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October 23, 2017

Anthony T. Gody, Jr., Director
Division of Reactor Safety, Region II
U.S. Nuclear Regulatory Commission

James A. Isom, Senior Reactor Operations Engineer
Reactor Inspections Branch, DIRS, NRR
U.S. Nuclear Regulatory Commission

SUBJECT: NRC's Engineering Inspections

Dear Mr. Gody and Mr. Isom:

The Union of Concerned Scientists (UCS) considers effective, independent regulatory oversight to be the public's best and most reliable protection against safety declines caused by aging nuclear power reactors, shrinking O&M budgets, ineffective plant management, and other factors. The Reactor Oversight Process (ROP) is an important part of the regulatory toolkit used by the Nuclear Regulatory Commission (NRC) to dispense effective, independent oversight.

One of the ROP's many positive attributes is that it's treated as a work-in-progress by the NRC. There are formal processes built into the ROP that routinely evaluate potential process changes and make any appropriate tweaks. The NRC's formal change processes engage internal and external stakeholders to seek the elusive "greatest good for the greatest number" that Jeremy Bentham and John Stuart Mill advocated.

Currently, the NRC is evaluating the ROP's engineering inspections for possible tweaking that could improve their efficiency and effectiveness. It was evident during the October 11, 2017, public meeting conducted by the NRC that the working group has extensive experience with the strengths and weaknesses of the ROP and its inspection program and is applying that considerable experience towards finding ways to conduct engineering inspections more efficiently without compromising their effectiveness. Efficiency gains can be measured relatively easily via the reduction in number of inspection hours expended before and after any changes.

Effectiveness gains are considerably more difficult to measure objectively. Even apparently objective numerical metrics (such safety system failures or engineering-related accident sequence precursors) could show increasing or decreasing trends for reasons totally unrelated to the engineering inspection program. The ROP, and the public's protection, will be diminished if tangible efficiency gains are offset by intangible effectiveness declines.

During the October 11 public meeting, I advocated adding formal feedback aspects to the NRC's responsive inspections (i.e., Special Inspection Team and Augmented Inspection Team) that determine whether tweaks to the ROP could better oversee the issues contributing to the event/discovery. I learned that the 95003 inspection procedure explicitly includes such feedback. It might be worthwhile to expand that feedback to other reactive inspections.

The October 11 public meeting featured a presentation by industry representatives about their proposal to replace the NRC's engineering inspections with their own self-assessments. UCS is not opposed to industry self-assessments. There may well be a time and place for industry self-assessments. But 2017/2018 and engineering inspections are neither the time nor the place for them for reasons detailed in the attached report.

As this report clearly indicates, the industry often fails to detect latent conditions that are subsequently identified either by events or by NRC inspectors. These failures were not caused by licensees seeking to deceive the NRC or thinking that the doors to their latent condition closets would never be opened (except to toss in more latent conditions). Instead, the recurring theme among the many examples summarized in the enclosed report was that workers thought the configuration was acceptable while the NRC disagreed. Our report suggests that workers also have inherent biases that can influence the selection of samples. In short, the NRC's engineering inspections simply cannot be replaced by industry self-assessments.

This is not to suggest that the engineering inspections cannot be made more efficient while remaining effectiveness-neutral. During the October 11 public meeting, members of the working group outlined changes that would allow the engineering inspections to cover the same ground but with an estimated 8 to 15 percent reduction in resources. Covering the same ground more efficiently is an option. Ceding that ground to the industry must not be an option.

Sincerely,

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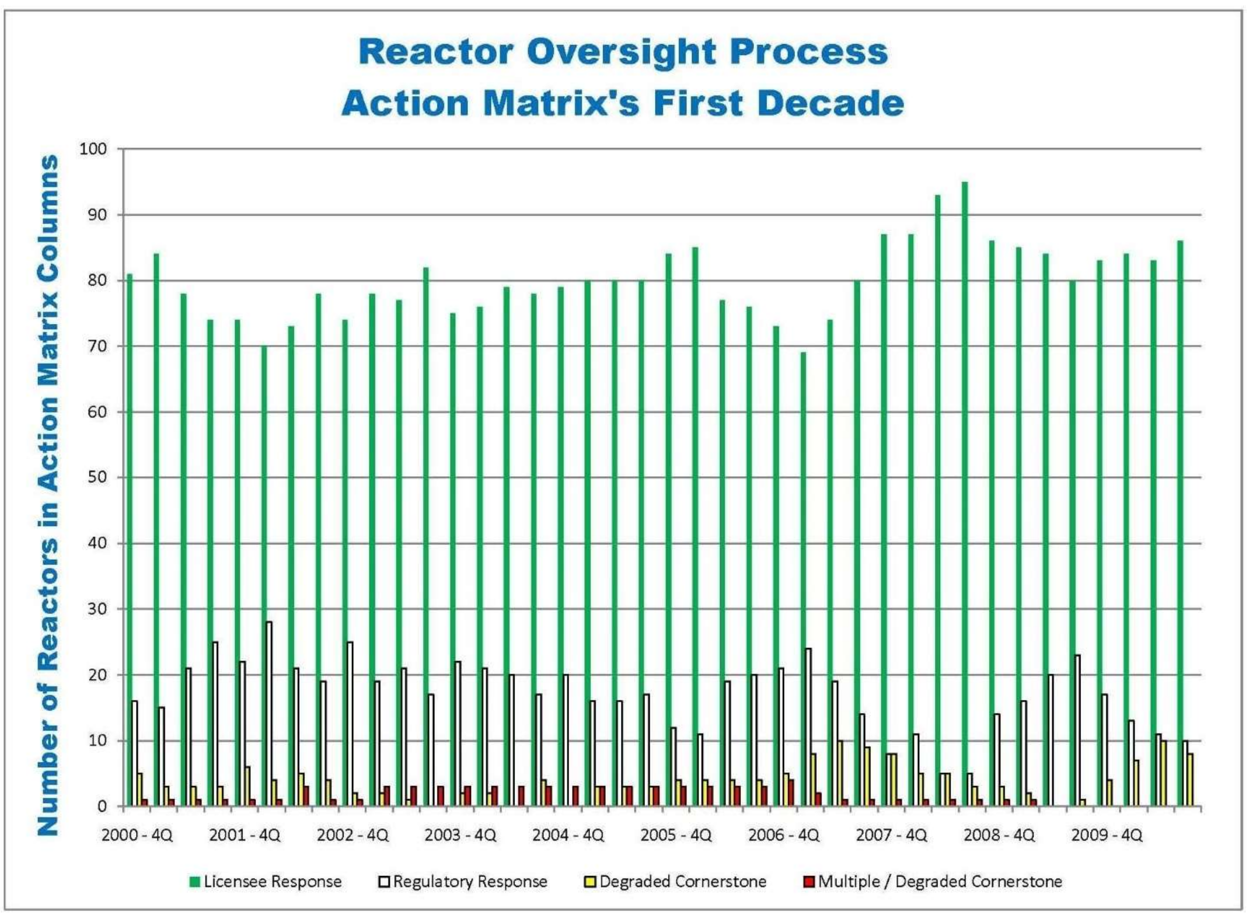
Reactor Oversight Process — Baseline Inspection Program — Engineering Inspections

The Reactor Oversight Process (ROP) is one of the most significant nuclear safety achievements by the Nuclear Regulatory Commission (NRC). The ROP is considerably better than the Systematic Assessment of Licensee Performance (SALP) in many ways including:

- The ROP's Performance Indicators measure safety levels in nearly two dozen areas, compared to the handful of areas assessed in SALP.
- The ROP issues "report cards" every quarter, compared to every 18 to 24 months in SALP.
- The ROP specifies NRC's response to indications of declining performance, compared to SALP's singular passive "Watch List" for some performers.
- The ROP's inspection procedures, Significance Determination Process for findings, and bases for NRC's performance assessments are transparent, clearly communicating the NRC's expectations for licensees.

The baseline inspection program is a fundamental element of the ROP. In fact, when a reactor's performance puts it in Column 1 of the ROP's Action Matrix, the ROP essentially shrinks to just the baseline inspection program portion.



As shown in the figure, reactors were in Column 1 (the Licensee Response Column) 80% of the time during the ROP's first decade. Every reactor, regardless of Action Matrix column placement, receives the baseline inspection program effort from the NRC. As performance levels drop, the NRC applies additional inspection and oversight resources.

The baseline inspection program, along with the performance indicators, enables the NRC to confidently assess safety levels and determine the proper Action Matrix column placement. A reactor does not get placed into Column 1 because the NRC "feels" it is doing okay—the results from the baseline inspection program coupled with the performance indicator data tell the NRC that the reactor's performance met expectations and warrant placement in Column 1.

Engineering inspections are an important element of the baseline inspection program. *The Engineering Inspections – What Gets Inspected When?* Section below describes the engineering inspections and the samples selected by each inspection for examination by the NRC. UCS won't oversell the engineering inspections by claiming they are the most important element—that would be like arguing which leg of a three-legged stool is most important. But the engineering inspections provide the NRC, licensees, and the public with safety insights not readily available elsewhere in the baseline inspection program. The engineering inspections specifically look for latent conditions. The *Latent Conditions* section below defines the term and describes some of the latent conditions identified by the NRC's inspection efforts.

UCS Perspectives on NRC's Engineering Inspections

Effective, independent regulatory oversight is the public's best and most reliable protection against safety declines caused by aging nuclear reactors, shrinking O&M budgets, ineffective management, and other factors. The NRC's engineering inspections constitute a vital element of its independent oversight efforts. UCS feels strongly that replacing some or all the NRC's engineering inspections with self-assessments conducted by plant owners would as a minimum reduce public confidence and could actually compromise safety levels, thus subjecting the public to unduly increased risk.

This is not to suggest that the NRC's engineering inspections could not be made more effective while sustaining their effectiveness. The NRC working group reviewing the engineering inspections outlined proposed revisions to the program that would continue to cover the same ground, but with potentially 8 to 15 percent less inspection effort. UCS does not oppose efficiency gains, unless they are achieved by effectiveness losses.

Engineering Inspections – What Gets Inspected When?

The NRC's baseline inspection program includes the following engineering inspections:

1. Inspection Procedures 71111 Attachment 17T, Evaluations of Changes, Tests, and Experiments, December 8, 2016. (ML16350A998)

   This engineering inspection reviews 18 to 37 evaluations, screenings, and/or applicability determinations for 10 CFR 50.59 every three years.

2. Inspection Procedure 71111 Attachment 21M, Design Bases Assurance Inspection (Team), December 8, 2016. (ML1634B000)

   This engineering inspection reviews the following samples every three years:

- Four to six components selected based on risk significance
- Four to six modifications to mitigating systems, structures, and components
- One sample among containment-related systems, structures, and components for large early release frequency (LERF) considerations
- One to three operating experience samples

3. Inspection Procedure 71111 Attachment 21N, Design Bases Assurance Inspection (Programs), December 8, 2016. (ML16340B001)

   This engineering inspection reviews one engineering program (e.g., Environmental Qualification of electrical equipment) every three years.

4. Inspection Procedure 71111 Attachment 07, Heat Sink Performance, December 8, 2016. (ML16161A056)

   This engineering inspection reviews one or two heat exchanger and/or heat sink samples annually and another two to four heat exchangers and/or heat sink samples every three years.

5. Inspection Procedure 71111 Attachment 05T, Fire Protection (Triennial)

   This engineering inspection reviews three to five risk-significant fire areas or zones plus one or more B.5.b mitigating strategies every three years.

6. Inspection Procedure 71111 Attachment 05XT, Fire Protection – NFPA 805 (Triennial), January 13, 2013. (ML12328A167)

   This engineering inspection reviews an "appropriate number" of fire areas/fire zones every three years.

7. Inspection Procedure 71111 Attachment 08, Inservice Inspection Activities, December 22, 2016. (ML16350A344)

   This engineering inspection reviews two or three types of non-destructive examination (NDE) activities, including at least one volumetric examination, during every reactor refueling outage.

UCS Perspectives on Sampling Inspections

Engineering inspections examine a relatively small number of samples from among a larger universe of candidates. "Smart" sampling is employed to examine samples where verification of adequacy and corrective of inadequacy have greater public health returns on the resource investments.

The samples reviewed are essentially examined both with a microscope and with a wide-angle lens. Microscopic examinations determine whether systems, structures, and components are properly designed, procured, maintained, and operated such that their necessary safety functions can be fulfilled. Wide-angle lens examinations ensure that the systems, structures, and components will not be impaired by "collateral damage" (e.g., compromised should a high energy line break occur or mis-operated because the control room simulator does not realistically demonstrate the plant's response to a transient or accident.) Consequently, sampling inspections can meet two important objectives: (1) to verify that safety-related widgets conform to all applicable regulatory requirements, and (2) to provide some confidence that the widget factories are producing widgets conforming to regulatory requirements.

UCS is concerned that both objectives will be harder to achieve with industry self-assessments than by NRC engineering inspections. UCS presumes that self-assessments would review approximately the same number of samples over an inspection cycle as get inspected by the NRC. But biases in selecting samples could lessen the objectivity and hence the value of self-assessments.

Consider the subject matter expert (SME) at a nuclear power plant selecting samples for an upcoming self-assessment. That SME could be the most safety-conscious, capable, dedicated nuclear professional on the planet whose visage should be carved into Mount Rushmore alongside the people on coins and currency, and Teddy Roosevelt. Rather than selecting samples which he or she is supremely confident are 100% satisfactory and therefore would be a wasted effort to confirm their perfection, the SME picks the required handful that might reveal sub-perfection.

Or, the SME could be more humanoid and not select samples that are already on his or her “To Do” list, thereby avoiding all the additional paperwork associated with findings about problems already slated to be resolved.

Or, the SME could know about real or potential problem areas inherited from his or her predecessor and avoids picking items that might cause management to ding him or her for sins committed by another.

These and other biases can result in the SMEs placing thumbs on the sample selection scales. The results would essentially be the SMEs self-assessing themselves—how well did I pick samples that yielded the outcome I desired?

NRC inspectors are people, too, who also have biases. They also select samples with preconceived notions about what systems, structures, and components may have vulnerabilities and those which would be a waste of time to examine. Thus, NRC inspectors also place thumbs on the sample selection scales.

While all sample selections may be subject to biased thumbs, not all biased thumbs are equal. In general, the NRC inspector’s biases are global, shaped by individual experience in the nuclear industry and recent operating experience from the nuclear industry. In general, a SME’s biases are more local, also shaped by individual experience but also more susceptible to shaping by fuller awareness of which skeletons are in what closets at the nuclear plant. Therefore, NRC inspectors have the lesser of the two biases that could undermine the effectiveness of the sample selections in engineering inspections.

SME self-assessments

NRC inspections

Latent Conditions

An ADAMS Content Search conducted on October 12, 2017, with “latent issue” in the Document Content search box and no other discriminator returned a total of 131 hits. 56 hits related to Davis-Besse while 75 hits did not have 50-346 as the docket number.

An ADAMS Content Search conducted on October 12, 2017, with “latent condition” in the Document Content search box and no other discriminator returned a total of 73 hits. 13 of the hits were LERs and another 13 of the hits were NRC inspection reports.

It’s virtually certain that considerably more than 204 (131 plus 73) records among the more than 730,000 records publicly available in ADAMS involve latent issues/latent conditions. These labels are not routinely used when discussing matters involving latent issues/latent conditions. Thus, ADAMS is neither an inventory of latent issues/latent conditions nor a statistically reliable indicator for trending these parameters.

UCS reviewed nearly five dozen NRC inspection reports containing “latent issue” and/or “latent condition” for insights as to the nature of such matters and the types of problems identified during the NRC’s examinations. Some of these NRC inspection reports are summarized below in reverse chronological order.

Indian Point

The NRC issued a Green finding on February 3, 2017, for an inadequate operability review dated October 17, 2016, by the owner of a potential internal flooding hazard from a service water system piping leak. The review assumed that a non-safety-related sump pump in the room would prevent flooding. But the NRC inspectors noted that this pump would not have electrical power under accident conditions. The service water system piping leak was initially identified on April 27, 2016. At that time, the leak rate was estimated to be one-eighth of a gallon per minute. Workers instituted daily checking of the leak rate. On September 18, 2016, the recorded leak rate jumped to 8 gallons per minute, but this factor of 64 increase was dismissed as “insignificant.” On October 15, 2016, workers discovered the floor drain in the room clogged and the room flooded to several inches deep. The leak rate was measured to have increased to 20 gallons per minute. Workers installed a patch on the pipe on October 17, 2016, which reduced the leak rate to about 1 gallon per minute. The operability reviewed was revised that day in response to concerns identified by the NRC inspectors, but the revised review failed to address non-safety-related components (the piping patch and the sump pump) and operator manual actions needed to prevent room flooding from disabling the service water system (ML17037C541).

Fermi Unit 2

The NRC issued a Green finding on January 28, 2015, for failure to adequately control loose materials near the 345,000-volt and 120,000-volt switchyards. On September 24, 2014, NRC inspectors found unrestrained wood, loose wooden pallets, construction cones, and other material in and around the switchyards. Workers initiated two corrective action reports that day after the NRC inspectors reported their findings. On November 24, 2014, the NRC inspectors walked down the switchyards again due to forecasts of sustained high winds in the area. The NRC inspectors found a cart loaded with small items left unattended near the 345,000-volt switchyard (ML15029A206).

Grand Gulf

The NRC issued a Severity Level IV non-cited violation on May 4, 2012, for an inadequate 10 CFR 50.59 evaluation completed on January 24, 2001. The 50.59 evaluation addressed a proposed change to the criticality controls within the spent fuel pool. Specifically, the licensee divided spent fuel pool storage into two regions. In one region, a neutron absorber was credited in maintained K_{eff} less than 0.95. In the other region, neutron absorbers were not credited and administratively controlled empty storage locations were used to maintain K_{eff} less than 0.95 (ML12125A277).

Kewaunee
The NRC issued a Green finding on November 3, 2010, after determining that a revision to the emergency operating procedures in 2006 failed to retain the necessary procedural step to manually close two valves (MS-100A and MS-100B) to isolate steam paths from a faulted steam generator (ML103080021).

Diablo Canyon
Operators rapidly shut down the Unit 2 reactor on June 30, 2009, after cooling for a main transformer failed. Workers determined that loose terminal connections for the 480-volt power supply to the transformer's cooling control cabinet caused the failure. The Unit 1 reactor had experienced loss of transformer cooling due to loose terminal connections. A work order had been written to replace the connections, but that work order was closed without the actions being taken. In April 2009, worker using thermographic monitors identified hot connections in the 480-volt power supply to the transformer cooling control cabinet, but no actions were taken to investigate or correct the hot spots (ML093000274).

Columbia Generating Station
On June 23, 2005, the operators manually started the reactor core isolation cooling (RCIC) system following a reactor scream. The RCIC system tripped. Subsequent investigation revealed that when the RCIC pump developed sufficient discharge pressure to open the downstream injection check valve, a pressure wave dropped the RCIC pump suction header pressure below the setpoint that triggered the automatic closure of the steam admission valve for the RCIC turbine. On June 18, 2001, a modification was implemented for the RCIC keepfill pump. Prior to this modification, the keepfill pump ran continuously to maintain the suction header pressure at approximately 80 psig. The modification ran the keepfill pump periodically when required to maintain the RCIC pump discharge pressure above approximately 66 psig. The change to keepfill pump's operations introduced the latent condition that resulted in the RCIC system's failure during the June 23, 2005, event (ML053110531).

Arkansas Nuclear One
On February 2, 2004, the NRC issued a Green finding for numerous 10 CFR Part 50, Appendix B failures to identify conditions adverse to quality and enter them into the corrective action program. The examples included recurring problems with Unit 2 battery 2D12. NRC inspectors found that battery problems, such as physical anomalies and individual cell parameters outside limits, were documented by informal methods rather than being entered in the corrective action program. Further, the NRC inspectors found that corrective action effectiveness for the battery had been exempted from the site's general effectiveness review program (ML040340723).

Diablo Canyon
Unit 2 was manually tripped on February 9, 2002, in response to decreasing steam generator water level. The failure of the coil in an ASCO solenoid valve caused a main feedwater regulating valve to close. The coil's failure was caused by thermal aging degradation of the coil wire insulation. The environmental qualification records showed that inappropriate criteria had been used to establish the acceptable qualified life of the coils. Approximately 70 safety-related solenoid operated valves were found to have been affected by the non-conservative EQ criteria. The qualified life of the solenoid operated valves was reduced from approximately 22 years to 7 years when the appropriate criteria were used (ML042440528).

UCS Perspectives from Reviewing NRC Inspection Reports

The two Diablo Canyon events and the Columbia Generating Station event involved self-revealing latent conditions. The other events involved NRC inspectors identifying latent conditions that had at least the potential for reducing safety levels.

The self-revealing latent conditions do not suggest that plant workers are incompetent. The latent conditions were subtle that became not-so-subtle after being revealed.

The numerous latent conditions identified by NRC inspectors do not suggest that plant workers are less capable or less effective than NRC inspectors. NRC inspectors and plant workers are all highly trained and dedicated nuclear professionals who pursue their duties very responsibly.

Instead, the self-revealing and NRC-identified latent conditions illustrate the challenges that plant workers face in identifying latent conditions. Most of the time, the capable and dedicated plant workers are doing their level best to comply with all applicable regulatory requirements. It is exceedingly rare that a worker deliberately violates a requirement. The self-revealing and NRC-identified latent conditions almost always result from plant workers sincerely believing things are okay only to be laboring under false perceptions.

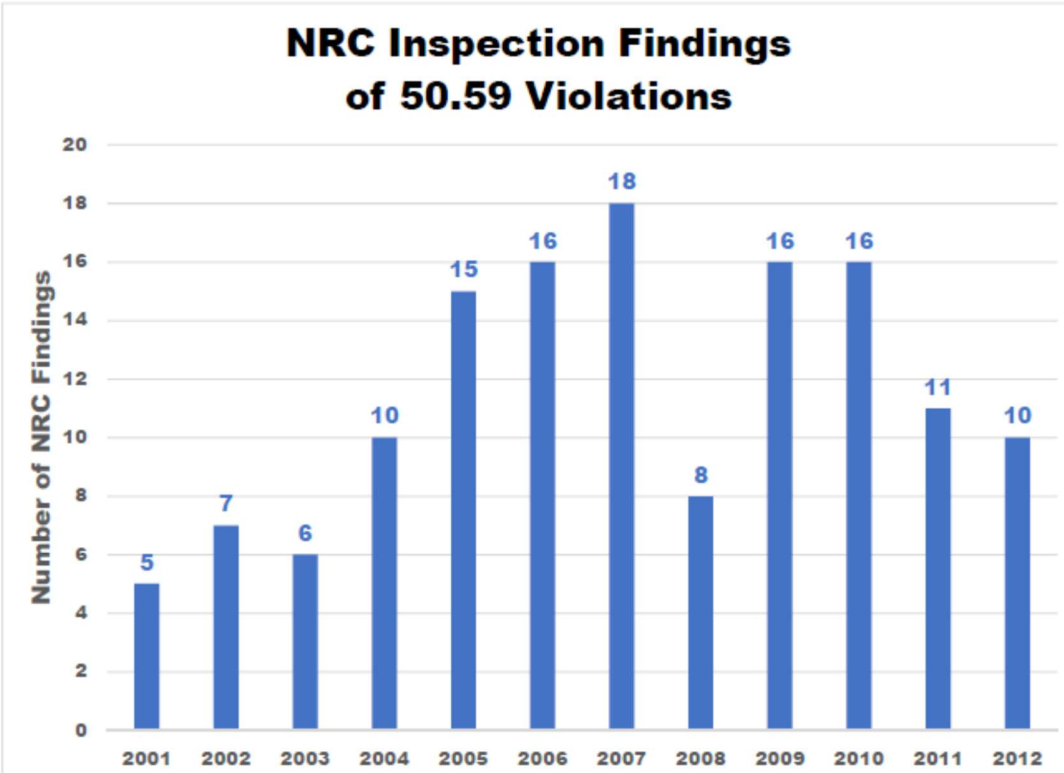
NRC inspectors examine components in the plant and review calculations in the office without being indoctrinated in the associated tribal lore. NRC inspectors are therefore not influenced by tradition (i.e., it's always been done this way) or tribulations (i.e., all the homework and sweat that went into doing it this way that must have made it done right.)

Software packages performing spelling and grammatical checks are popular not merely because people are lousy spellers, crappy typists, or bad writers. These independent checks are simply more reliable at flagging miscues than the authors reading, re-reading, and re-re-reading text passages. Similarly, NRC inspectors who played no part in designing, maintaining and operating some widget can assess it with greater detachment and independence. The findings summarized above illustrate the tangible safety gains achievable from the NRC's independent evaluations.

To be sure, there's as much—or even greater—value achieved when NRC's independent evaluations report no findings. Because the NRC's independent evaluations are more likely to flag latent conditions, greater confidence and more assurance can be found in an "all clear" expressed in an NRC report than in an "all clear" in a biased self-assessment report.

Latent Conditions – 50.59 Findings by NRC

During 2013, the NRC released a 68-page compilation of its inspection findings involving violations of 10 CFR 50.59 between 2001 and 2012 inclusive. 138 findings were listed: 50 Green, 86 Severity Level IV, and two n/a. 138 violations over a 12-year period averaged nearly one 50.59 violation each month, or nearly one violation too many each month over the decade-plus.



Source: ML13094A257

UCS searched ADAMS for findings since 2012 by the NRC of 50.59 violations. The abundant hits returned by the searches clearly show that safety problems involving inadequate 50.59s continue to occur. Some of these NRC findings are summarized below in reverse chronological order.

<u>Oconee</u>
The NRC issued a Green finding on November 9, 2016, for a failure to translate the limiting design flow rate of 170 gallons per minute for the alternate reactor building cooling system into operating procedures. The procedure inadequacy could have resulted in the system experiencing flow rates of 600 to 700 gallons per minute, which could have damaged piping and components via waterhammer (ML16315A104).

<u>St. Lucie</u>
The NRC issued a Green finding on February 5, 2016, for failure to properly evaluate the replacement steam generators. Specifically, NRC inspectors found that the analyses needed to show conformance with the ASME Code for the seal welds for the tube-to-tubesheet joint had not been performed (ML16036A156).

<u>Duane Arnold</u>
The NRC issued a Green finding on February 3, 2016, for workers adding a temporary shaft housing on condensate pump B without applying the formal temporary configuration change process. The jury-rigged

addition caused moisture to pass through the lower motor shaft seal into the lower motor bearing oil reservoir. Repeated feeding and bleeding of the lower motor bearing oil reservoir were needed to prevent oil emulsification (M16035A054).

Point Beach

The NRC issued a Green finding on October 29, 2015, for an internal flooding problem. Specifically, workers determined the potential for internal flooding to put more water into the diesel generator building than could be carried away by the building's floor drains. The owner's assessment of this condition failed to account for the risk to the fuel oil transfer pumps for the Train A emergency diesel generators in the room housing the Train B emergency diesel generator (ML15302A428).

Byron

The NRC issued a Severity Level IV non-cited violation of 10 CFR 50.59 on July 21, 2015, for failure to perform a written safety evaluation to justify a change that cross-connected the refueling water storage tanks for the two reactor units. The NRC reported that "the licensee did not evaluate the adverse effect of reducing reactor unit independence" (ML15203A042).

Cook

Operators manually tripped the Unit 2 reactor on April 23, 2015, during restart from a refueling outage after two steam dump valves failed open. The NRC issued a Green finding on November 12, 2015, because the valves had been replaced during the refueling outage with a design that was not compatible with the steam dump system. The improperly designed valves trapped condensate. The accumulated condensate, along with a different plug design, caused backpressure of sufficient force to cause the valves to fail open (ML15316A616).

Palisades

On September 10, 2014, NRC inspectors observed workers installing an alligator clip jumper in the control circuit for the output breaker of emergency diesel generator 1-1 during preventative maintenance. The owner had performed an evaluation that concluded the temporary use of the jumper kept the emergency diesel generator operable. Otherwise, the emergency diesel generator would be inoperable and the unit would have to be shut down within six hours. The owner's evaluation referenced NEI 96-07, But NRC inspectors found that the jumper's use violated two specific elements of the NEI guidance document. When the owner re-evaluated the jumper's use in response to the NRC's concerns, its use could not be justified (ML15121A810).

Duane Arnold

The NRC's Component Design Bases Inspection report issued September 26, 2014, identified five findings, including the failure to include minimum required system voltages in the acceptance criteria for the 125 vdc station battery surveillance tests. The NRC inspectors noted that the surveillance test allowed battery voltage as low as 107 volts. But the design calculations for the batteries assumed minimum voltages of 107.2 volts for battery 1D1 and 108.02 volts for battery 1D2 (ML14272A453).

Dresden

The NRC issued a finding on June 16, 2014, on the failure to conduct screenings per 10 CFR 50.59 before de-energizations of motor-operated valves (MOVs). Several MOVs were de-energized to resolve concerns about their spurious operation during fires. A station procedure permitted such changes without 50.59 screenings provided the component only has a fire protection function. But some of the MOVs involved were part of the reactor shutdown cooling system and the reactor building closed loop cooling water system (ML14168A224).

Harris
On May 31, 2014, NRC inspectors identified problems with the installation of three temporary air compressors during the replacement of permanent air compressor C. The NRC inspectors reviewed an attachment to the air compressor operating procedure intended to guide operators in the use of the temporary air compressors and found it lacking with respect to the impact on the permanent plant air dryers and replenishment of fuel for the diesel-driven temporary air compressors (ML14206A975).

Monticello
The NRC issued a Green finding on November 18, 12013, for the failure to update the Offsite Dose Calculation Manual (ODCM) to reflect recent data. Workers conducted a periodic review of meteorological data from 2011-2012 and concluded it was consistent with data form 2006-2010. But NRC inspectors noted that the data from both periods showed the wind spend recorded at the 10-meter elevation averaged 24 percent lower than the values used in the ODCM. The lower wind speeds could yield higher radiation doses within the emergency planning zone (ML13323B637).

Braidwood
The NRC issued a non-cited violation on October 9, 2013, for an inadequate safety evaluation under 10 CFR 50.59 for the relocation of the essential service water discharge return pipes from being below the surface of the Braidwood Cooling Lake to being above its surface. The return pipes were relocated to resolve a site flooding concern. But NRC inspectors determined that the safety evaluation failed to consider the risk to the relocated pipes from tornado-driven missiles (ML13282A668).

Nine Mile Point
The NRC issued a Green finding on May 9, 2013, for an inadequate safety evaluation under 10 CFRF 50.59 for a revision to the reactor shutdown cooling system operating procedure. The procedure was revised on March 24, 2009, to de-energize shutdown cooling system motor-operated valves in the open position. On October 18, 2012, plant workers identified that these valves had a safety function to close to terminate loss of reactor cooling water inventory during certain accidents and that role could not be assured with the valve de-energized in the open position. The NRC inspectors found that the 50.59 evaluation for the procedure change was inadequate because it only considered the postulated transient of a loss of shutdown cooling and failed to consider the postulated design basis loss of coolant accident (ML13130A025).

Columbia Generating Station
The NRC issued a Severity Level IV non-cited violation on April 23, 2013, for changes to the current licensing basis without a request license amendment request. In February 1973, the owner submitted the Preliminary Safety Analysis Report (PSAR) for the Washington Nuclear Project Unit 2 (now called the Columbia Generating Station) to the Atomic Energy Commission (now called the Nuclear Regulatory Commission. Among other things, the PSAR provided a design ambient temperature of 104°F for the control room. In response to regulatory concerns about this design, the owner committed to installing redundant safety-related water chillers for the control room heating, ventilating, and air conditioning system. The NRC's Safety Evaluation Report (NUREG-0892) concluded this modified design conformed with General Design Criterion 19, "Control Room," of Appendix A to 10 CFR Part 50. The NRC formally made the chillers part of the operating license through License Condition 2.C.(21) which required both chillers to be operable by May 31, 1984. A November 1984 update to the Final Safety Analysis Report (FSAR) described the chillers and stated the main control room design temperature was 72 to 78 °F. In September 1989, workers revised the FSAR, without the NRC's approval, to define the control room design temperature at 85 °F. In May 1998, workers again revised the FSAR, without NRC's approval, to define the control rood design temperature to be 85 °F effective temperature. Effective temperature is based on a combination of wet bulb and dry bulb temperature. 85 °F effective temperature would allow the control room dry bulb temperature to rise to 104 °F—the value previously rejected by the

regulator. The owner considered this FSAR change to be editorial in nature and that a 50.59 safety evaluation justifying it was not required (and not conducted). Because the control room temperature can be maintained within the 104ºF without using the chillers, the owner used the editorial change to claim that the chillers do not have a safety-related function. After the NRC inspections revealed these shenanigans, the owner revised the FSAR and technical specifications to return to a control room design temperature of 85 ºF (ML13113A427).

UCS Perspectives from Reviewing Inspection Reports of 50.59 Findings

10 CFR 50.59 may be the best litmus test for whether licensees can be entrusted with self-assessment in lieu of NRC engineering inspections. If so, self-assessments clearly fail the test.

10 CFR 50.59 permits licensees to determine whether they can revise procedures or modify their facilities without prior NRC review and approval. When a proposed procedure change or plant modification is within the bounds of previous NRC regulatory decisions, the licensee can make the change without NRC's approval. But when a proposed change is outside safety boundaries previously agreed upon by the NRC (or would only remain within previous boundaries using analytical methods not vetted by the NRC), the NRC must review and approval the change before it can be made.

The number of 50.59 findings from the NRC's 2013 compilation and UCS's subsequent ADAMS searches does not suggest there's been a complete failure by licensees to conform with 10 CFR 50.59. To put these findings in context, thousands of 50.59 screenings and hundreds of fuller 50.59 evaluations are performed annually across the fleet of US reactors. The findings therefore do not show 50.59 violations to be rampant, but they do show them to be a recurring reality.

What does this reality mean regarding self-assessments by licensees instead of engineering inspections by the NRC? None of the 50.59 accounts summarized above or contained with the NRC's 2013 compilation reported or implied deliberate misconduct by licensees. Rather, they suggest that the licensees were doing their level best attempting to comply with 50.59 but fell short of that goal.

The longstanding reality of licensees trying hard but coming up short again and again and again strongly suggests that self-assessments by licensees will also come up short.

But to double-check this conclusion, UCS searched ADAMS for Licensee Event Reports (LERs) submitted by licensees to the NRC involving 50.59 violations. This search sought to determine whether licensees were even better than NRC inspectors at finding such latent conditions, thus making self-assessments a more effective tool in ferreting out latent conditions. Perhaps NRC inspectors have only identified the rare 50.59 shortcoming and plant workers are doing a superior job. But the evidence does not show, or even suggest, superior industry performance.

Latent Conditions – 50.59 Findings Reported by Licensees

UCS used the NRC's licensee event report (LER) search tool to find LERs submitted between January 1, 2001, and December 31, 2012, mentioning 50.59. Whereas the NRC's compilation issued in 2013 covering this same period listed 138 violations involving 50.59, there were only 10 LERs during that period.

UCS then used the LER search tool to find LERs since December 31, 2012, that mentioned 50.59. This search returned only 7 LERs.

The disparity between 50.59 problems identified by NRC inspectors and those found by plant workers widens when one reviews the LERs. As indicated by these LER summaries, many LERs merely report 50.59 issues initially identified by NRC inspectors.

Monticello
The owner submitted an LER dated December 20, 2013, reporting that the **NRC found problems** with the design of the diesel fuel oil supply system. The LER stated that the root cause was that workers had "institutionalized the acceptability of manual operator actions to meet single failure requirements." The diesel fuel oil supply system had two pumps that transfer fuel from the fuel oil storage tank to the day tanks for the two emergency diesel generators. But valves in a cross-connection line between the two fuel oil transfer systems meant that a single pipe failure could disable both systems. In addition, the Division 1 fuel oil transfer could not run when offsite power was unavailable unless the Division 2 EDG was running. So, the single failure of the Division 2 EDG during a loss of offsite power also disabled the Division 1 EDG (ML13353A695).

Fort Calhoun
The owner submitted an LER dated July 31, 2013, reporting that the **NRC took issue** with the relocation of the control room air conditioner condensers from inside the control building to the roof of the auxiliary building without prior NRC review and approval. The relocated condensers are in close proximity and vulnerable to being disabled by the same tornado missile. The owner committed to installing tornado protection for the condensers (ML13213A069).

Grand Gulf
The owner submitted an LER dated September 14, 2012, reporting that a 50.59 safety evaluation dated August 18, 1997, had improperly redefined single passive failures of the Standby Service Water system to only pump seal leakage and valve packing failures (ML12261A125). **An NRC CDBI had questioned** whether this change could be made without the NRC's approval. On September 14, 2012, the owner formally requested NRC's approval of a change to the passive failure methodology applied to the Standby Service Water system. The owner provided several responses (ML12299A095), ML12353A602, ML13077A399, and ML13217A076) to NRC's requests for additional information regarding this proposed change. The NRC approved the change on September 25, 2013 (ML13261A349).

Vogtle
The owner submitted an LER dated April 11, 2012, reporting that an open valve cross-tied the safety-related and seismically qualified Refueling Water Storage Tank (RWST) and the non-safety-related and non-seismically qualified Spent Fuel Pool Purification system in Modes 1-4 rendered the RWST inoperable. Procedures had been revised in 2009 to permit the valve to be opened under administrative controls without considering the RWST to be inoperable. A 50.59 safety evaluation supported the procedure change. A review of **NRC Information Notice 2012-01** and specifically its description of a non-cited violation issued to another licensee for a similar RWST cross-tie revealed the problem (ML12103A276).

McGuire
The owner submitted an LER dated November 23, 2010, reporting a cross-connection between the starting air systems for the emergency diesel generators (EDGs) violated the Technical Specifications. Each EDG was equipped with a starting air system. Each starting air system had two sub-trains consisting of an air compressor, aftercooler, dryer, and air receiver tank. In the mid-1990s, a series of modifications upgraded the starting air system. The modifications included installation of a cross-tie between the sub-trains upstream of the air receiver tanks. Beginning in June 1999, the valves in the cross-tie lines were routinely left open. With the sub-trains cross-tied, the configuration eliminated redundancy by essentially

equipping the starting air system for each EDG with one large tank. The LER identified the root cause as being an inadequate 50.59 safety evaluation (ML103400087).

Hatch
The owner submitted an LER dated February 16, 2007, reporting the longstanding practice of propping upon a control room access door resulting in not maintaining the control room boundary required by Technical Specifications. In 1982, a non-safety-related, non-seismic structure called the Main Control Room Annex was installed adjacent to the main control room. The Shift Supervisor's office, the kitchen, and a storage area were relocated from the main control room into this annex to free up space for the Analog Transmitter Trip System being added. Due to heavy traffic between the main control room and its annex, a hinged metal door stop was installed on the floor to prop the door in the open position. The Main Control Room Environmental Control system is designed to automatically start in event of an accident to pressurize the main control room such that clean air leaks out rather than potentially radioactively contaminated air leaking in. **NRC inspectors questioned the propped open control room access door** in December 2006. The Main Control Room Environmental Control system could not function properly with the door open and it required manual action to close the door. On December 19, 2006, the owner concluded that the propped open door was prohibited by the Technical Specifications and discontinued the practice (ML070470663).

UCS Perspectives from Reviewing Licensee Event Reports of 50.59 Findings

Since January 1, 2001, NRC inspectors have identified over 150 findings of inadequate 50.59s.

Since January 1, 2001, licensees have submitted 17 LERs about inadequate 50.59s. And many of those 17 LERs involved inadequate 50.59s identified by NRC inspectors and in response to questions by NRC inspectors.

This decade-plus operating experience strongly suggests that while the number of 50.59 issues might not decline if self-assessments replace NRC inspections, the number of 50.59 issues identified, reported, and fixed will likely significantly decline. Lockstep with the increasing number of uncorrected 50.59 issues, safety levels will also decline.

The industry has not demonstrated the ability to find latent conditions as well as NRC inspectors. To the contrary, the 50.59 issues found since 2001 strongly suggest that NRC inspectors are far more capable in finding these latent conditions. Which strongly suggests, of course, that NRC engineering inspections are more effective than self-assessments in protecting public health and safety.

Transparency

With the justifiable exception of security-related issues, the NRC's ROP not only reports the results from the agency's assessments of safety performance at operating reactors, it also clearly describes the tests and the grading processes behind the results. The transparent insights into the process help build trust and confidence in the results achieved by that process.

The nuclear industry has announced its intentions to submit both process documents and self-assessment reports to the NRC. Unless the plant owners contended that these documents and reports contained proprietary information (as has frequently been claimed for other submittals to the NRC), this material would be publicly available in the NRC's online ADAMS library.

The nuclear industry indicated that the process documents would describe the composition of self-assessment teams and the selection of sampled to be reviewed by the teams. The industry indicated that the self-assessment reports would be comparable in level of detail to the NRC's engineering inspection reports. These materials have only been discussed conceptually, so it's impossible to determine whether they would match the amount of information publicly available for the NRC's engineering inspections or provide more or less information.

Even if the information publicly available about the self-assessment process and results matched that available from the NRC's inspection procedures and inspection reports, the public would see a reduction in transparency. Members of the public routinely request records under the Freedom of Information Act (FOIA) related to NRC inspection reports. Here's a very abridged listing of NRC inspection report related FOIAs:

FOIA No.	Requestor	Subject
FOIA/PA-2017-0675	Christine Legere	Pilgrim Inspection Report 05000293/2017405
FOIA/PA-2011-0272 (ML112790033)	Greenpeace	Indian Point inspection records
FOIA/PA-2007-0175	Utility Workers Union of America Local No. 369	Oyster Creek Inspection Report 05000219/2003003
FOIA/PA-2006-0130 (ML061580191)	Michael Best & Friedrich LLP, Attorneys at Law	Inspection reports regarding radiation releases from Dresden
FOIA/PA-2006-0128	Not known	Turkey Point Inspection Report 2005-010
FOIA/PA-2006-007 (ML063420093)	Greenpeace	NRC Inspection Report 5000298/2004014 supporting records (Cooper)
FOIA/PA-2003-0372 (ML040360081)	John Parker	Indian Point inspection reports

UCS Perspectives on Transparency-lite Self-Assessments

The FOIA does not permit public access to records possessed by plant owners. It only permits public access, under certain conditions, to records possessed by the NRC. Thus, self-assessments conducted by plant owners instead of inspections conducted by the NRC would significantly reduce the public access to inspection-related records. This would be a significant lessening of transparency. As transparency lessens, so would public trust and confidence.

Inspection Cycle

During the October 11, 2017, public meeting conducted by the NRC about the industry's proposal for replacing NRC's engineering inspections with self-assessments, the NRC spoke briefing about possibly revising the baseline inspection program from a three-year cycle to a four-year cycle. The industry spoke briefly about a five-year cycle being better still, conjuring up the age-old dilemma of when a strobe light is burned out rather than just being really, really, really slow.

The current baseline inspection program comprises numerous inspection procedures that are performed at various intervals. The least frequently performed inspections are those performed once every three years, hence the three-year inspection cycle.

The ROP issues performance assessments for each operating reactor every quarter. Findings from NRC inspections along with performance indictors submitted by plants owners (and verified annually by NRC inspectors) are used by the NRC to determine which column of the Action Matrix each reactor gets placed into. In turn, the Action Matrix column placement determines the extent of NRC oversight effort. Reactors in Column 1 receive only the ROP's baseline inspection effort. Reactors in Columns 2 through 4 receive additional NRC oversight effort due to their identified performance declines.

Ideally, the ROP would feature a quarterly inspection cycle. A quarterly inspection cycle would mean that the amount of data input into the quarterly assessments would be the same for every operating reactor. In other words, the results from the assessments (i.e., the Action Matrix column emplacements and associated NRC oversight response levels) would be on an apple-to-apple basis.

The longer the inspection cycle, the less validly a quarterly assessment interval describes reactor performance levels. Consider how the ROP's quarterly assessments, and NRC's oversight responses guided by Action Matrix column placements, differ for three reactors with the exact same inspection history during inspection cycles of different lengths. Each reactor has the exact same number of White inspection findings in the exact same cornerstones for the exact same violations. There are no other inspection findings during the inspection cycle and all performance indicators for all three reactors remain in the Green band throughout the inspection cycle. And none of the reactors have cross-cutting issues identified.

Year / Quarter	Reactor X / 3 yr Cycle	Reactor Y / 3 yr Cycle	Reactor Z / 4 yr Cycle
Year 1 / Quarter 1	White Finding	White Finding	White Finding
Year 1 / Quarter 2	White Finding		
Year 1 / Quarter 3	White Finding		
Year 1 / Quarter 4			
Year 2 / Quarter 1			
Year 2 / Quarter 2		White Finding	
Year 2 / Quarter 3			
Year 2 / Quarter 4			White Finding
Year 3 / Quarter 1			
Year 3 / Quarter 2			
Year 3 / Quarter 3		White Finding	
Year 3 / Quarter 4			
Year 4 / Quarter 1			
Year 4 / Quarter 2			
Year 4 / Quarter 3			
Year 4 / Quarter 4			White Finding

The White findings in the first quarter of the first year for all three reactors should mean that all reactors get placed in the same Action Matrix column (likely Column 2). Thus, all reactors receive the exact same NRC oversight response.

Reactor X locks up a Column 2 placement in the second quarter of the first year for another White finding. The NRC responds with a 95001 supplemental inspection.

Reactor X moves into Column 3 of the Action Matrix in the third quarter of year one with its third White finding. The NRC responds with a 95002 supplemental inspection.

If all White findings get resolved within four quarters, then Reactor Y never gets placed into Action Matrix Column 3 during a three-year inspection cycle and Reactor Z never gets placed into Action Matrix Column 3 during a four-year inspection cycle.

UCS Perspectives on Inspection Cycle

Suppose that Reactors X, Y, and Z each entered the first quarter of year one with the same three undetected safety violations. Reactor X is clearly safer than Reactor Y which is in turn clearly safer than Reactor Z because the pre-existing safety violations (i.e., latent conditions) were found and fixed sooner.

Unless the 95001 and 95002 supplement inspections are entirely valueless, Reactor X is further safer than Reactors Y and Z because it receives heightened NRC attention. That increased regulatory oversight translates into lesser likelihood that other latent conditions exist at Reactor X. Because Reactors Y and Z received lesser NRC attention translates into a higher likelihood that other latent conditions exist.

A quarterly inspection cycle is impractical. The wider the gap between the quarterly assessment period and the inspection cycle, the less the assessments are providing an apples-to-apples (or bad apples-to-bad apples) results.

The quarterly assessments and associated ROP Action Matrix column placements dictate the extent of NRC's oversight efforts. The longer the inspection cycle, the less the NRC's oversight effort is determined by actual safety conditions at reactors and the more it is determined by the calendar. As the hypothetical examples above illustrate, the calendar can play too large a role.

The NRC could eliminate the gap caused by a quarterly assessment interval and a multiple-year inspection by considering findings in calendar-correct context. In other words, the NRC's quarterly assessments must result in the same responses for Reactors X, Y and Z above since they had the exact same safety performance. It would be unfair to the owner of Reactor X and to the communities around Reactors Y and Z to have such disparate regulatory responses to the same underlying safety situations.

UCS's Self-Assessment of This Report

To promote efficiency and effectiveness, UCS self-assessed the contents of this report. Neither the NRC nor the nuclear industry need independently establish the facts reported herein or the conclusions drawn by UCS from the facts. Our self-assessment determined that the facts are 100% correct and in proper context and our conclusions are 134.8% valid and appropriate. The NRC and nuclear industry can most efficiently and most effectively respond by simply implementing all our recommendations as written.

Of course, since our primary conclusion was that self-assessments are little more than useless self-serving pieces o' garbage (POG), the NRC might want to independently ponder this material. The nuclear industry can do whatever it wants, since that's what it'll do any way.