMENTS

UCS's FY 2016 revenue was ~$32.6 million

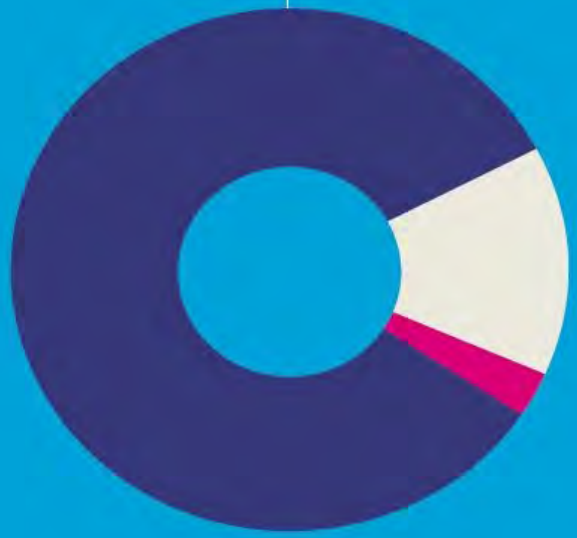
UCS: Our Outcomes



(Nuclear Safety Project)

EXPENSES

Eighty-three percent of every dollar contributed to UCS directly funded program work in fiscal 2016, with the remaining 17 percent spent on the critical infrastructure that supports our programs. With an annual budget of $32 million, UCS continues to strengthen our unique ability to help solve our planet's most pressing problems with the power of independent science.



83%
PROGRAMS

14%
FUNDRAISING & MEMBER COMMUNICATIONS

3%
GENERAL & ADMINISTRATIVE

UCS: Our Global Security Program

Dr. Edwin Lyman

Half of UCS's Nuclear Power Team

(Ed covers the hard stuff; I tackle the easy stuff like fire non-protection)

1992 **Lisbeth Gronlund**
and
1992 **David Wright**
Co-Director/Senior Scientist
MA Office

1996 **Dave Lochbaum**
Director, Nuclear Safety Project
Midwest Office

2002 **Laura Grego**
Senior Scientist
MA Office

2003 **Ed Lyman**
Senior Scientist
DC Office

2002 **Gregory Kulacki**
Senior Analyst/China Project Manager
Midwest Office

2011 (07-10) **Eryn MacDonald**
Analyst
MA Office

2007 (88-91) **Sean Meyer**
Manager of Strategic Campaigns
MA Office

2001 **Stephen Young**
Senior Washington Rep/Senior Analyst
DC Office

2015 **Hannah Parra**
Outreach & Communications Assistant
MA Office

<1996 **Teri Grimwood**
Global Security Program Associate
DC Office

UCS's Goals Today

Acknowledge and applaud representative positive outcomes achieved by the NRC staff

Identify the elements and attributes that help external stakeholders recognize the NRC's positive outcomes (i.e., help make such outcomes more transparent)

NRC Kudos (abridged listing)

PWR CRDM Nozzle Cracking

BWR SLC Test Tank

Maintenance Rule

Reactor Oversight Process

Flooding Pre-Fukushima

CFFF Event Lessons Learned

NOT Putting Perry in Column 4

Zero-Sum BIP Enhancement

More NRC Kudos (still abridged)

Counterfeit, Fraudulent and Suspect Items work

NRR and OIG component aging reports

Putting Agreement State (Georgia) on probation

Hatch undervoltage relay fix

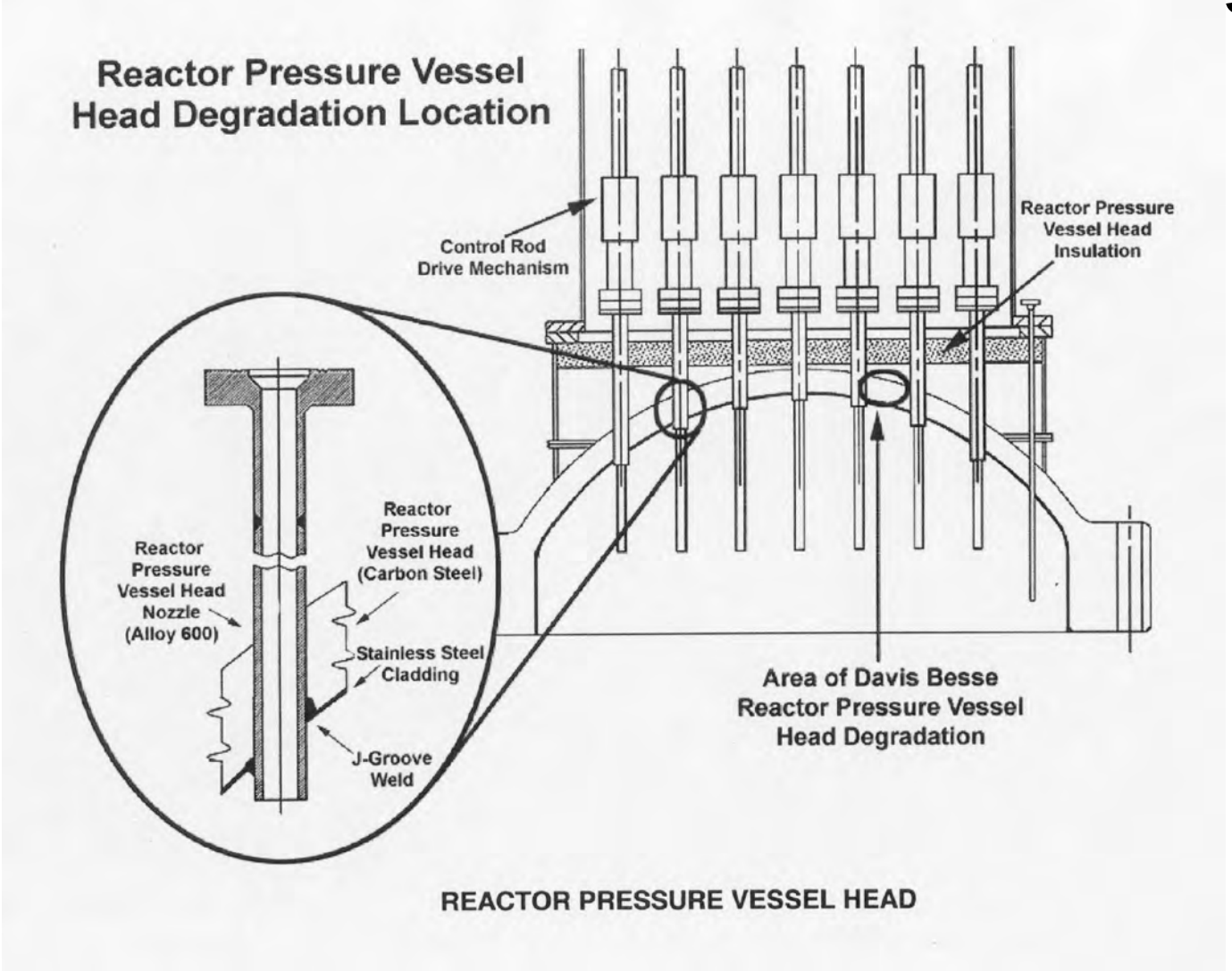
OIG's triennial safety culture surveys

PWR CRDM Nozzle Cracking

CRDM Nozzle Leakage Observed at Oconee 3

March 2001 – CRDM nozzles at Oconee found to be cracked in unexpected locations

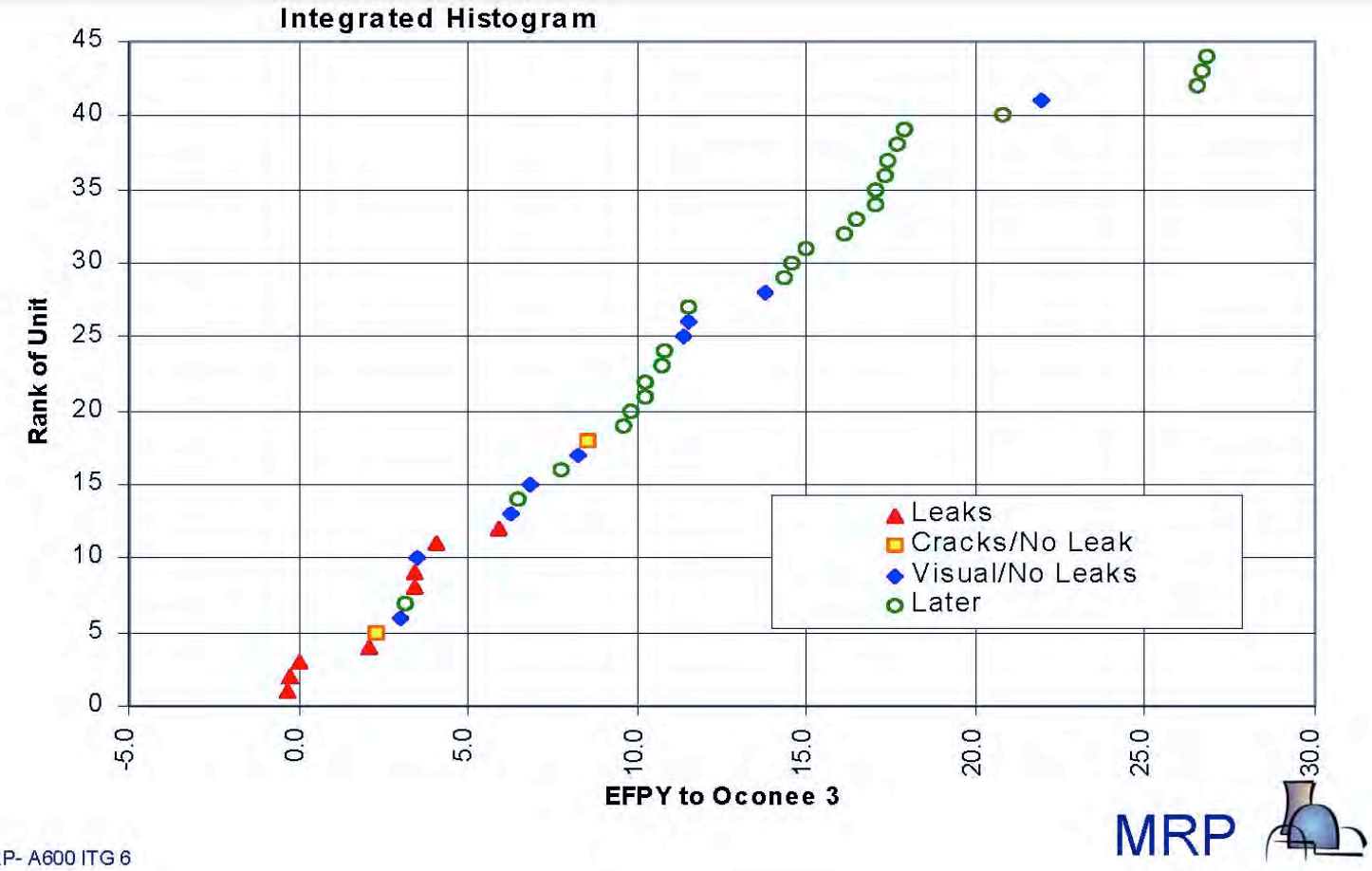
PWR CRDM Nozzle Cracking



August 2001 – NRC determined key factors causing cracking and put 69 PWRs into three vulnerability bins

PWR CRDM Nozzle Cracking

Inspections Confirm Rankings



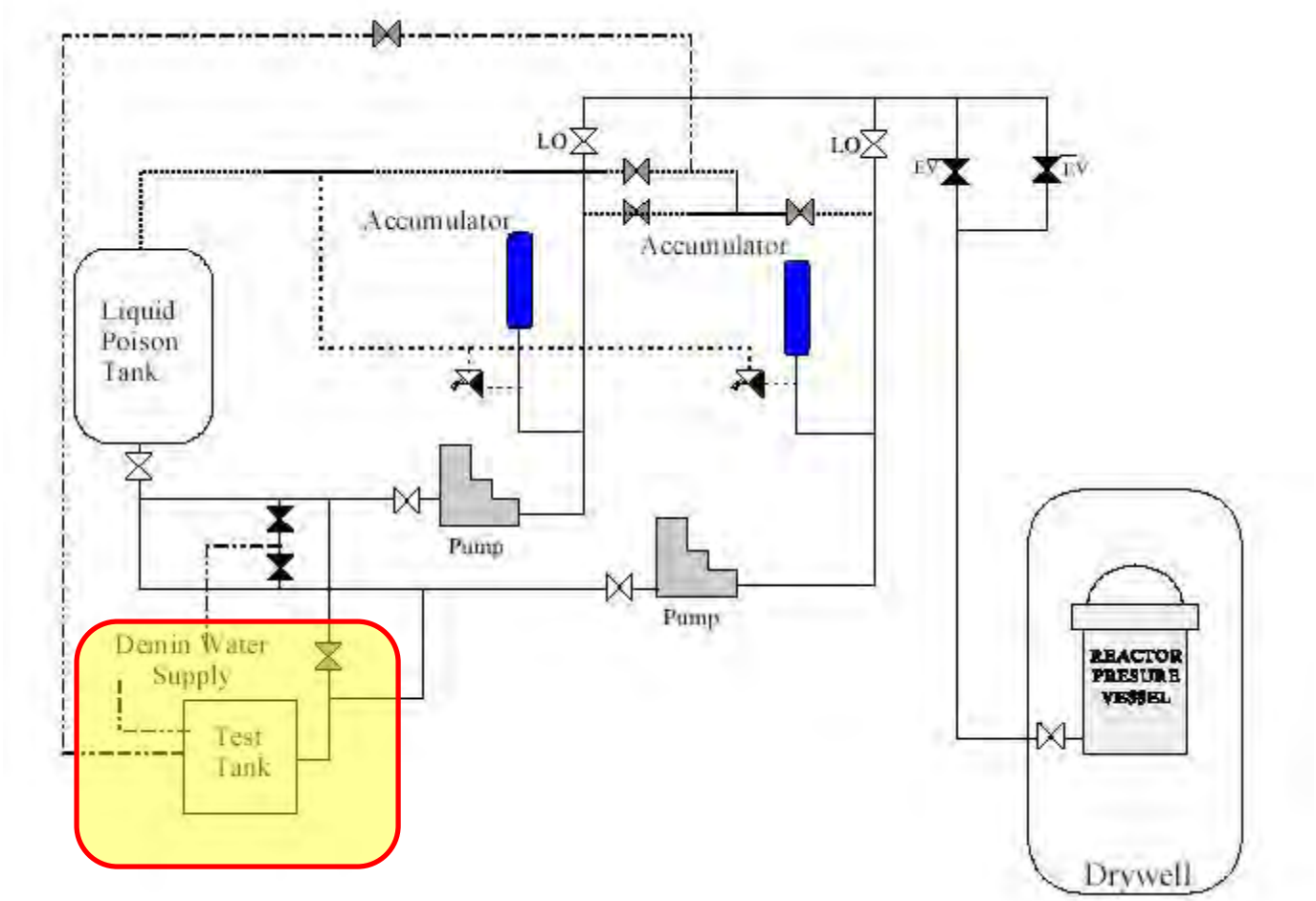
March 2002 – Subsequent CRDM nozzle inspections confirm that NRC had right factors and rankings.

PWR CRDM Nozzle Cracking

- Spring 2001 – Cracking identified in unanticipated location
- By August 2001, NRC determined key factors causing cracking, binned 69 PWRs as having high, medium, and low susceptibility for cracking, and mandated inspection regimes based on susceptibility
- The dozen PWRs highly susceptible to cracking were inspected in fall 2001 as scheduled, despite the NRC's need to reallocate resources following 9/11
- When the CRDM nozzle inspections for the 69 PWRs were completed, the results showed that the NRC analyzed and triaged the problem correctly

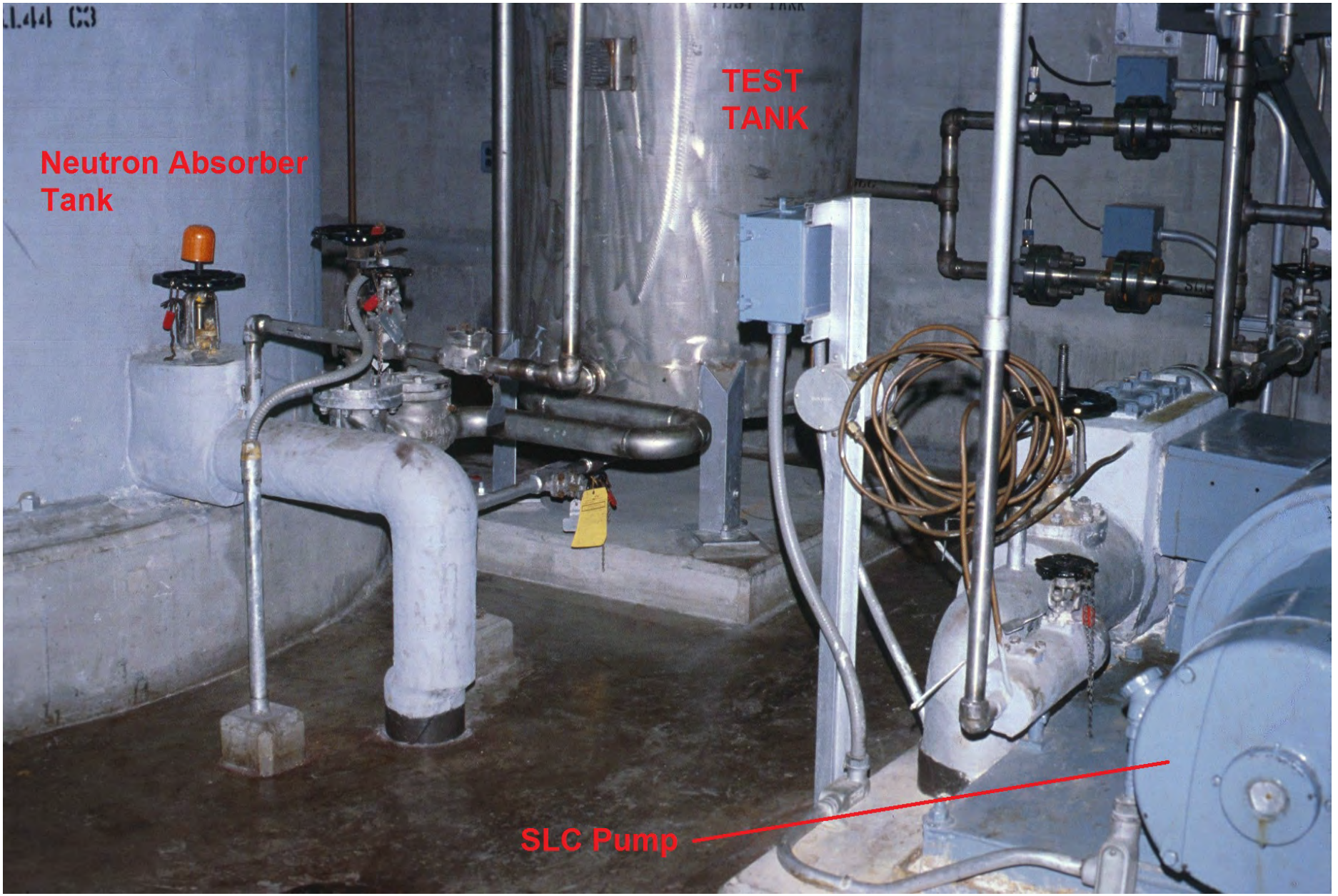
More: http://allthingsnuclear.org/dlochbaum/rapid-regulator-response

BWR SLC Test Tank

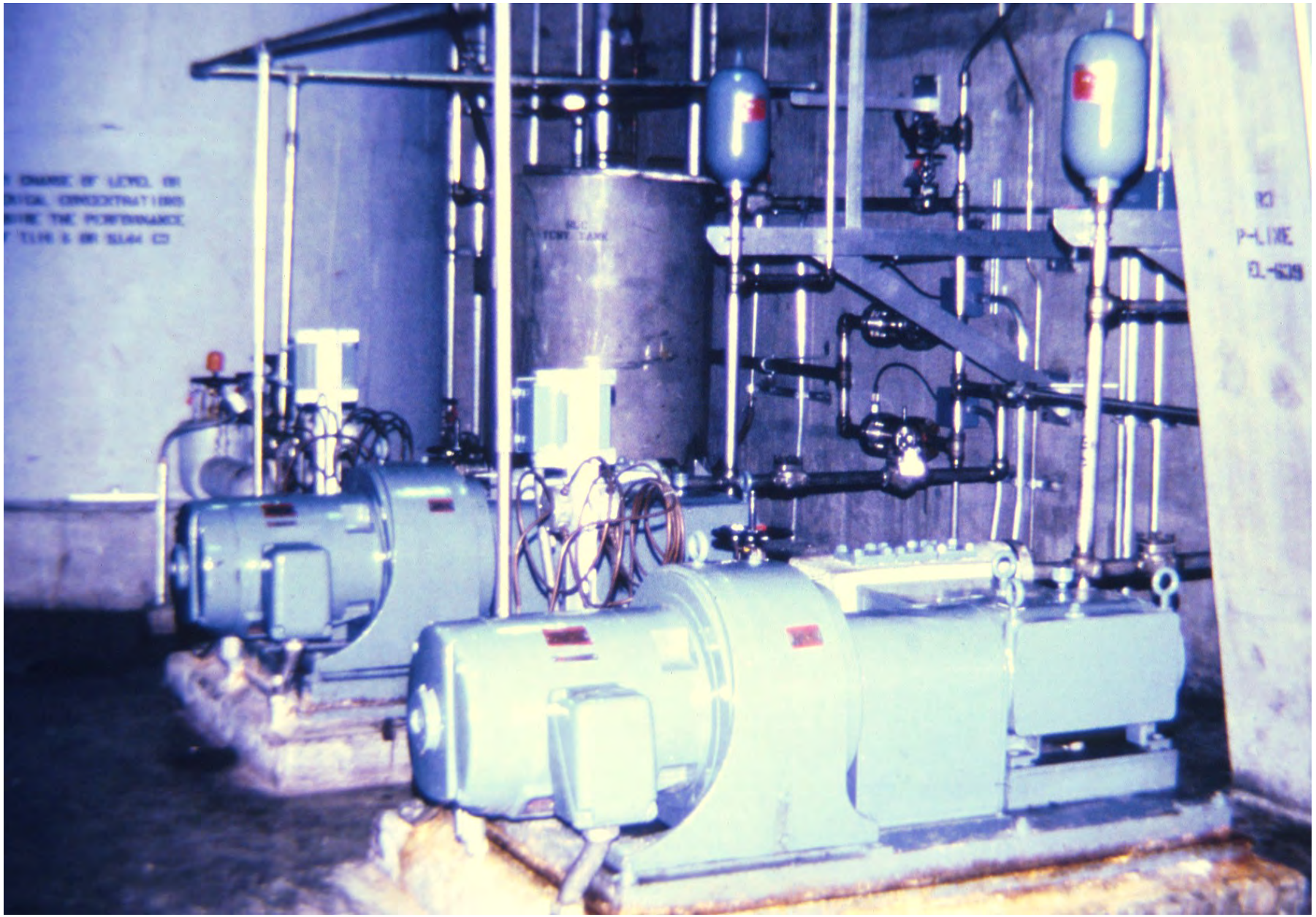


CDBI at LaSalle found that test tank was routinely left filled with water after surveillance tests; but analysis for design basis earthquake assumed the tank was empty.

BWR SLC Test Tank



BWR SLC Test Tank



BWR SLC Test Tank

- CDBI walkdown found SLC test tank routinely left 75% filled with water.
- Surveillance test procedure expressly allowed the tank to remain partially filled following testing.
- CDBI reviewed DBE calculation and found that supports for SLC test tank not designed for loads from non-empty tank.
- Collapse of tank onto nearby safety-related equipment during earthquake could disable SLC.
- NRC issued Green finding.
- Workers at Duane Arnold reviewed OE from this event and discovered they were equally guilty.

Source: NRC CDBI Inspection Report dated 02/15/2011 (ML110460708)
Source: DAEC LER dated 01/07/2011 (ML110070763)

Maintenance Rule

NUREG/CR-4611
PNL-5859

Trends and Patterns in Maintenance Performance in the U.S. Nuclear Power Industry: 1980-1985

Manuscript Completed: September 1986
Date Published: October 1986

Prepared by
A. D. Chockie, J. Olson*, P. A. Bolton*,
C. Winter, W. A. Wheeler*, C. L. Geisendorfer*

Pacific Northwest Laboratory
Richland, WA 99352

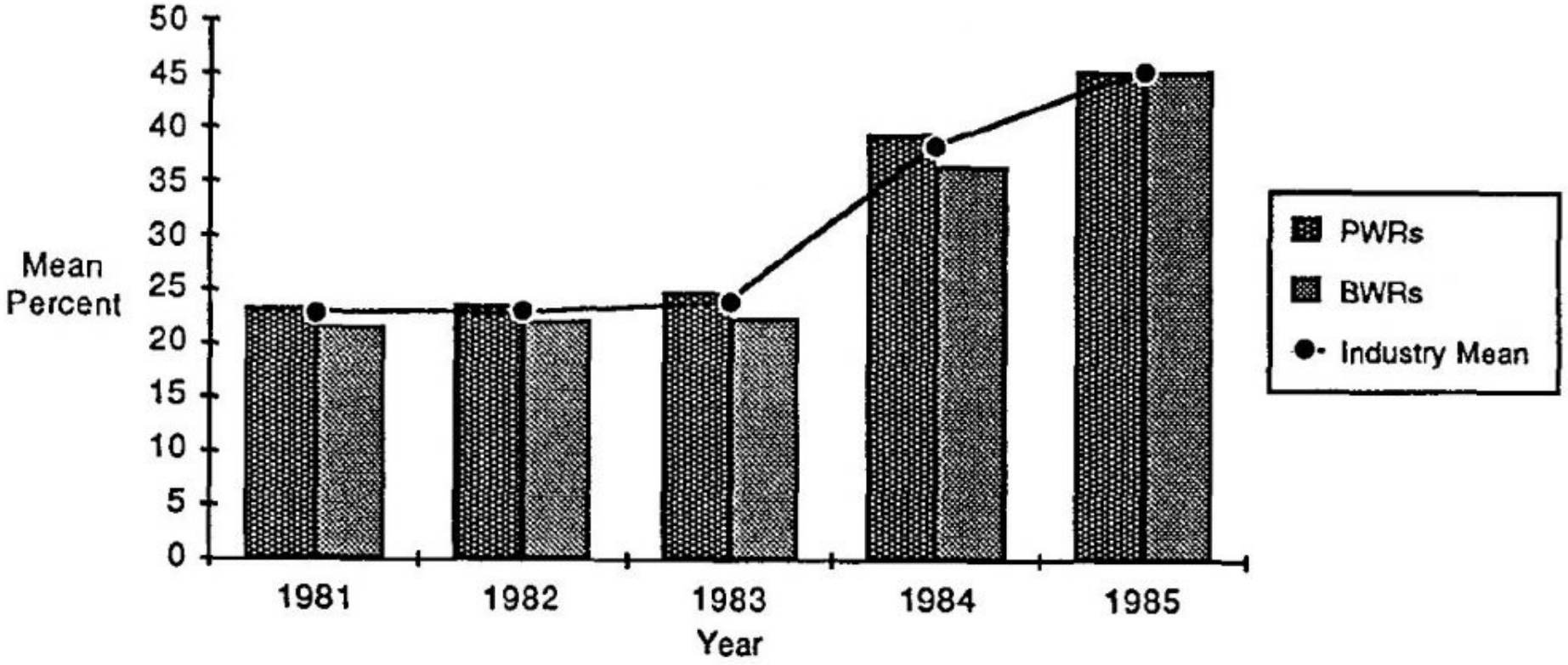
*Battelle Human Affairs Research Center

Prepared for
Division of Human Factors Technology
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555
NRC FIN B2986

More: http://allthingsnuclear.org/dlochbaum/nrcs-nuclear-maintenance-rule

Maintenance Rule

FIGURE B.5.1. Percent of Maintenance-Related LERs by Reactor Type



Maintenance Rule

NUREG–1526

Lessons Learned from
Early Implementation of
The Maintenance Rule at
Nine Nuclear Power Plants

Manuscript Completed: June 1995
Date Published: June 1995

C.D. Petrone, R.P. Correia, S.C. Black

Division of Technical Support
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555–0001

Within a decade, the NRC identified an emerging program, implemented an enduring solution, and identified lessons learned from that fix.

Maintenance Rule

October 1986: NRC issues NUREG on maintenance trends

March 23, 1988: NRC issues Policy Statement about maintenance and announces plan to pursue rulemaking

July 10, 1991: NRC publishes Maintenance Rule

June 1995: NRC issues NUREG on lessons from early implementation of Maintenance Rule

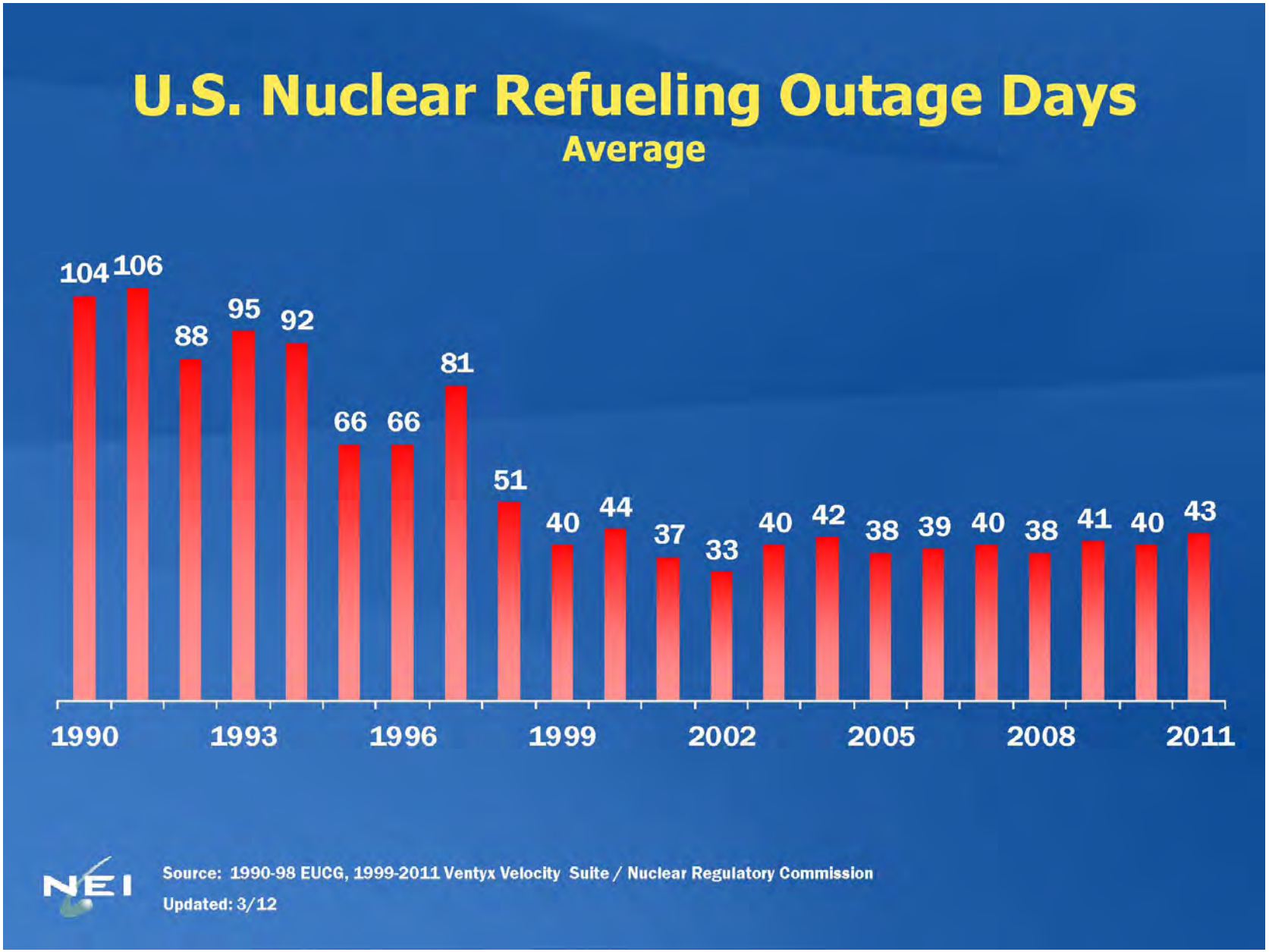
July 10, 1996: Maintenance Rule becomes effective

Maintenance Rule

The Maintenance Rule decade yielded an increased awareness of the factors affecting safety system availability and reliability.

The many dividends from this investment of time and effort include:

Maintenance Rule



Maintenance Rule

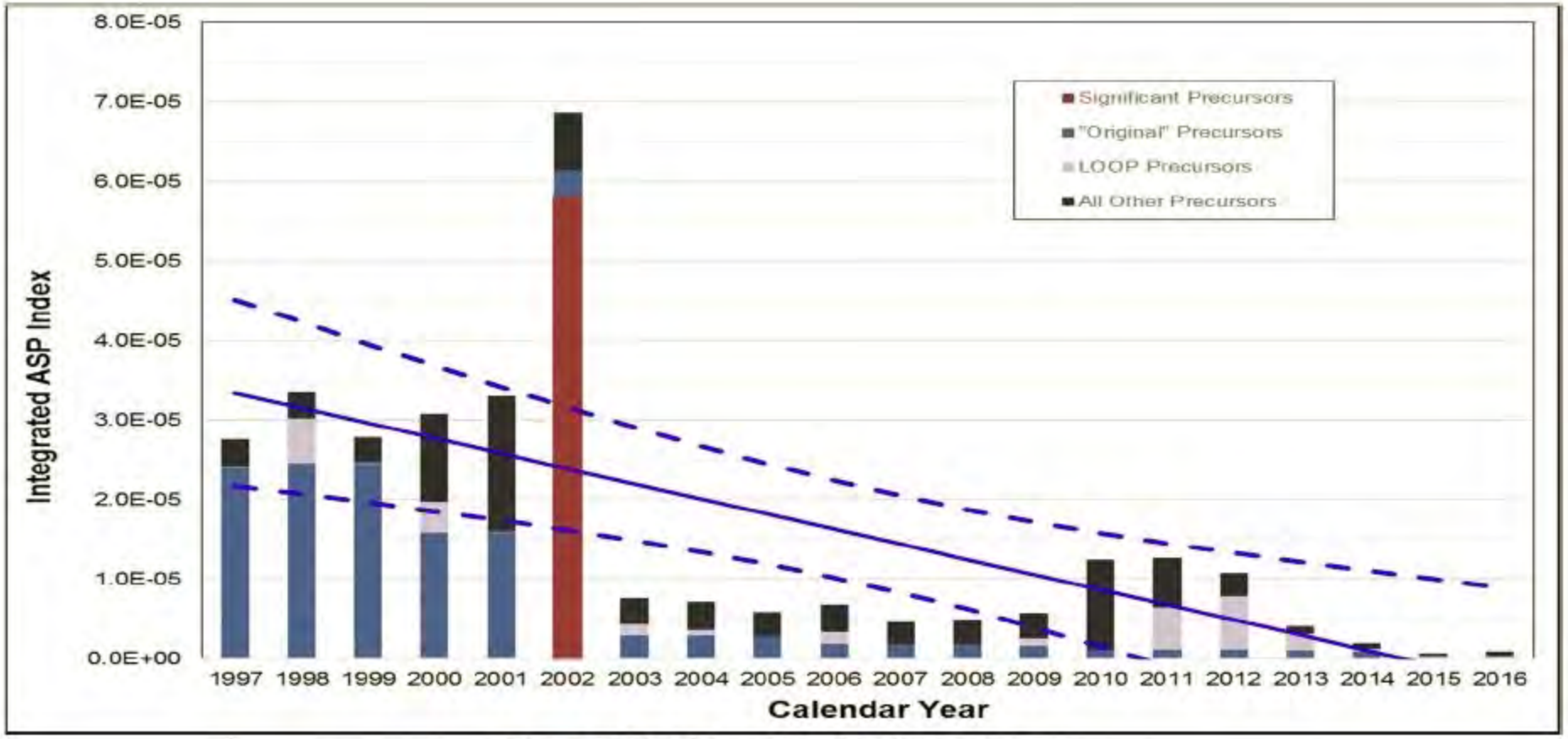


Figure 10. Integrated ASP Index

Source: Annual ASP Report (ML17153A365)

Reactor Oversight Process

	Functional Areas	Previous Performance Category (03/01/85 to 09/30/86)	Present Performance Category (10/01/86 to 04/30/88)	
A.	Plant Operations	1	2	
B.	Radiological Controls	2	3	
C.	Maintenance	1	2	
D.	Surveillance	1	2	
E.	Fire Protection	1	2	
F.	Emergency Preparedness	2	2	
G.	Security	3	2	
H.	Outages	2	2	
I.	Quality Programs and Administrative Controls Affecting Quality	2	3	
J.	Licensing Activities	1	2	
K.	Training and Qualification Effectiveness	2	3	

Superior Performance

Good Performance

Satisfactory Performance

Source: 1988 Fort Calhoun SALP (ML12209A361)

Reactor Oversight Process

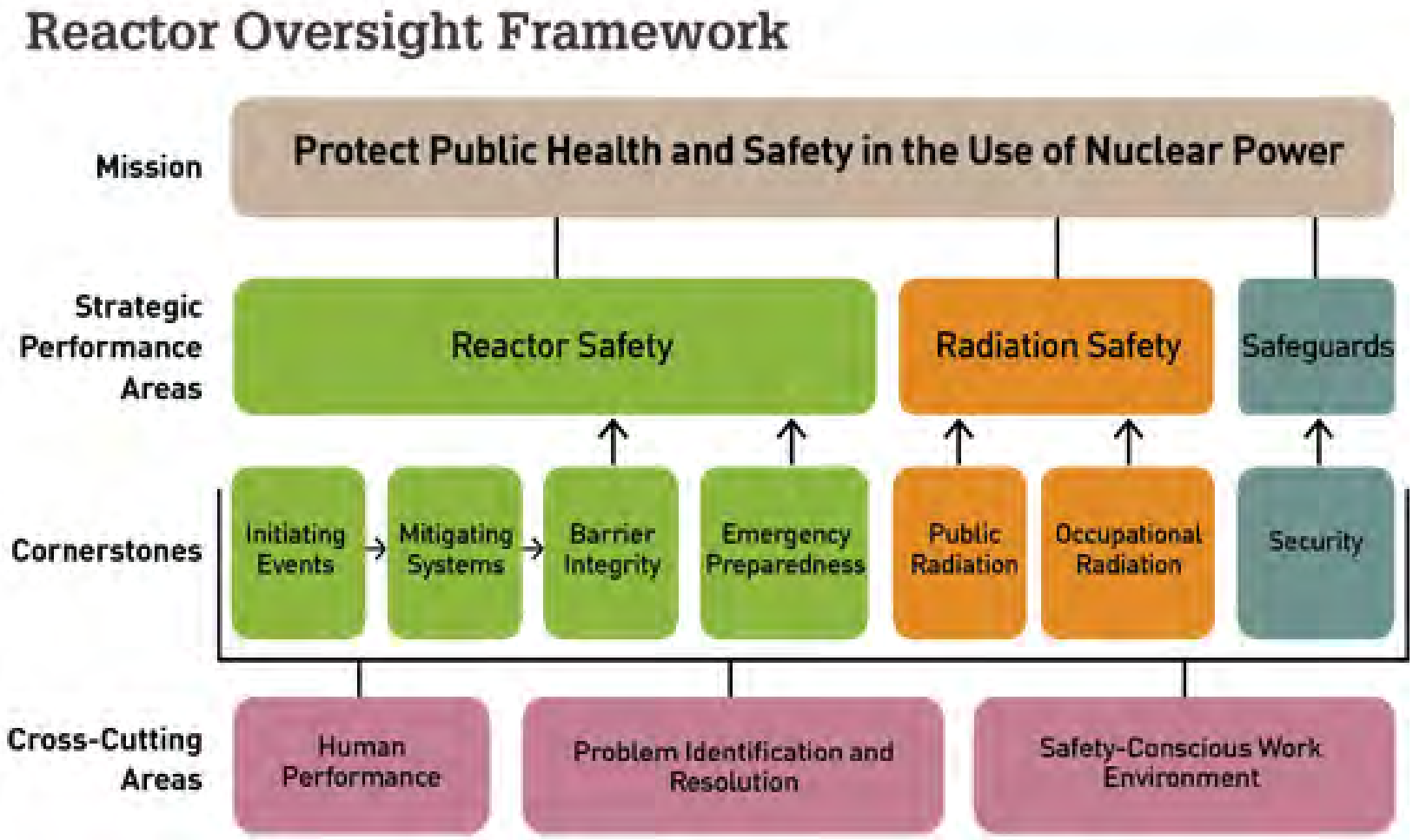
Functional Areas and Ratings:

	Current	Previous	
Plant Operations	2	2	Good Performance
Maintenance	2	2	
Engineering	1	1	Superior Performance
Plant Support	2	1	

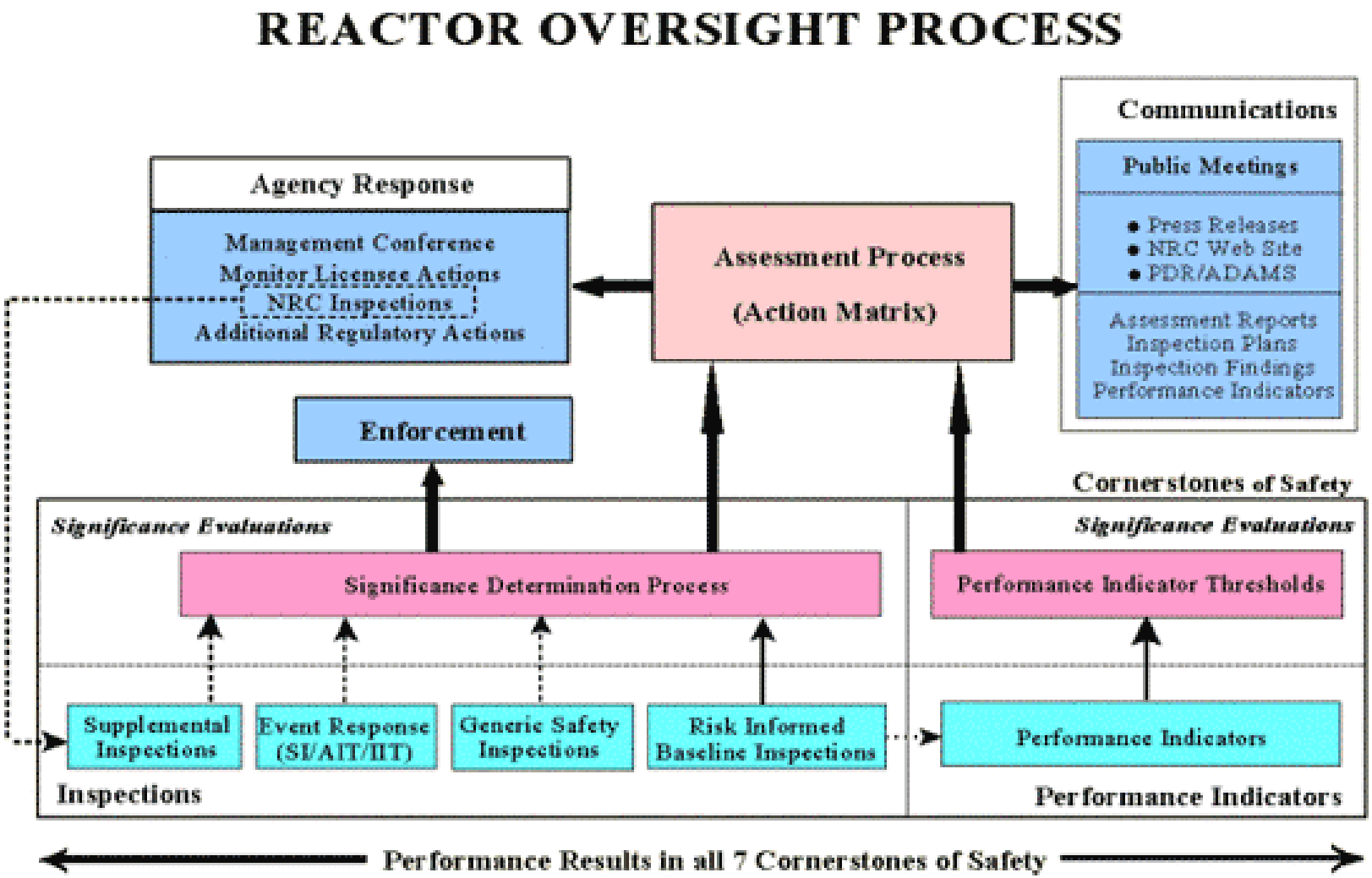
Source: 1997 Fort Calhoun SALP (ML12212A090)

Reactor Oversight Process

Reactor Oversight Process



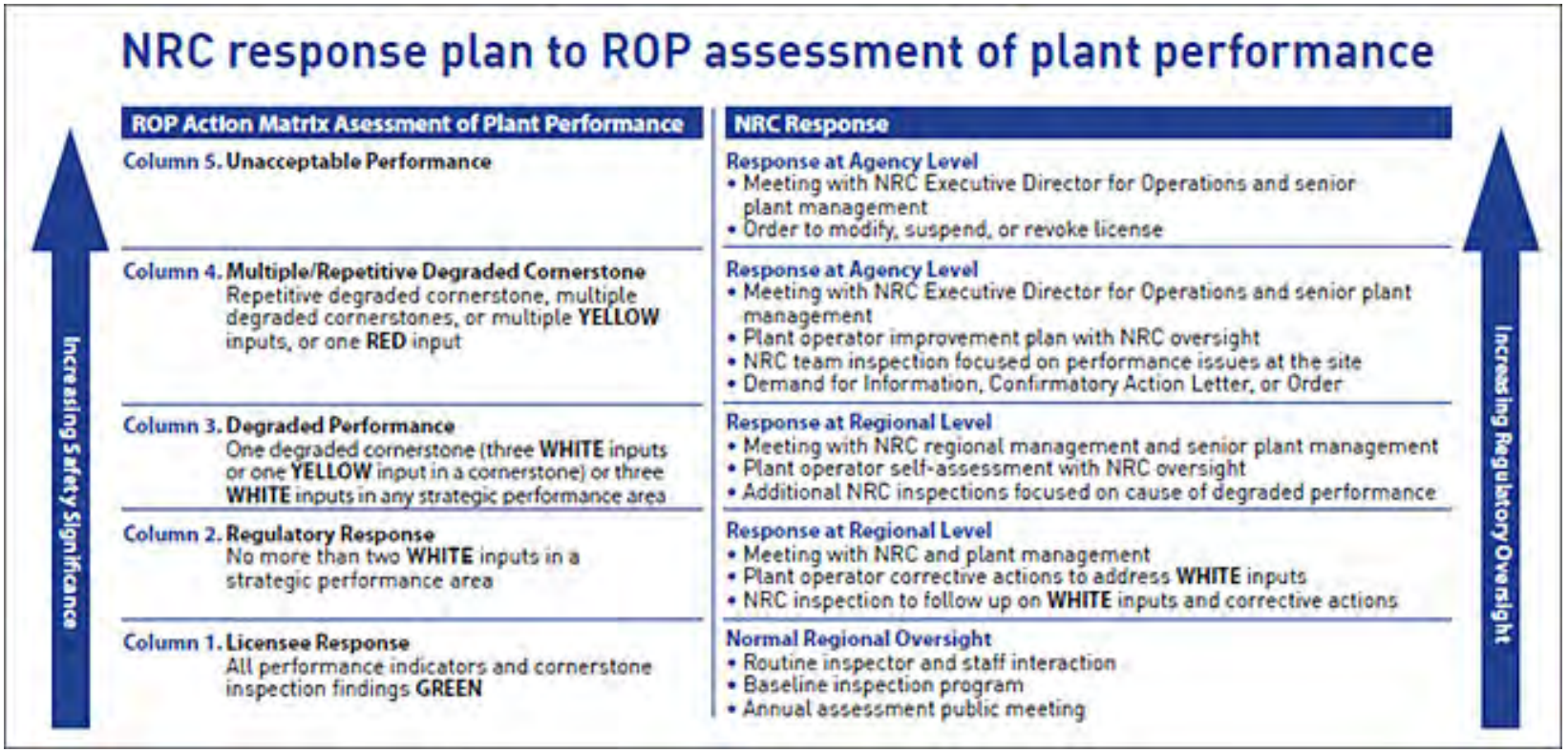
Reactor Oversight Process



Reactor Oversight Process

Licensee Response (Baseline Inspection)	Regulatory Response (Response at Regional Level)	Degraded Performance (Response at Regional Level)	Multiple/Repetitive Degraded Cornerstone Column (Response at Agency Level)	Unacceptable Performance (Response at Agency Level)
Beaver Valley 1	Columbia Generating Station		Arkansas Nuclear 1	
Beaver Valley 2	Diablo Canyon 2		Arkansas Nuclear 2	
Braidwood 1	Dresden 3		Pilgrim 1	
Braidwood 2	Fermi 2			
Browns Ferry 1	Grand Gulf 1			
Browns Ferry 2	Hope Creek 1			
Browns Ferry 3	Monticello			
Brunswick 1	Oyster Creek			
Brunswick 2	Saint Lucie 1			
Byron 1	Salem 2			
Byron 2	South Texas 1			
Callaway	South Texas 2			
Calvert Cliffs 1	Vogtle 1			
Calvert Cliffs 2	Vogtle 2			
Catawba 1				
Catawba 2				

Reactor Oversight Process



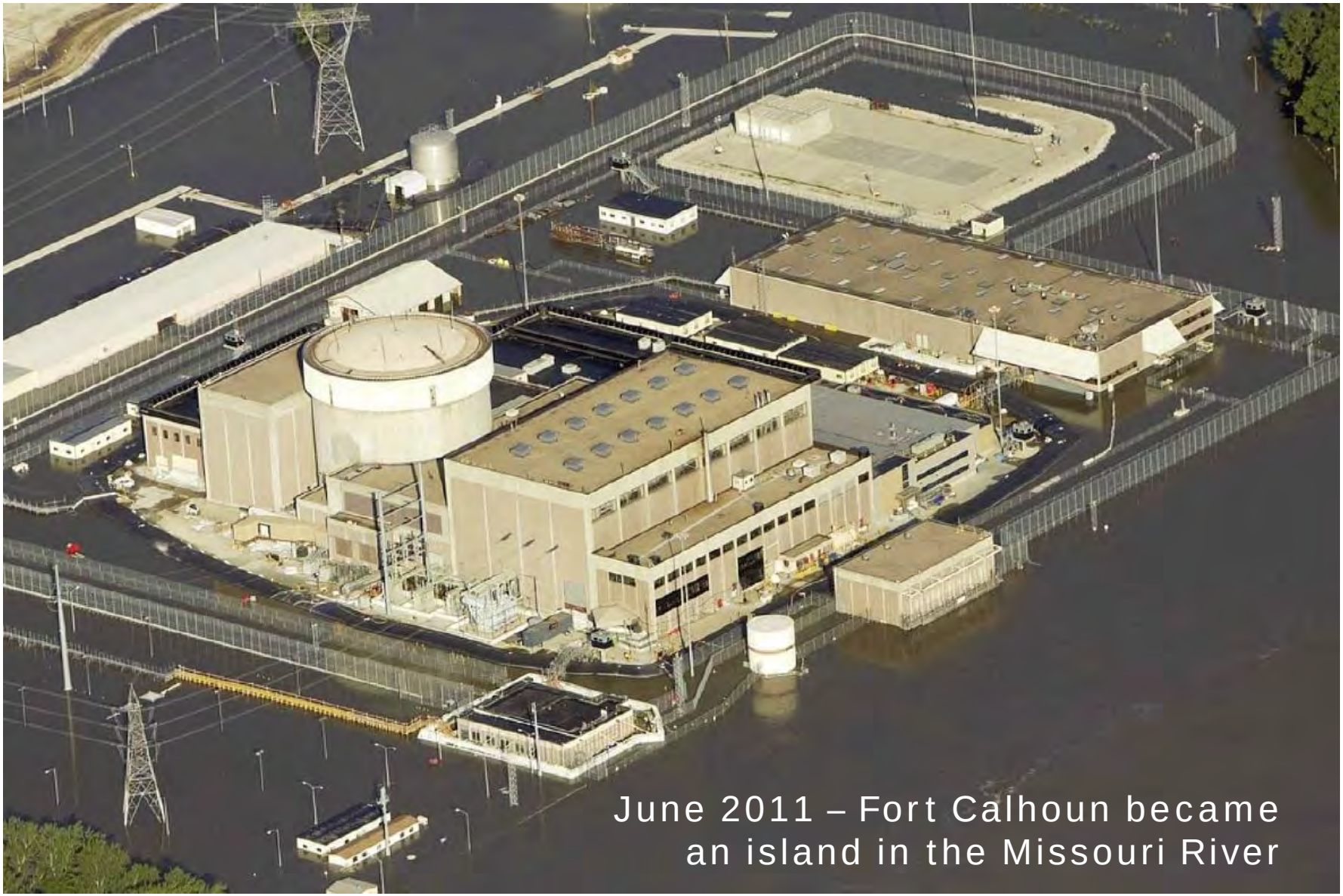
Reactor Oversight Process

Pre-ROP	ROP
Handful of areas rated	7 cornerstones assessed by NRC findings and ~18 performance indicators
Ratings every 18 to 24 months	Ratings every 3 months
No failing grades	Failing grades
Under-performing reactors on “Watch List” without pre-determined NRC responses	Under-performing reactors on “To Do” list with prescribed NRC responses

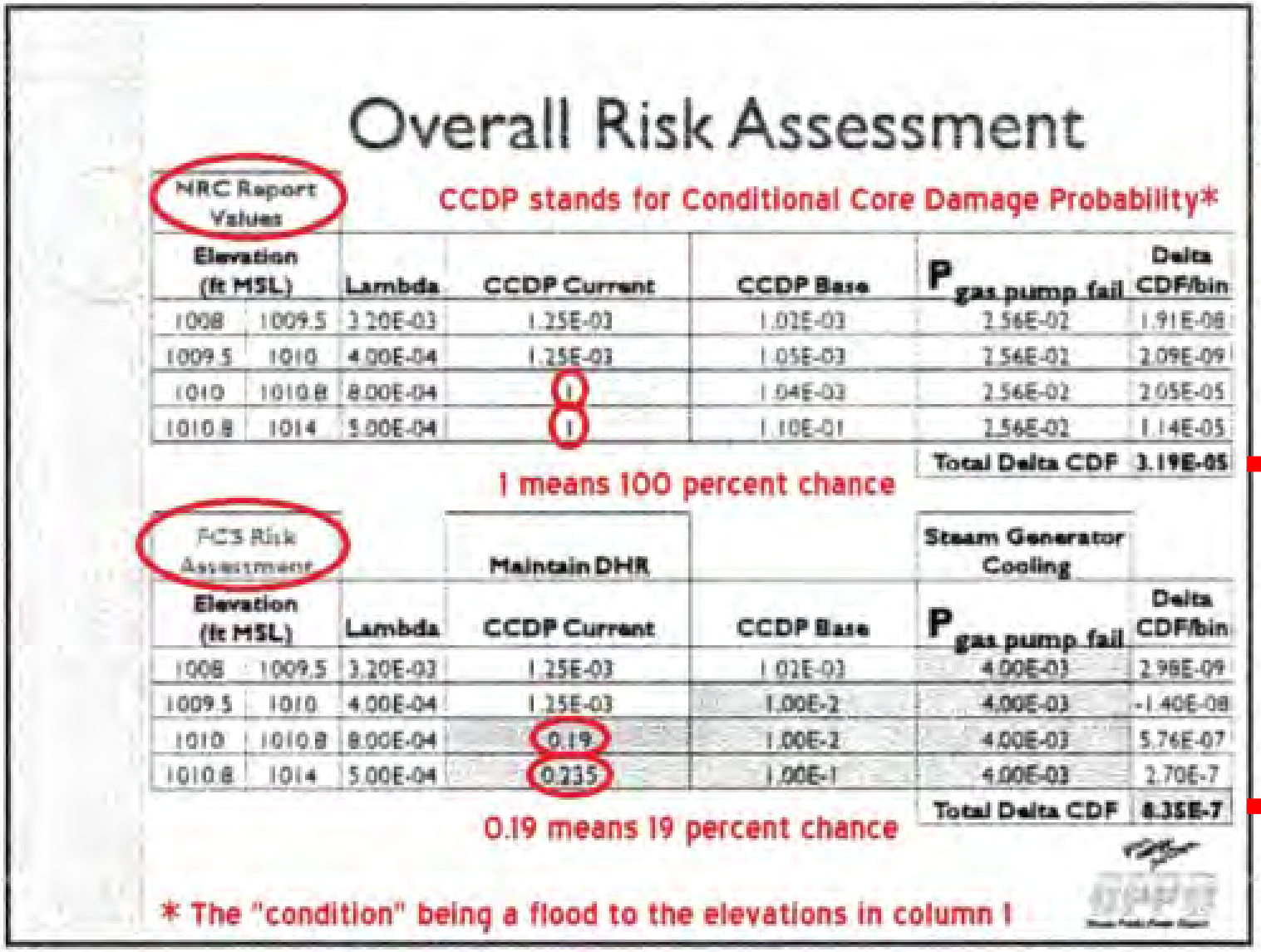
By monitoring more discrete areas more frequently with mandated NRC responses to declining performance, ROP better prevents problems from growing to epidemic proportions.

More: http://allthingsnuclear.org/dlochbaum/reactor-oversight-process

Flooding Pre-Fukushima



Flooding Pre-Fukushima



Overall Risk Assessment

NRC Report Values

CCDP stands for Conditional Core Damage Probability*

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	2.56E-02	1.91E-08
1009.5	1010	4.00E-04	1.25E-03	1.05E-03	2.56E-02	2.09E-09
1010	1010.8	8.00E-04	1	1.04E-03	2.56E-02	2.05E-05
1010.8	1014	5.00E-04	1	1.10E-01	2.56E-02	1.14E-05
					Total Delta CDF	3.19E-05

1 means 100 percent chance

FCS Risk Assessment

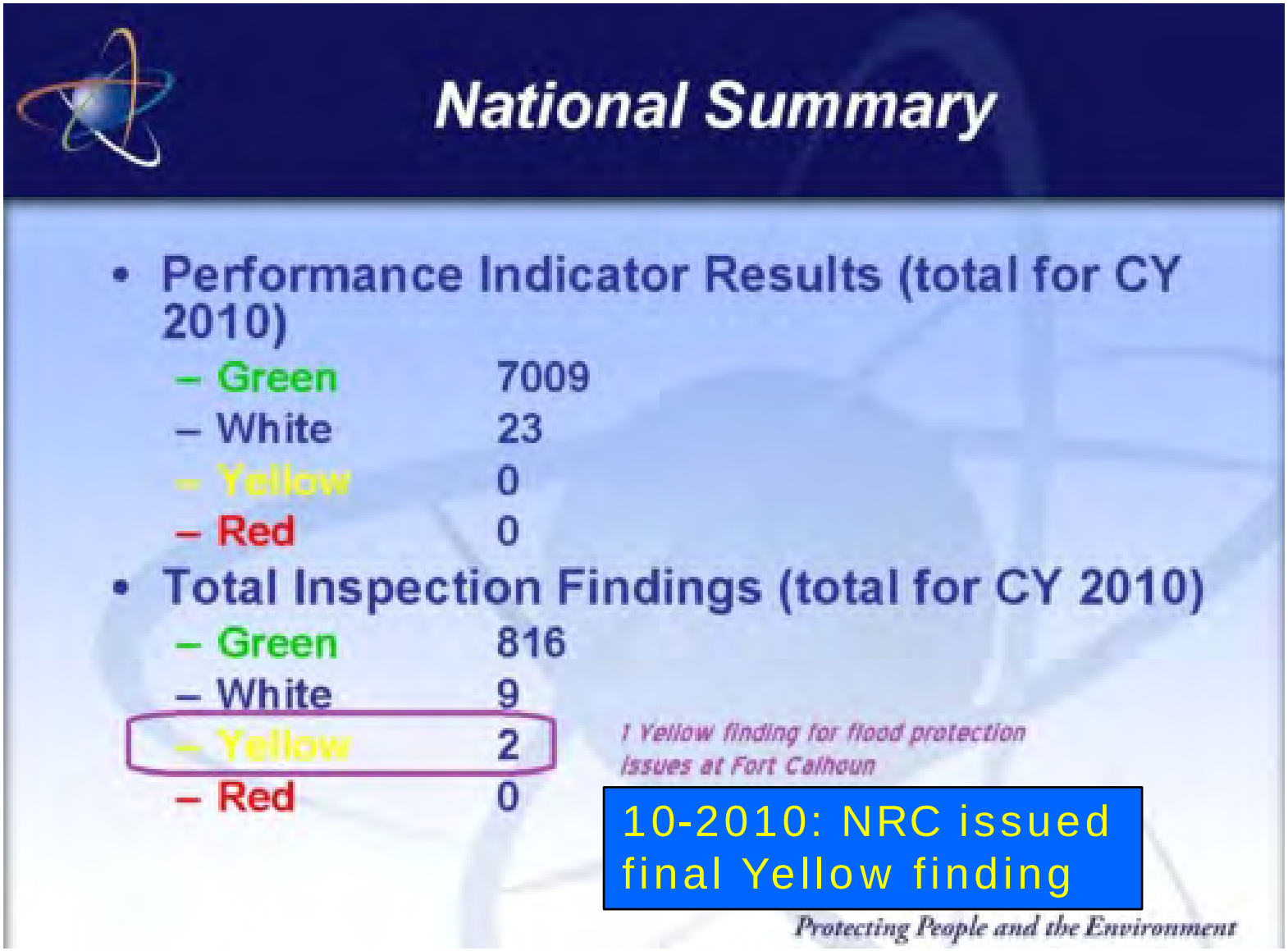
			Maintain DHR		Steam Generator Cooling	
Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-1	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

0.19 means 19 percent chance

* The "condition" being a flood to the elevations in column 1

08-2010: NRC heard argument that flooding violations had little significance

Flooding Pre-Fukushima



Flooding Pre-Fukushima

07-2010: NRC issued preliminary Yellow finding for flood protection finding (ML101970547)

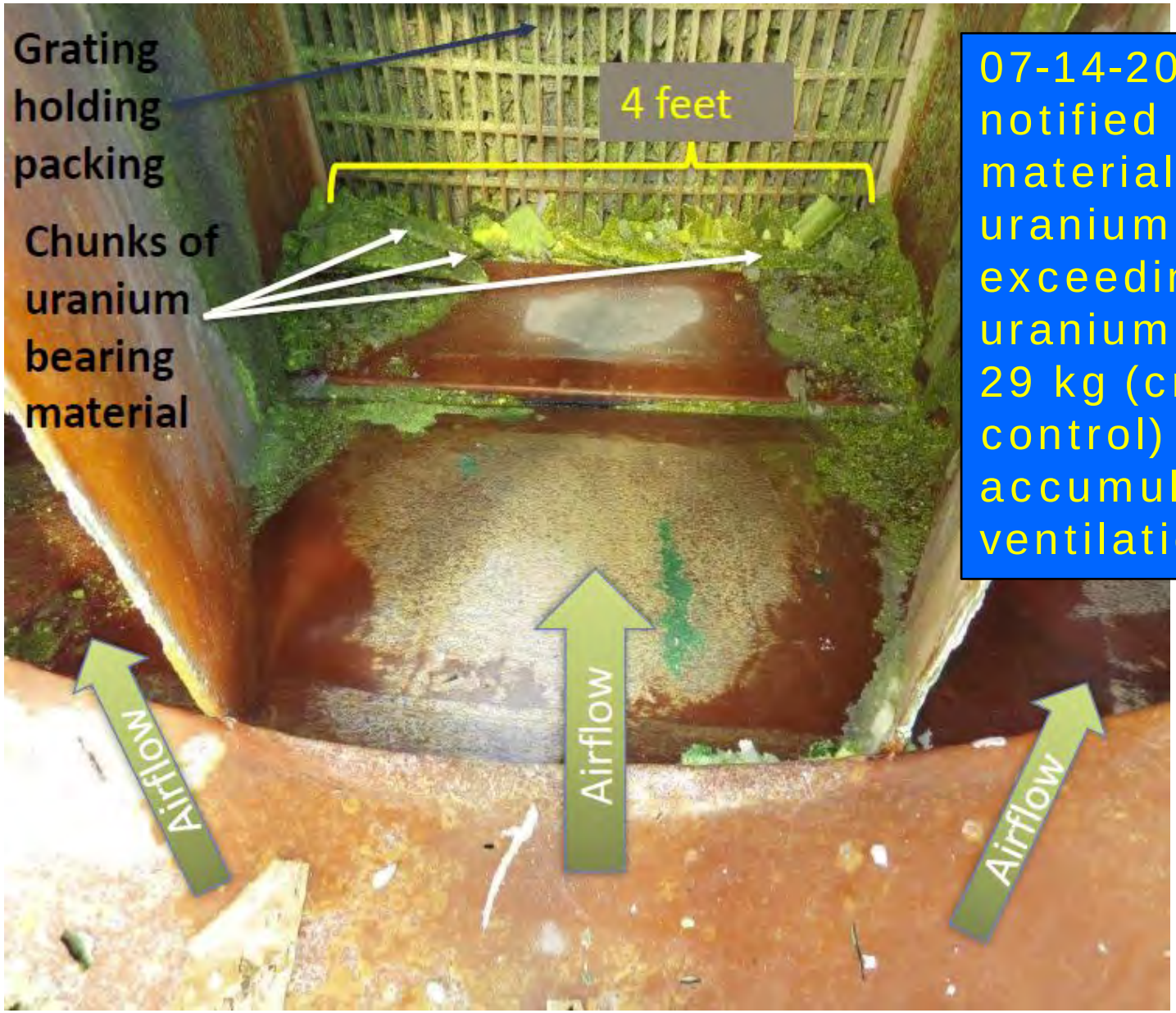
08-2010: NRC listened to licensee contend that finding is merely Green (ML102380230)

10-2010: NRC issued final Yellow finding (ML102800342)

06-2011: With flood protection shortcomings fixed, plant survived becoming an island.

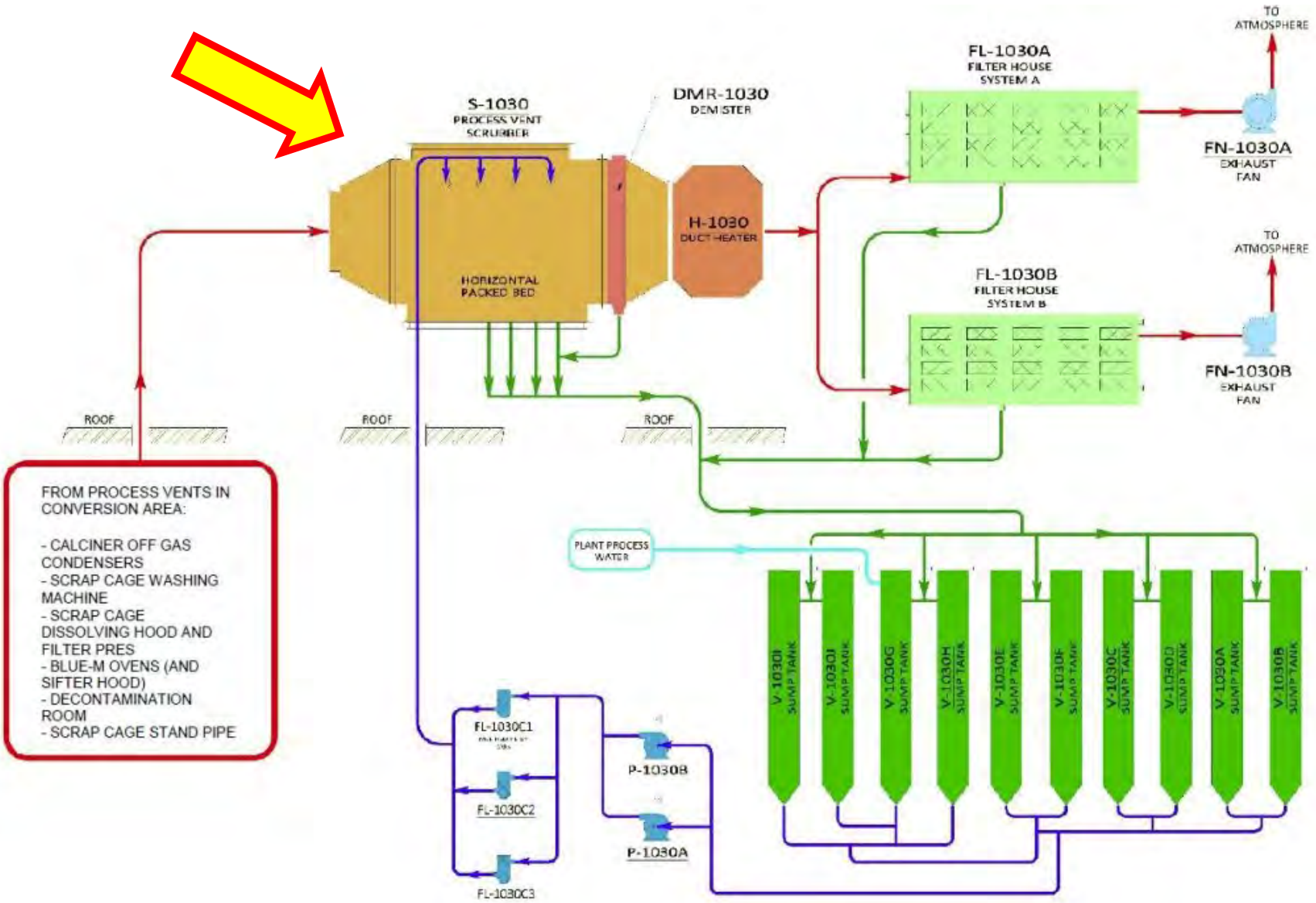
More: http://allthingsnuclear.org/dlochbaum/the-nrc-in-action

CFFF Event Lessons Learned



07-14-2016: Licensee notified NRC that material containing uranium potentially exceeding the uranium mass limit of 29 kg (criticality control) had accumulated in a ventilation scrubber

CFFF Event Lessons Learned



More: http://allthingsnuclear.org/dlochbaum/kudos-to-nrc-for-lessons-learned-review-at-columbia-fuel-fabrication-facility

CFFF Event Lessons Learned

07-14-2016: Licensee notified NRC of discovery that more than the uranium mass limit accumulated in a ventilation scrubber

07-28-2016: NRC chartered an Augmented Inspection Team to investigate the CFFF event

08-11-2016: NRC issued Confirmatory Action Letter to licensee regarding causes and corrective actions for event (ML16224B082)

10-26-2016: NRC issued the AIT report (ML16301A001)

☆ 10-28-2016: NRC chartered a team to conducted a lessons-learned review of the event (ML16301A001)

☆ 01-30-2017: NRC issued lessons learned report.

CFFF Event Lessons Learned

The lessons learned report made 18 recommendations in the following areas:

- license review process
- inspection program
- operating experience program
- roles and responsibilities
- knowledge management

Great example of pro-active effort not seeking to fix some past sin but to be more effective in the future.

Preceding Examples Might Suggest That “Good” Outcomes Require More Regulation or More Enforcement

“Good” Outcomes Can be Achieved via Less Regulation or Less Enforcement

NOT Putting Perry in Column 4

Action Matrix Summary

Licensee Response Column	Regulatory Response Column	Degraded Cornerstone Column	Multiple/Repetitive Degraded Cornerstone Column	Unacceptable Performance Column
Arkansas Nuclear 1	Beaver Valley 1	Browns Ferry 2	Browns Ferry 1	
Arkansas Nuclear 2	Beaver Valley 2	Perry 1	Perry 1	
Braidwood 1	Browns Ferry 3	Sequoyah 1		
Braidwood 2	Davis-Besse	Sequoyah 2		
Brunswick 1	Fermi 2	Watts Bar 1		
Brunswick 2	FitzPatrick	Wolf Creek 1		
Byron 1	Grand Gulf 1			
Byron 2	Kewaunee			
Callaway	Nine Mile Point 1			
Calvert Cliffs 1	Point Beach 1			
Calvert Cliffs 2	Prairie Island 1			
Catawba 1	Prairie Island 2			
Catawba 2	Susquehanna 2			
Clinton	Three Mile Island 1			

1st Quarter 2013: Perry met the criteria for placement in Column 4 due to a White inspection finding and a White performance indicator in the Occupational Radiation Safety cornerstone and a greater-than-green finding in security.

NOT Putting Perry in Column 4

Action Matrix Summary

Licensee Response Column	Regulatory Response Column	Degraded Cornerstone Column	Multiple/Repetitive Degraded Cornerstone Column	Unacceptable Performance Column
Arkansas Nuclear 1	Beaver Valley 1	Browns Ferry 2	Browns Ferry 1	
Arkansas Nuclear 2	Beaver Valley 2	Perry 1		
Braidwood 1	Browns Ferry 3	Sequoyah 1		
Braidwood 2	Davis-Besse	Sequoyah 2		
Brunswick 1	Fermi 2	Watts Bar 1		
Brunswick 2	FitzPatrick	Wolf Creek 1		
Byron 1	Grand Gulf 1			
Byron 2	Kewaunee			
Callaway	Nine Mile Point 1			
Calvert Cliffs 1	Point Beach 1			
Calvert Cliffs 2	Prairie Island 1			
Catawba 1	Prairie Island 2			
Catawba 2	Susquehanna 2			
Clinton	Three Mile Island 1			

But Region III sought and obtained permission to deviate from Manual Chapter 0305 and keep Perry in Column 3 (ML13004A403)

More: https://www.nrc.gov/reactors/operating/oversight/deviations.html

NOT Putting Perry in Column 4

NRC Region III issued public letter to licensee (ML13018A163) and press release (ML13018A432) explaining that the issues at Perry were:

- isolated and not indicative of broader issues
- understood via baseline and 95002 inspections
- addressed by existing follow-up plans

NRC could have stuck to process and wasted resources by a 95003 inspection.

Instead, NRC justified a rare deviation from process and clearly communicated the basis for that deviation.

More: https://www.nrc.gov/reactors/operating/oversight/deviations.html

Zero-Sum BIP Enhancement

07-17-2013: NRC staff (HQ and regions) held public meeting with industry and NGO representatives about the ROP's baseline inspection program (BIP)

02-05-2014: NRC staff (HQ and regions) held follow-up public meeting to discuss proposed changes to the BIP

04-04-2014: NRC issued report to NRR Director on BIP enhancement project (ML14017A340)

Zero-Sum BIP Enhancement

Open, transparent process involving many internal and external participants was commendable – but typical for ROP process changes

The atypical commendable aspect to this project was the up-front understanding that any new or expanded BIP inspections needed to be offset by eliminations or reductions elsewhere.

Throwing more resources at something is the easy out. This zero-sum approach maintained BIP's safety focus, avoiding dilution/distraction of NRC's oversight.

Common Attributes

Timely: Not because resolution was within one week or one year but because resolution was achieved without undue delay

Clear Communications: What was done and why it was done was explained

Durability/Effectiveness: Just as the shortest distance between two points is a straight line, so is the safest path between a problem and its resolution. In these cases, NRC obtained outcomes without tangents, backtracking, etc.

Conclusions

Tens of millions of Americans live within 50 miles of nuclear power plants.

Tens of thousands of Americans work at nuclear power plants.

Thanks to many efforts by the NRC staff like the small sample cited here, these Americans are safer and more secure.

Americans deserve your best effort.

You deserve a big thanks.

Union of Concerned Scientists

THANKS!

www.ucsusa.org
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