

# { Safety in Numbers }

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W20

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# **Benefits of Time Passage**

- > Accumulation of operating experience**
- > Significant expansion of computer modeling capabilities**

**These benefits combined could better inform decisions for removing unnecessary margin while still properly managing underlying risks.**

# Caution (a.k.a. Big BUT...)



**Expanding risk-informed regulation increases subjectivity**

**Subjectivity is not inherently evil if it is handled properly**

**Davis-Besse in 2001 and Palo Verde last year reflect subjectivity being handled improperly**



# Caution: Davis-Besse (2001)

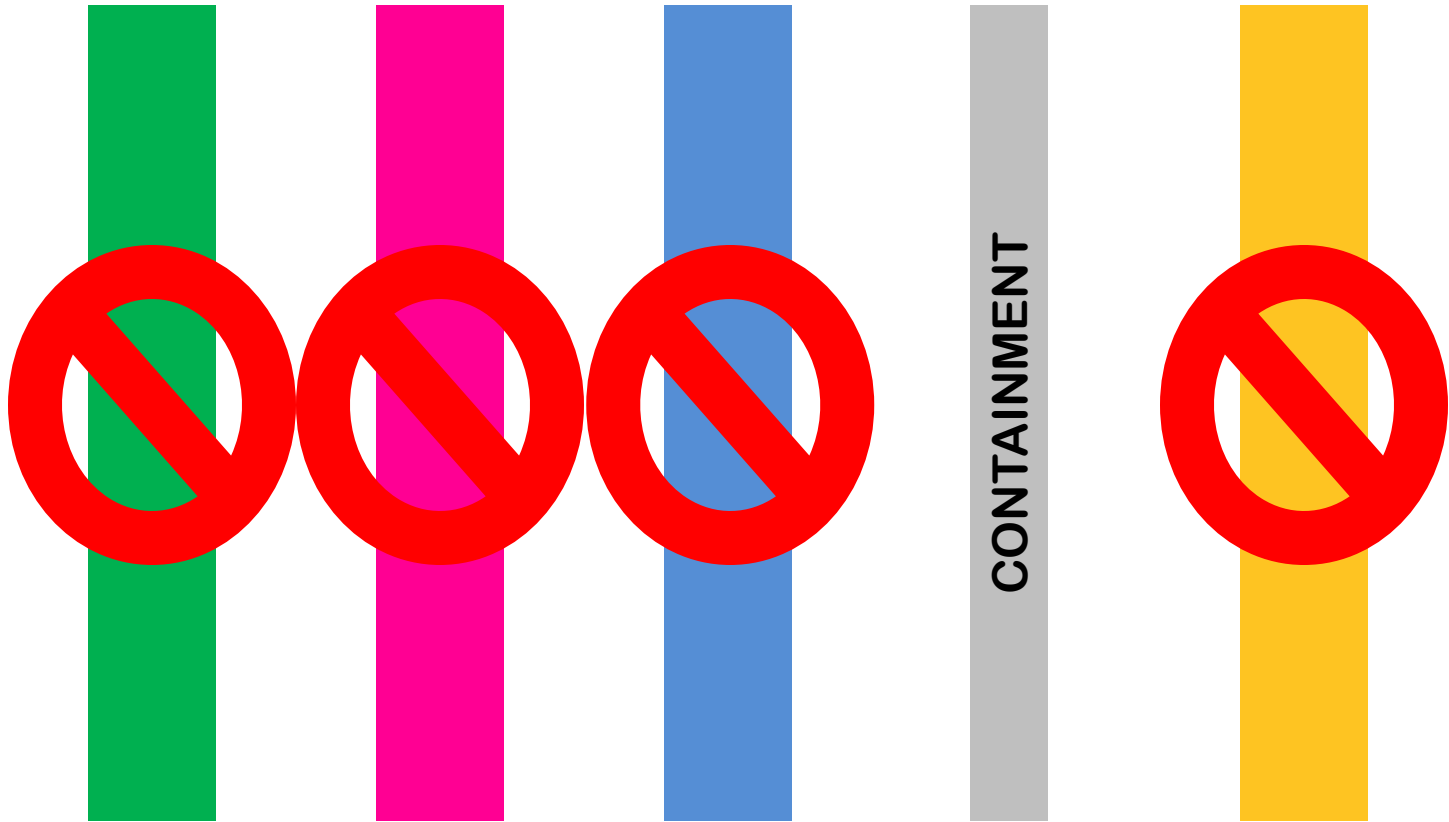


Source: Final slide from 11/29/2001 staff briefing of EDO on decision not to issue shut down order

## RG 1.174 SAFETY PRINCIPLES

- Current Regulations are met
  - It is likely that current regulations are not met with respect to TS requirements and GDC
- Defense-in-depth philosophy maintained
  - It is likely that one of 3 barriers is lost
  - However, Davis-Besse has large dry containment
- Sufficient safety margins are maintained
  - It is likely that safety margins are reduced
- Only a small increase in CDF results
  - Incremental  $\Delta$ CDF (no comp measures) is  $1.1\text{E-}06/\text{ry}$  to  $1.3\text{E-}04/\text{ry}$
  - Baseline CDF is  $6.6\text{E-}05/\text{ry}$
- The basis of risk measurement is monitored using performance measurement strategies
  - Will not occur until inspection is performed

# Caution: Davis-Besse (2001)



**NRC subjectively accepted known and suspected erosion of multiple defense-in-depth layers on its subjective notion that containment was 100% reliable**

# Caution: Davis-Besse (2001)

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October 7, 2003

EA-03-131

Mr. Lew Myers  
Chief Operating Officer  
FirstEnergy Nuclear Operating Company  
Davis-Besse Nuclear Power Station  
5501 North State Route 2  
Oak Harbor, OH 43449-9760

SUBJECT: FINAL SIGNIFICANCE DETERMINATION FOR A YELLOW FINDING (NRC INSPECTION REPORT 50-346/03-15) - DAVIS-BESSE POTENTIAL CLOGGING OF THE EMERGENCY SUMP FOLLOWING A LOSS OF COOLANT ACCIDENT

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**NRC's notion about containment integrity proved fall from right as evidenced by this YELLOW finding for improper containment coatings that could clog sump.**

# **Caution: EDG AOT LAR LOL**

**2015: NRC would not approve the 65-day EDG AOT LAR for Cook Unit 1 citing a 14-day limit in BTP 8-8**

**2017: NRC approved 62-day EDG AOT LAR for Palo Verde 3 also citing BTP 8-8 (but remaining silent about the whole fortnight thing)**

# Caution: EDG AOT LAR LOL

## Final ASP Program Analysis - Precursor

### Accident Sequence Precursor Program – Office of Nuclear Regulatory Research

**Palo Verde Nuclear  
Generating Station,  
Unit 3**

Emergency Diesel Generator Failure Resulting in a Condition  
Prohibited by Technical Specifications

**Event Date:** 12/15/2016

**LER:** [530-2016-002-01](#)  
**IR:** [05000530/2017008](#)

**$\Delta$ CDP=  $2 \times 10^{-5}$**

**Plant Type:** Combustion Engineering Pressurized-Water Reactor (PWR) with a Large Dry,  
Ambient Pressure Containment

**Plant Operating Mode (Reactor Power Level):** Mode 1 (100% Reactor Power)

**Analyst:**  
Keith Tetter

**Reviewer:**  
Chris Hunter

**Contributors:**

**BC Approved Date:**  
11/15/2017

The alleged “low risk” of deliberately  
running a reactor for up to 62-days  
without an EDG qualified as an ASP event.



# Caution: EDG AOT LAR LOL

**Palo Verde:** According to the NRC, the NRC-approved 57-day operation of Palo Verde Unit 3 with one of two EDGs broken resulted in  $\Delta\text{CDF}$  of  $3.6 \times 10^{-6}$ , exceeding the  $1 \times 10^{-6}$  ASP threshold.

**DC Cook:** By not approving a 65-day EDG AOT LAR, NRC avoided a positive  $\Delta\text{CDF}$  and may actually have made things safer.

# Caution: EDG AOT LAR LOL

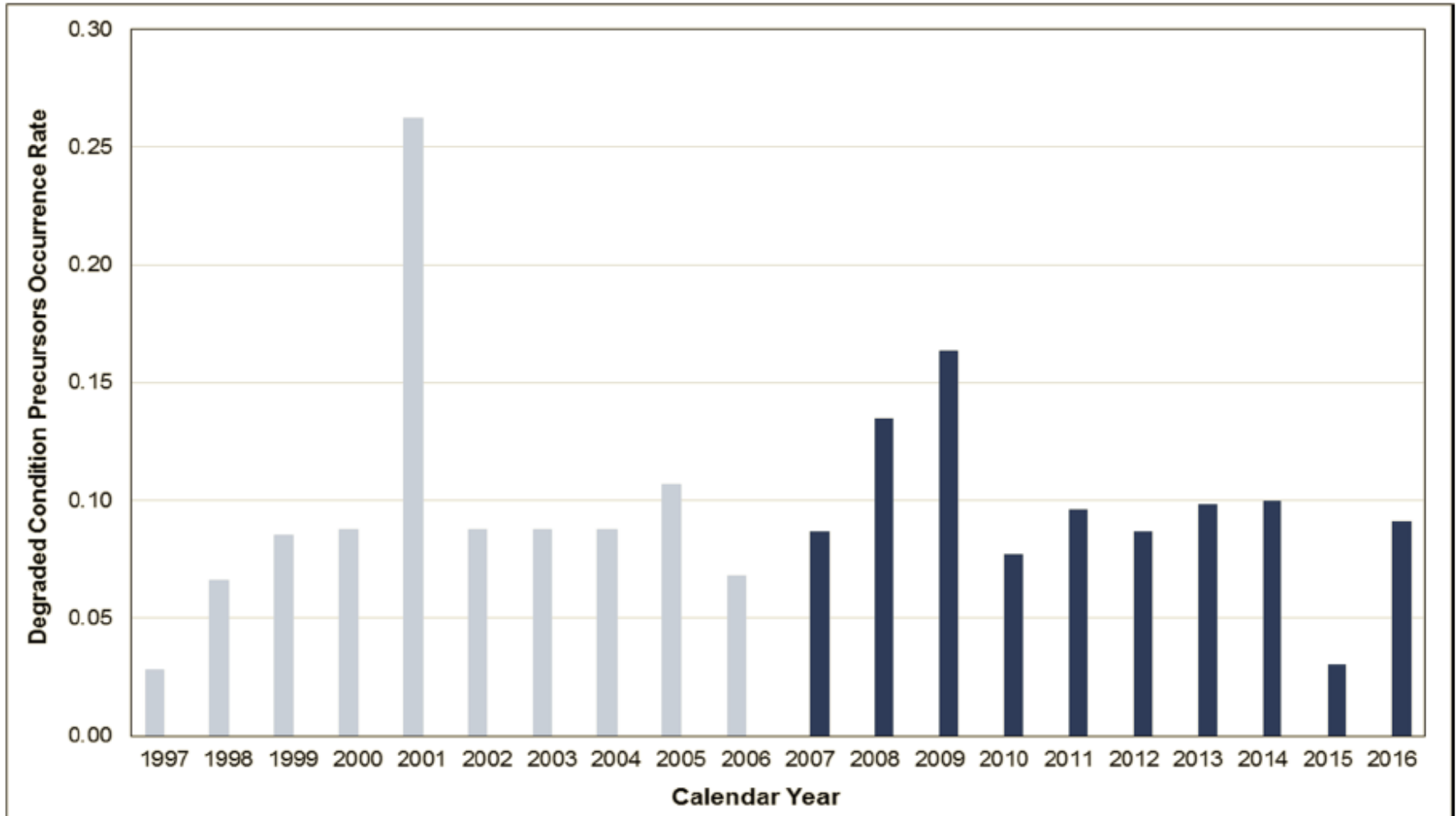


Figure 6. Occurrence Rate of Precursors Involving Degraded Condition(s).

Source: ASP Program Annual Report (ML17153A365)

# Caution: EDG AOT LAR LOL

Note that when risk evaluations performed as part of the SDP are used for ASP program purposes, the SDP color representing the significance of the inspection finding is used as the official ASP Program result. The associated risk of the four SDP colors is as follows:

- *Red (High Safety Significance)*, which corresponds to an event with a CCDF/ $\Delta$ CCDF greater than or equal to  $10^{-4}$ ;
- *Yellow (Substantial Safety Significance)*, which corresponds to an event with a CCDF/ $\Delta$ CCDF greater than or equal to  $10^{-5}$ , but less than  $10^{-4}$ ;
- *White (Low to Moderate Safety Significance)*, which corresponds to an event with a CCDF/ $\Delta$ CCDF greater than or equal to  $10^{-6}$ , but less than  $10^{-5}$ ; and
- *Green (Very Low Safety Significance)*, which corresponds to an event with a CCDF/ $\Delta$ CCDF less than  $10^{-6}$ .



**$\Delta$ CCDF of  $3.6 \times 10^{-6}$**

**Source: ASP Program Annual Report (ML17153A365)**

**Caution: EDG AOT LAR LOL**

## **Nuclear Safety 101:**

Proper regulation, deterministic or risk-informed, should **LESSEN** the ASP rate, not **INCREASE** it

## **Nuclear Safety 102:**

Don't deliberately take actions that result in ASP events & White findings

# **Another Caution (with Kudos)**

**More risk-informed regulation lessens importance of single-failure criterion**

**More risk-informed regulation increases importance of common-cause failures.**

**UCS acknowledges and applauds ongoing efforts by NRC and industry to better understand and factor CCFs into PRAs.**



# Still Another Caution

***Delivering the Nuclear Promise and Project Aim*** initiatives each entail reductions in what is being done.

Care must be taken to avoid reducing data collection and analysis (i.e., macro OpE) that might impede populating the PRAs with necessary contemporary information.

# **Still Another Caution: ITP DOA**

**Project AIM killed the Industry Trends Program (ITP) which “was intended to provide a basis for assessing whether adoption of the ROP led to a degradation in overall operating reactor safety”**

**The absolute easiest and cheapest way to miss a warning sign of pending trouble is not to look.**

# **Still Another Caution: I&C DOA**

**Project Aim stopped research into incorporating digital I&C into PRA, eliminating the “development of new methods, models and tools in this area”**

**So, PRAs will model how I&C systems used to be, not how they currently are.**

**Ignorance is not only bliss, it's less costly. Swell!**

# **Still Another Caution: OpE DOA**

**Project Aim reduced “the number of operating experience based system and component studies” and reduced “the frequency in updating risk-informed regulatory guidance”**

**So, 21<sup>st</sup> century risk ciphering will use outdated OpE and obsolete guidance.**

# **Still Another Caution: SPAR OOD**

**Project AIM reduced “the updating of Standardized Plant Analysis Risk (SPAR) models” meaning that SPAR models will become more and more out of date (OOD) as time flies**

**Given the wide disparity between SPAR and PRA results, updating pace should be quickened, not slowed or stopped.**



# Question (Rhetorical?)

**Will hoping that  
express lanes for risk-  
informed regulation  
get constructed ...**



**Source:**

**<https://www.flickr.com/photos/132926214@N07/>**

**... truly speed up  
the horse & buggy  
PRA pace?**

**Source: <https://www.flickr.com/photos/pquan/>**

# **Acronyms**

**AOT – Allowed Outage Time**

**ASP – Accident Sequence Precursor**

**BTP – Branch Technical Position**

**CCF – Common Cause Failure**

**CDF – Core Damage Frequency**

**EDG – Emergency Diesel Generator**

**I&C – Instrumentation and Controls**

**LAR – License Amendment Request**

**LOL – Laughing Out Loud**

**NRC – Nuclear Regulatory Commission**

**OpE – Operating Experience**

**PRA – Probabilistic Risk Assessment**

**ROP – Reactor Oversight Process**