

Report on Recommended Revision to Criteria for Transition to Column 3

Problem Statement

Recommendation 5 from the Reactor Oversight Process (ROP) Independent Assessment Report, dated February 2014, stated that the NRC should review the criteria for transition to Column 3 of the NRC Action Matrix against the original ROP program goals to ensure that the significance of White inspection findings is not being overemphasized and to ensure that agency resources used to process White inspection findings are commensurate with findings that, by definition, are of low to moderate safety significance. A working group was formed to determine if two White inputs in a cornerstone is appropriate to transition a licensee from the Regulatory Response column, otherwise known as Column 2, to the Degraded Cornerstone Column, or Column 3, in the Action Matrix as described in Inspection Manual Chapter (IMC) 0305 "Operating Reactor Assessment Program." According to IMC 0305, a licensee in Column 3 will have met all cornerstone objectives, but with moderate degradation in safety performance. Declining safety performance would result in increased NRC oversight and supplemental inspections using Inspection Procedure (IP) 95001 for licensees in Column 2, and IP 95002 for licensees in Column 3.

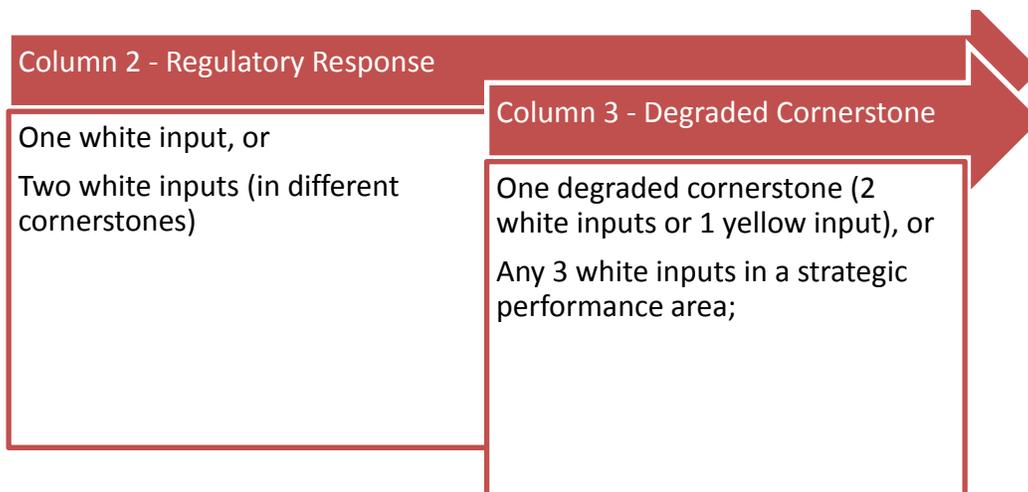
Outcome

The working group conducted an extensive review of the historical and technical bases of the current threshold and determined that two White inputs may not appropriately balance NRC regulatory response with the risk-informed input into the process. The working group recommends the Column 3 threshold be one Yellow input or any three White inputs in a strategic performance area.

Background

Currently, according to IMC 0305, a licensee's performance resulting in 2 White inputs or 1 Yellow input would transition them from Column 2 Regulatory Response to Column 3 Degraded Cornerstone (Figure 1).

Figure 1 IMC 0305 Operating Reactor Assessment Program Guidance

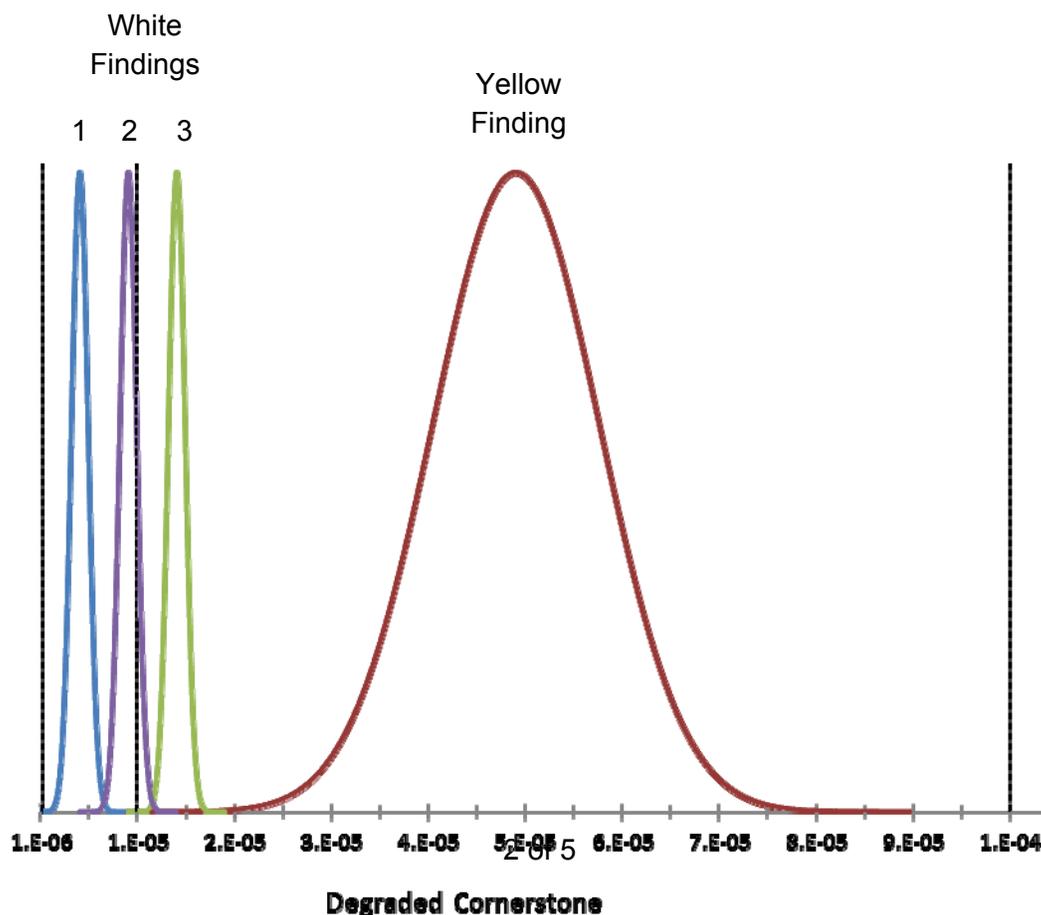


NRC staff interviewed senior personnel that were involved with the initial development of the ROP to determine the basis or justification for transitioning a licensee from Column 2 to Column 3 in the Action Matrix based on two White inputs. The overall consensus from the research indicated that the selection of two White inputs was consciously conservative given the infancy of the ROP and lack of operating history with the ability of the Action Matrix to appropriately assess licensee performance.

Subsequently, NRC staff conducted an evaluation of the criteria and determined that the risk significance of two White inputs was significantly less than that of one Yellow input. The additional oversight and inspection required for the licensee in Column 3 because of two White inputs was not necessarily commensurate with the overall safety significance. Figure 2 below illustrates the difference between two White inputs and one Yellow input using delta core damage frequency (CDF) per year for comparison. The graphs represent a probability distribution or a range of probable delta CDF/yr centered on the mean for the distribution. Assuming that one White input is in the middle of the White band (i.e., $5E-06$ CDF/yr), the sum of two White inputs would characterize licensee performance at the White/Yellow threshold, and the sum of three White inputs would characterize licensee performance slightly above the threshold respectively.

Analogously, if we assume that on average a Yellow input based on the SDP is $5E-05$ CDF/yr, that would place a licensee in the middle of the Yellow band. With the inclusion of a third White input, the total risk significance is $1.5 E-5$ CDF/yr ($5E-06$ CDF/yr * 3 White Inputs), at the very low end of the Yellow band.

Figure 2. Basis for Progression in the Action Matrix



Result

As illustrated above in Figure 2, the risk significance using delta CDF/yr of 2 White inputs is not equivalent to a Yellow input. With the addition of a third White input, the performance of the licensee crosses the White/Yellow threshold but is still approximately three times less than a Yellow input of 5E-05 CDF/yr (i.e., the middle of the Yellow band). Therefore, increasing the inputs required to transition in the Action Matrix from Column 2 to Column 3 to 3 White inputs would still be conservative and would continue to ensure appropriate regulatory oversight under the ROP.

Performance Indicators

Since inputs into the Action Matrix include both inspection findings processed through the significance determination process (SDP) and performance indicators (PIs), the working group determined it was important to ensure that the risk significance of White PIs was consistent with the risk significance of White inspection findings. The Initiating Events PIs seem to be consistent with White findings in terms of risk significance. In the table below, a Pressurized Water Reactor (PWR) licensee who crosses the Green/White threshold with more than three Unplanned Scrams per 7000 Critical Hours would experience a change in CDF/yr equivalent to 1.26E-6, which is on the lower end of the distribution curve representing delta CDF/yr for White findings shown in Figure 2. The delta CDF/yr for a licensee exceeding the threshold for the PI for Unplanned Scrams with Complications is also on the distribution curve for a White finding shown in Figure 2. Therefore, White PIs for the Initiating Events cornerstone have a risk significance roughly equivalent to White inspection findings.

Performance Indicator		Delta CDF	
		PWR	BWR
IE01 Unplanned Scrams per 7000 Critical Hours (automatic and manual scrams during the previous four quarters)	>3	1.26E-06	1.60E-07
IE03 Unplanned Power Changes per 7000 Critical Hours (over previous four quarters)	>6		
IE04 Unplanned Scrams with Complications (over the previous four quarters)	>1	6.81E-06	8.70E-07

For the Mitigating Systems cornerstone, the primary PIs are the Mitigating Systems Performance Index (MSPI) indicators. The MSPI indicators monitor system unavailability and unreliability over time, which translates to a delta CDF. The Green/White thresholds were established to be equivalent to the risk significance of inspection findings.

Deterministic Cornerstones

The argument using Probabilistic Risk Assessment (PRA) naturally applies to the three cornerstones that most directly rely on PRA (Initiating Events, Mitigating Systems, and Barrier Integrity) for determining significance of findings and PIs. For the more deterministic cornerstones, which include Emergency Preparedness, Public and Occupational Radiation Protection, and Security, a more qualitative argument is required.

IMC 0609, "Significance Determination Process," states for White findings, "Qualitatively, a White significance indicates an acceptable level of performance, but outside the nominal risk range. Cornerstone objectives are met with **minimal** reduction in safety margin." It further states for Yellow findings, "qualitatively, a Yellow significance indicates a decline in licensee performance that is still acceptable with cornerstone objectives met, but with **significant** reduction in safety margin." The current framework suggests that two inputs with **minimal** reduction in safety margin equals one input with **significant** reduction in safety margin. This is a difficult argument to make.

Staff performed a review of all licensees who transitioned to Column 3 based on two White inputs in a single cornerstone. Since the inception of the ROP, 31 units moved to Column 3 based on two White inputs. Of those, 10 units would have eventually transitioned to Column 3 under the additional criteria of three White inputs in a strategic performance area, or a Yellow input. Only four of the 31 licensees transitioned under the deterministic cornerstones.

Staff completed a review of IP 95002 supplemental inspection reports for those licensees who transitioned to Column 3 based only on two white inputs to the Action Matrix, primarily from 2005 to the present. The staff used the following criteria to make a determination as to whether or not a licensee was appropriately characterized as having a degraded cornerstone:

- Significant findings from the IP 95002 inspection, or several Green findings
- Need for re-inspection
- Significant programmatic weaknesses identified from root cause evaluations
- Could performance issues have been identified by an IP 95001 or through another inspection?

The majority of licensees that transitioned to Column 3 based solely on two White inputs received no more than one additional Green finding as a result of the supplemental inspections, had no need for a re-inspection, and documentation did not identify any significant programmatic weaknesses. There were three licensees who were unable to successfully complete the first 95002 inspection, primarily due to poor extent of condition evaluations and/or lack of sufficient progress implementing corrective actions. With no other major programmatic weaknesses identified, it could be argued that these licensees could more appropriately be characterized as not being prepared for the 95002 supplemental inspection, vice having a degraded cornerstone. One of these licensees in Column 3 due to a "degraded" EP cornerstone who needed a re-inspection passed a graded EP exercise with no findings prior to the 95002 inspection, which would support the assertion that the cornerstone may not have been degraded.

There were a couple of licensees who staff concluded were appropriately characterized as being placed into Column 3 based on the above criteria. However, they were the exception.

The staff also reviewed safety performance for all of these licensees after exiting Column 3. Of the 22 licensees reviewed, only one unit exhibited declining performance within four quarters of returning to Column 1. The rest either remained in Column 1, or transitioned to Column 2 two or more years after exiting Column 3.

Based on the results of the review of 95002 inspection reports, the working group concluded that there was insufficient evidence to support the validity of the criterion of two White inputs in a

cornerstone to indicate a cornerstone was degraded and to transition a licensee to Column 3 of the Action Matrix. Historically, there were only four licensees who transitioned to Column 3 based on two White inputs in the deterministic cornerstones. These are relatively rare occurrences, and are bounded by the conclusions reached from the review described above.

Recommendations

- Eliminate the criterion for two White inputs in a cornerstone to transition a licensee to Column 3. The revised criteria for transition to Column 3 would continue to be 1 Yellow input, or three White inputs in a strategic performance area.
- Revise the criteria for transition to Column 2 to one or two White inputs in a strategic performance area, for completeness.
- Revise IP 95001 to provide more flexibility in the resource estimate, and to provide additional resources and guidance to review any potential commonalities between multiple White inputs in the same cornerstone and/or strategic performance area.