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October 8, 2014

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Cindy Bladey
Office of Administration
Mail Stop: 3WFN 06A-A44M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: **Comments: Draft Regulatory Guide DG-1141, "Setpoints for Safety-Related Instrumentation," 79 Fed. Reg. 40163, July 11, 2014**

GE Hitachi Nuclear Energy (GEH) has reviewed the subject draft regulatory guide and provides public comments in Enclosure 1. GEH appreciates the opportunity to identify suggestions, issues, and concerns for consideration in finalizing the revised regulatory guidance as it relates to important methodologies that are implemented by licensees and applicants, and for which revisions could have significant implications. When it was identified that the original Notice listed an incorrect accession number for DG-1141, the public comment period, which originally was to expire on September 9, 2014, was extended to October 10, 2014 (*see* 79 Fed. Reg. 46469, Aug. 8, 2014). The GEH comments in Enclosure 1 are based on the corrected reference for DG-1141.

Please contact me or Timothy Enfinger (910-819-4881; timothy.enfinger@ge.com) if you have questions regarding the enclosed comments.

Sincerely,

Jerald Head

Jerald G. Head
Senior Vice President, Regulatory Affairs

Commitments: No commitments are made in this letter.

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Template = ADM – 013
E-RIDS= ADM-03
Add= P. J. Rebstock (PJR1)
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Enclosure:

1. GEH Comments on Draft Regulatory Guide DG-1141

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Enclosure 1

MFN 14-065

GEH Comments on Draft Regulatory Guide DG-1141

Objective

As requested by the NRC, this document provides the official GEH comments to Draft Regulatory Guide DG-1141 (Reference 1). The comments are directed to the main technical issues in DG-1141.

GEH recognizes that NRC regulatory guides provide one acceptable method for complying with NRC regulatory requirements and that other methods may be proposed or may be approved by the NRC. However, when the NRC issues regulatory guidance that is inconsistent with previously approved methods, it could result in inappropriate and unnecessary backfits in future licensing actions. Industry experience with establishing setpoints has not indicated that there are safety problems with the methods currently approved by the NRC and used throughout the industry. Therefore, issuing revised regulatory guidance that departs from the previously accepted approach may not be in the interest of safety. In this instance, the revised guidance could lead to additional spurious trips and, as explained further below, could actually increase the probability of spurious plant trips. GEH acknowledges that the comments below use the term "requirement" or "requires" when referring to the proposed regulatory guidance, even though GEH recognizes that the NRC may approve alternatives.

From this perspective, GEH provides the comments below. This document is organized to first identify the DG-1141 issue, and then to provide the GEH comment and the suggested modification or clarification. A summary is provided at the end.

1. Trip Probability

DG-1141

Figure 2 on page 18 of DG-1141 shows that, assuming no bias error and assuming that the error around the Limiting Setpoint (LSP) is the 95% confidence population error, the LSP is located such that the margin to the Analytical Limit (AL) provides a probability of 97.5% that the trip for a single channel will occur before the AL is reached.

GEH Comment

The Draft DG-1141 appears to impose a requirement of 97.5% probability of single channel trip before the AL is reached. This is inconsistent with the current and previous revisions of RG 1.105 (Revision 3 and earlier) which clearly define the requirement of trip before AL is reached to be 95% probability. The previous 95% probability requirement is the basis of the licensed GEH safety analyses, and the basis of the NRC-approved GEH setpoint methodology (Reference 2). Thus, using the 95% probability criterion (rather than the 97.5% criterion) would be consistent with the statements in Draft DG-1141 that the setpoint should be determined in accordance with the requirements of the safety analysis.

The GEH safety analysis application methodologies use the same 95/95 definition. This is evidenced by a letter from the NRC to GE (Reference 3) which states, in part, "*This procedure provides for a statistical determination of the pressurization transient ΔCPR/ICPR such that there is a 95% probability with 95% confidence (95/95) that the event will not cause the critical power ratio to fall below the MCPR Fuel Cladding Integrity Safety Limit.*" Thus, 95% is the non-exceedance %/probability. GEH has consistently used this 95/95=95% non-exceedance definition in analysis of Anticipated Operational Occurrences. The 97.5% probability is a different definition of 95% probability/95% confidence level from that already being applied by the NRC.

Note that locating the setpoint with respect to the AL based on the 95% probability criterion for a single channel provides a much higher trip probability for the trip function because the safety systems generally have 4 multiple channels with 2-out-of-4 trip logic, or 1-out-of-2 twice trip logic. GEH calculations show that for the case when the LSP is based on the single channel 95% probability criterion, the probability of trip before AL is reached is 99.95% for 2-out-of-4 trip logic, and 99.5% for 1-out-of-2 twice trip logic for the multiple channel configuration. The calculations also show that for the case when the LSP is based on the single channel 97.5% probability criterion, the probability of trip before AL is reached increases slightly to 99.99% for 2-out-of-4 trip logic, and 99.88 % for 1-out-of-2 twice trip logic for the multiple channel configuration. These results show that the increase in this multiple channel trip probability when the LSP is based on the single channel 97.5% trip probability criterion, when compared to when the LSP is based on the single channel 95.0% trip probability criterion, is insignificant from the safety point of view.

Note also that basing the setpoint on the 97.5% probability criterion instead of the 95% probability criterion could also decrease the margin between the setpoint and the normal operating limit (OL), and that would result in an undesirable increase in the spurious trip probability. GEH calculations show that the margin between the setpoint and the OL would decrease by 0.315 times the error standard deviation if the setpoint was based on the 97.5% probability criterion instead of the 95% probability criterion, assuming that the LSP is the final setpoint and the measurement errors that determine the probability of tripping before the AL is reached are the same as the errors that determine the probability of spurious trip avoidance.

This would increase spurious trip probability as follows:

Number of Channels/Coincidence	**Approximate Increase in Spurious Trip Probability**	**Change in Spurious Trip Probability**
Single channel spurious trip	1.7	from 10% to ~16.7%
2-out-of-4 multiple channel spurious trip	2.5	from ~5.2% to ~13.2%

Number of Channels/Coincidence	Approximate Increase in Spurious Trip Probability	Change in Spurious Trip Probability
1-out-of-2 twice multiple channel spurious trip	2.6	from 3.6% to ~9.4%

This assumes that the OL is such that the margin between the setpoint based on the 95% probability criterion and the OL provides 10% spurious trip probability. The reduced setpoint/OL margin is for the case where the setpoint is based on the 97.5% probability criterion.

These calculations show that basing the LSP on the 97.5% probability criterion rather than the historical 95% probability criterion results in an insignificant increase in probability of tripping before the AL is reached, but could lead to a significant detrimental increase in spurious trip probability. Moreover, the licensed GEH safety analyses are based on LSPs that meet the 95% probability criterion, so no increase in trip probability is required from the safety point of view.

The 97.5% probability criterion is the consequence of using "two-sided" statistics, whereas using "single-sided" statistics would correctly locate the setpoint such that it meets the historical 95% probability requirement for not exceeding the AL. Note that the NRC's statistical handbook (Reference 4, NUREG-1475 Rev 1, "Applying Statistics") indicates that use of single-sided statistics is appropriate for the usual case where the variable approaches a safety related setpoint, or limit, in one direction from the safe side (see description of Critical Power Ratio in example 9.4 of Reference 4. and see Section 9.13 of Reference 4 for a description of how to determine with high confidence the upper limit of the population standard deviation from the standard deviation obtained from a limited size sample).

Proposed Resolution #1

It is proposed that the Draft DG-1141 replace Figure 2 with one that shows that the LSP margin to the AL be such that the probability of trip before AL is reached is ≥ 95%. Note that this change would allow the use of both the 95% and the 97.5% probability criteria. The Draft DG-1141 should also replace the definition of the required margin between the AL and the LSP to be the margin that provides 95% probability with high confidence (>95%) that the trip for a single channel will occur before the AL is reached.

DG-1141 should include a reference to NUREG-1475 for an expanded definition of the 95/95 criterion applied to locating the LSP with respect to the AL.

2. 95/95 Criterion

DG-1141

Section 4.4 of DG-1141 (page 14) describes the 95/95 criterion as the criterion for estimating the population error around the setpoint, and Section 5.2, page 17, states that a consequence of the 95/95 criterion is that the probability in the tail above the AL is 2.5%.

GEH Comment

The 95/95 criterion described in Section 4.4 of DG-1141 applies to instrument error around the setpoint but does not define the margin of the setpoint to the AL. The instrument error around the setpoint and margin to the AL are two different concepts, because the setpoint for an instrument with the same error can be located an arbitrary number of sigmas away from the AL. A detailed explanation of this has been with the NRC (see Reference 5 and the related documents). The fact that DG-1141 indicates the instrument errors around the setpoint should be determined using 95/95 criterion is one requirement, but requiring the setpoint/AL margin to be such that probability of exceeding the AL is only 2.5% is a separate requirement.

(1) The first requirement to use 95/95 errors to determine the total measurement error (or uncertainty) is technically a valid approach, though it will be difficult to implement in practice and to rigorously enforce. As explained in DG-1141, this requirement calls for obtaining the error for a population by multiplying the error (or standard deviation) measured for a limited number of samples by a statistical factor that depends on the number of samples, and the confidence level to which the population error is to be determined. For 95% confidence, this multiplication factor could be much larger than one. For a normal population error distribution (which is typical of random instrument errors as stated in DG-1141, item C6) the 95/95 error is approximately the 2-sigma population error, where the standard deviation (or 1-sigma error) for the population error distribution is known to 95% confidence. Note that for the typical normal distribution, 95% of the population error data is between the plus 2-sigma and minus 2-sigma limits, but these are error limits around the setpoint, and have no relationship to how conservatively the setpoint itself is located relative to the AL or what the margin is between the AL and the setpoint.

(2) The second requirement to locate the setpoint relative to the AL is not a consequence of the first requirement to use 95/95 error data, but a separate requirement that should be based on the probability of assuring that the trip will occur before the AL is reached. Locating the setpoint relative to the AL so that 2.5% of the tail of the population error distribution is beyond the AL (as shown in Fig 2 of DG-1141) implies that 97.5% of the population error data is on the conservative side of the AL. Since the population error (or standard deviation) is known to be 95% confidence, this means that DG-1141 is using a 97.5/95 criterion to determine the margin between the setpoint and the AL. Use

of this 97.5/95 criterion in DG-1141 implies that the probability that the trip will occur before the AL is reached is 97.5%, and there is 95% confidence in that assertion. This is different from the 95/95 criterion historically used to determine the margin between the LSP and the AL

(3) The last paragraph of DG-1141, Section 4.4, indicates that instrument suppliers must elaborate in the specific definition of accuracy and other specifications based on test results. This is necessary for correct, unambiguous use of instrument vendor data in setpoint calculations. For example, an instrument vendor can specify the instrument uncertainty at a 2-sigma level, or at a 95% probability. The confidence level associated with the accuracy statement is needed to meet the requirement of DG-1141. Because multiple factors are considered in setpoint calculations, it is usually necessary to convert specifications at different probabilities or standard deviations to obtain the required 95% probability of trip at or before reaching the AL.

Proposed Resolution #2

It is proposed that DG-1141 technically distinguish between the 95/95 criterion used for the error around the setpoint, and the 95/95 criterion used to determine the margin between the setpoint and the AL, and both criteria should be defined in the Glossary to avoid confusion. The criterion for the margin between the setpoint and the AL should be changed from 97.5/95 currently implied in DG-1141, to 95/95 as used historically in the past, which is consistent with the plant safety analyses.

3. Practical Implementation of 95/95 Error Requirement

DG-1141

Section C.6 on page 24 of DG-1141 states that the errors used in the setpoint calculation must meet the 95/95 criterion, or provide a means for justifying the use of statistical estimates or parameters that do not meet the 95/95 criterion when such data are not available.

GEH Comment

The means of justifying 95/95 errors needs clarification. It is noted that imposition of 95/95 requirement for all the errors used in the setpoint calculation will be practically difficult to conform to and monitor. This is because the measurement error needed for setpoint calculations is a statistical square root of the sum of the squares (SRSS) combination of many independent instrument random error components (e.g., temperature effect, pressure effect, radiation effect, and power supply effect) and producing statistically valid 95/95 data

by instrument vendors for all these errors could be very difficult and costly, with limited benefits to improving safety.

Section C.6.e is important because it acknowledges that specifying a confidence level for some of the uncertainties involved in setpoint calculations (indicating that channel performance uncertainty data are typically not based on a large number of observations) adds the expectation that licensees and applicants will account for such values in the form of bounding estimate values and supporting analyses, which increases the cost of procurement of instruments. The quantification of confidence level was introduced in RG 1.105 coincident with concerns with the use of drift data, but it was not previously clear to which types of uncertainties it applies. DG-1141 recognizes that some errors cannot be measured with enough sample data to provide a 95/95 error from a statistical point of view, because the use of sample size dependent statistical factors to multiply the measured error (or standard deviation) would not produce meaningful estimate of the population error. However, DG-1141 does not clarify how to provide justification for the error to use when statistically valid 95/95 error data is not available. The use of bounding error values for a population that can be justified is a valid approach. Note that a conservative bounding value could be considered as a 3-sigma error with high confidence (>95%). Another approach would be to use engineering judgment and historical records of setpoint performance to show that the error values used in the setpoints are conservative and meet the requirement to a high degree of confidence, as was approved by the NRC in NEDC-31336P-A (Reference 2).

Proposed Resolution #3

It is proposed that DG-1141 clarify that when statistically based 95/95 population error data is not available, then bounding errors can be used as 3-sigma errors with high confidence (>95%) in the setpoint calculation, assuming that these bounding errors can be properly justified. Section C.6.e should be expanded to clarify that data obtained through IEEE type testing, e.g. harsh environment uncertainties, will be limited in sample size, and direct application of the data is allowed. This is appropriate considering the quality standards applied to 1E equipment and the sample size (one sample) applied in functional testing.

4. Drift Calculation

DG-1141

Section C.4.c of DG-1141 discuses certain provisions related to uncertainty analyses in in industry standard ANSI/ISA 67.04.01-2006 as providing a reasonable approach. Section C.4.c(2) of DG-1141 states, however, that time related uncertainties (i.e., the drift error for a long calibration time interval) should be determined by linearly extrapolating the uncertainty

specification (drift error specified for smaller time intervals) rather than by the SRSS of multiple intervals. An example is provided in DG-1141.

GEH Comment

The linear extrapolation method and example described in DG-1141 is very conservative and provides unrealistically high drift errors, which would unnecessarily make the setpoint more conservative, increase the spurious scram probability, and make it difficult to determine if the module was performing correctly. During licensing of GE setpoint methodology (Reference 2), GEH showed that the time dependent drift of instruments was generally a random error, and that if the drift for 6 months was known (or specified), the drift for 2 years could be conservatively estimated by taking SRSS of four 6-month drift errors. GEH drift evaluations have also shown that when the time interval for which the drift error is specified is much less than 6 months, it is unrealistically conservative to use the SRSS method to extrapolate this specified drift error to determine drift error for intervals greater than 6 months. For this case, GEH drift evaluations show that the drift error for 6 months can be conservatively taken to be the specified accuracy of the device, and extrapolated beyond 6 months when necessary using the SRSS method. GEH has used this drift methodology in BWR setpoint calculations for many years, and is not aware of any case where this method has not produced an adequately conservative estimate of drift error.

The DG-1141 Glossary definition of Deviation includes a note which states, in part, "*Drift is generally measurable only under strictly controlled laboratory conditions.*" Although the qualifier "generally" is included, this seems to limit the use of operational data in evaluating drift. When environmental conditions and the accuracy of calibration equipment are accounted for, operational data can be used to quantify drift, and increase the sample size used to achieve 95% confidence level. Drift is a particular area where operational data can contribute to attaining 95% confidence level.

Proposed Resolution #4

It is proposed that DG-1141 remove the requirement for calculating drift for a longer calibration time interval by linearly extrapolating the drift specified for smaller time interval, and replace that by a requirement to use a method for extrapolation that can be justified based on plant performance data and drift evaluations.

DG-1141 should continue to allow appropriate use of operational drift data. The TSTF-493 performance monitoring requirements (Reference 6) facilitate the use of operational data.

5. Use of Dynamic Effects in Setpoint Calculations

DG-1141

Section C.4.c of DG-1141 discuses certain provisions related to uncertainty analyses in in industry standard ANSI/ISA 67.04.01-2006 as providing a reasonable approach. DG-1141, Section C.4.c(3) states, however, that the dynamic effects of the process, such as transport delays, be included in the uncertainty analysis, and that the delays already accounted for in the safety analysis be listed in the uncertainty analysis.

GEH Comment

In most setpoint methodologies (and specifically the GEH setpoint methodology), dynamic effects are already considered in establishing the AL. GEH setpoint calculations refer to the source of the AL and the accompanying transient analysis. Thus, the pertinent dynamic effects are already listed in verifiable documents, and there is no need to repeat them in the setpoint calculation. Repeating such information can lead to unnecessary errors since setpoint calculations are generally done by different engineering organizations than the AL and transient analysis calculations.

Proposed Resolution #5

It is proposed that DG-1141 remove the requirement for identifying the dynamic effects of the process as long as the licensed methodology covers these effects in establishing the AL, and the setpoint calculation refers to the AL calculation.

6. Application of Regulations to All Technical Specification Setpoints

DG-1141

The wording in the "Scope" section on page 4 of DG-1141 states that the guidance in DG-1141 applies to all instrument setpoints that are included in the Technical Specification. Section C.2 of DG-1141 states that all setpoint related Technical Specification limits should be as conservative as values derived in this RG.

GEH Comment

The scope statement and the statement in Section C.2 imply that the guidance in DG-1141 applies to both setpoints that protect a safety limit (SL) and have an AL, and also to those that do not. This needs more clarification.

From the safety point of view, the guidance in DG-1141 cannot be applied to both setpoints that protect an SL and have an AL, and setpoints that do not protect a SL and have no AL.

For setpoints that do not have an AL, the LSP has no meaning. For example, all BWRs have Average Power Range Monitor (APRM) rod block setpoints in the Technical Specifications. The APRM rod block function is to block rod movement and alert the operator when the APRM power gets close to the scram setpoint. The APRM scram setpoint has an AL but the rod block setpoint has no AL, and the positioning of rod block setpoint relative to the scram setpoint is arbitrary and based on historical and operational factors specific for that BWR plant. Establishing an LSP for the APRM rod block setpoint by back-calculating the LSP from the setpoint would result in a meaningless LSP.

From the performance monitoring point of view, the guidance in DG-1141 appears to apply to all Technical Specification setpoints. This is quite different from the performance monitoring requirements in TSTF-493 (Reference 6) which apply only to a limited number of safety-related setpoints with ALs. Thus, DG-1141 and TSTF-493 are not compatible, and the requirements in the two documents are not totally consistent. Moreover, applying the DG-1141 performance monitoring guidance to setpoints with no safety function appears to put an unnecessary burden on all BWR and PWR operating plants with no gain in plant safety.

In summary, implementation of the guidance in DG-1141 to all Technical Specification setpoints results in a significant increase in plant operating costs and regulatory compliance costs without a requisite increase in plant safety.

Proposed Resolution #6

It is proposed that DG-1141 limit the application of the regulations to only those setpoints that have ALs. It is also proposed that the performance monitoring guidance be made consistent with TSTF-493, and to clarify the role of TSTF-493 once DG-1141 is finalized and RG 1.105 R4 is issued.

7. Use of Analytical Limits as Surrogates for Safety Limits

Section 2, 9th paragraph of DG-1141 (see page 9) indicates that the NRC staff considers ALs to be surrogates for SLs. Analytical limits are not surrogates for safety limits and it is not appropriate to treat them the same. Additional margin is provided in many fuel vendors' safety analyses; therefore, exceeding an AL does not mean an SL is exceeded. For example, SL avoidance is provided for or assessed at the worst point in the fuel cycle. The 5% of the trips which occur after the AL do not directly correlate with SL violations. NRC SL guidance and requirements should not apply to events where the trip did not occur at the AL. If a change is made in this area, it should state the existing NRC requirements and specifically how they are changed.

The same issue occurs in C.1 of DG-1141 regarding AL constituting surrogate safety limits. SLs are as defined in the technical specifications. They are not ALs. The criteria which apply to SLs should not apply to ALs. A plant should not shut down and wait for NRC permission to restart (which is the case for SL violation) in the event of an AL violation, which is not an SL violation.

Proposed Resolution #7

It is proposed that DG-1141 not expand the actions required when an SL is violated to include channels which do not trip when an AL is reached. If broader changes are being made or proposed to NRC requirements they should be spelled out. If it is not the NRC's intent to imply that all requirements and guidance (including enforcement guidance) applicable to SLs be applied to ALs, then the wording could be modified to more clearly state the point or to explain which specific guidance is considered important for ALs.

8. Glossary Definition of Square Root of the Sum of the Squares (SRSS)

In the DG-1141 Glossary definition of SRSS (page 31), it appears that in order to use the SRSS method for combining random uncertainties of 3 independent parameters B, C, D to give the uncertainty of the combined variable A, the variables must be random and added algebraically to give the total variable A. This is confusing and may be a terminology issue, since the variables need to be independent and only the uncertainties need to be random. DG-1141, page 16, refers to Section 4.5 of ANSI/ISA 67.04.01-2006 as addressing the use of SRSS as an acceptable method for combining uncertainties to find the total loop uncertainty under certain conditions. SRSS is discussed in other instances in DG-1141 in terms of combining uncertainties.

Proposed Resolution #8

Consider clarifying that the SRSS methodology applies only to the random errors of independent variables, and that when a sum variable is made by adding several independent constituent variables, the standard deviation error for the sum variable can be obtained by taking the SRSS of the standard deviation errors for the constituent variables.

SUMMARY

In summary, DG-1141 clarifies certain concepts, but also raises certain technical issues which do or may lead to conclusions that are technically inconsistent with the current and previous revisions of RG 1.105. These conclusions may be technically and fundamentally inconsistent with the existing NRC-approved GEH setpoint methodology (Reference 2) and GEH safety

analyses which have a well-founded technical and statistical basis. In the comments above, GEH proposes resolutions to these technical issues and looks forward to working with NRC to resolve these issues to ensure that the final regulatory guidance is technically correct and does not result in inappropriate backfits in future licensing actions that may involve setpoints.

REFERENCES

1. Draft Regulatory Guide DG-1141 (Proposed Revision 4 of Regulatory Guide 1.105, dated December 1999), "Setpoints for Safety-Related Instrumentation," June 2014 [ML081630179].

2. NEDC-31336P-A, "General Electric Instrument Setpoint Methodology," proprietary (NRC-approved version), September 1996; and NEDO-31336, "General Electric Instrument Setpoint Methodology" (non-proprietary, public version), September 1996.

3. Letter, USNRC to GE (Ms. J. S. Charnley, Fuel Licensing Manager), "Acceptance for Referencing of Licensing Topical Report NEDE-24011-P-A, 'GE Generic Licensing Reload Report,' Supplement to Amendment 11," March 22, 1986 [ML061880457].

4. NUREG-1475, "Applying Statistics," Revision 1, March 2011 [ML11102A076].

5. NRC Slide Presentation, "NRC Staff Interpretation of 95/95 Tolerance Limits in Safety System Setpoint Analysis," NRC Public Meeting with GEH, September 28, 2010 [ML102980536; also see related documents ML102950624 and ML102980533].

6. Letter, Technical Specifications Task Force (TSTF) to U.S. Nuclear Regulatory Commission (NRC), "Transmittal of Revised TSTF-493 Revision 4," TSTF-09-29, January 5, 2010 [ML100060064]; and Letter, TSTF to NRC, "Transmittal of TSTF-493 Revision 4, Errata," TSTF-10-07, April 23, 2010 [ML101160026].