STARS

Strategic Teaming and Resource Sharing

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STRATEGIC TEAMING AND RESOURCE SHARING (STARS) COMMENTS ON DRAFT REGULATORY GUIDE DG-1119, "GUIDELINES FOR EVALUATING ELECTROMAGNETIC AND RADIO-FREQUENCY INTERFERENCE IN SAFETY-RELATED INSTRUMENTATION AND CONTROL SYSTEMS" (67 FR 57044)

Gentlemen:

This letter provides comments from the Strategic Teaming and Resource Sharing (STARS)[1] nuclear power plants on draft regulatory guide DG-1119, proposed revision 1 of Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems."

STARS is pleased with the direction the NRC has taken with this draft regulatory guide. In this draft, STARS perceives a move toward more flexible implementation and testing. Attached are specific comments.

The STARS plants appreciate the opportunity to comment on the draft regulatory guide. If there are any questions regarding these comments, please contact me at 254-897-6887 or email me at dwoodla1@txu.com.

Sincerely,

DRWoodlan

D. R. Woodlan, Chairman
Integrated Regulatory Affairs Group
STARS

[1] STARS is an alliance of six plants (eleven nuclear units) operated by TXU Energy, AmerenUE, Wolf Creek Nuclear Operating Corporation, Pacific Gas and Electric Company, STP Nuclear Operating Company and Arizona Public Service Company.

Template = ADM-013

E-RIDS = ADM-03
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STARS Comments on DG-1119

	DG-1119 Section	COMMENT	JUSTIFICATION / ELABORATION / DISCUSSION
1	B	It is unclear as to what the NRC means when they say that this revision (DG-1119) complements the SER issued to accept TR-102323-R1 as "one method for addressing issues of EMC." DG-1119 raises a question as to whether or not the NRC Staff will accept EM Qualification according to TR-102323-R1(or possibly the Rev-2), especially when it comes to emission limits,. upon issue of the Revised Reg Guide 1.180. Clearly specify known published guides that will be acceptable alternatives for EM Qualification upon issue of Revised RG 1.180.	The original Reg Guide 1.180 noted that it did not include testing of signal cables and deferred that to TR-102323-R1. Now it is included in DG-1119 and as such appears to make it a complete guideline by itself. This ambiguity needs to be resolved.
2	Table-1	There is a note in the Comments' column that states: "Option of alternative test suites from most recent versions of MIL-STD and IEC guidelines". This is conservative. An allowance / clarification for the use of previous revisions of the recommended standards is needed.	To establish if it is possible to: 1. Still test according to MIL-STD461C or IEC 800-4, etc? 2. Procure equipment that has already been qualified by vendors to earlier revisions of the Military or the Commercial standards.
3	3.1 CE-101	Eliminate requirements for CE101 test	Nuclear Power Plants (NPP) have a power quality program in place. MIL-STD-461E does not recommend it for ground facilities (applicability limited to submarines and aircraft). If this is not possible, provide guidance to make this a normal mode conducted test only and set the emissions limits consistent with TR-102323-R1 (not R2), consistent with MIL-STD-461E.
4	3.2 CE-102	The CE102 test should be eliminated if its sole basis is to ensure power quality and only to serve as an additional control on high frequency radiated emissions from power leads.	Concerning the ability to make high-frequency measurements on the power leads – the value of this measurement from a LISN that may be 2.5 meters (or more) from the EUT is highly questionable. This is supported by Oakridge National Lab. Test data.

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5	3.2 CE-102	If the CE102 test is to be retained, then the rationale, application, and limits need to be revisited. These should be restored to the TR-102323 Rev. 1 values. Provide guidance on specific issues for exemption of the CE102 test.	The emission limits in DG 1119 have been reduced (made more conservative) below that of TR-102323 Rev. 1. The original reasons for testing high frequency conducted emissions stemmed from the mapping of NPP emissions by EPRI wherein the currents on all cables in a safety cabinet were measured. The possibility of emissions from "all cables" is carried over into the RE102 test where all cables are required to be exposed at the front edge of the EUT boundary for a length of at least two meters and positioned 5 cm above the ground plane. This could pose problems if one attempted to measure the emissions with a current probe instead of using a LISN.
6	3.2 CE-102	Expand the CE102 to include a measurement of common mode emissions on all interconnecting cables .	In agreement with the logic of the high frequency susceptibility tests, low frequency emissions from these cables will not radiate to be effectively measured by the RE101 or RE102 tests. In reality, the CE102 test as a measurement of common mode, high frequency emissions on the power cable is not technically credible on the basis that this confirms power quality since this test starts at 50 kHz, well above power quality considerations.
7	3.3	Provide guidance on specific issues for exemption of the RE101 test.	As an example, this test can be exempted if power to an individual rack of equipment is less than 10 amperes, ac or dc.
8	3.4	RE102 emissions need to be relaxed to the level specified in TR-102323. Raise the limit above 250 MHz.	The cost of new systems or modifications to increase exponentially. Significant emissions around 1 GHz from commercial, high performance microprocessors, is noted during industry testing. The limit in Figure 3.4 is not necessary because most power plant equipment can be shown to be unaffected by these high frequency emissions.
9	3.5 IEC Tests	It is not clear, how the tests would yield similar results when there is not a direct correlation of tests between the two families of standards.	Ref: Table-I, showing the best correlation between the two families: (NM represents Normal Mode coupling; CM represents Common Mode coupling.)

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10	4 Sucept. testing	There should be no reduction to Susceptibility test levels, for all susceptibility tests, for three different classes of equipment. Maintain recommended levels for floor standing equipment. Reduce these levels for sub-components or sub-chassis of floor standing equipment. Further reduce these levels for individual pc boards or cards that would be inserted in a sub-chassis of floor standing equipment. Provide guidance for scan steps and dwell time for all susceptibility tests.	For consistency with 461E & the IEC NPP equipment is basically broad band and has fast digital/control response such that severe test limitations of Military Standards is not required.
11	4.1	Provide exception to the CS101 test if the EUT can demonstrate acceptable power conditioning (filter and surge suppression installed properly at the input ports)	None
12	4.1 Table-9	Eliminate the IEC 61000-4-16	It is a common mode test and does not challenge power quality. Additionally, the IEC 61000-4-6 test covers the frequency above power quality at 10 KHz and above. The NUREG/CR-6782 supports this reason.
13	4.1.2 CS-114	For the range 10 KHz to 1MHz, the Operating envelop is substantially conservative as compared to the Mil. Std. The limits for the Nuclear Power Plants (NPP) should be equal to or less conservative than the Military standards. The NPP EMI data may be used to customize the operating envelops if it make them less conservative. Otherwise the standard industry envelops should be adopted.	The EMI exposure to equipment at the Nuclear Power Plants is no more severe than in the Military combat environment. A typical comment.
14	4.1.2	Increase the frequency range, without exception, on CS114 from 30 MHz to 200 MHz.	Radiative coupling to the exposed cables over the lower frequency range is not reliable under RS103. Also to bring it in line with recommendations in MIL-STD-461E and based on the real world test limitations.
15	4.2	Eliminate the CS115 test	Already covered under , IEC 61000-4-4 (the Electrical Fast Transient/Burst Test) also specified in IEEE C62.41-1991.
16	4.2	Specify the EFT/Burst level at +/- 2 kV with a pulse frequency of 5 kHz for the bursts, to be applied common mode to both signal and power leads.	The predominant problem in NPPs has been transient interference from signals similar to those generated for IEC 61000-4-4.

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17	4.2	Eliminate CS116 and its equivalent IEC 61000-4-12, the damped oscillatory wave, test as unsubstantiated within the DG-1119.	The frequency is adequately covered in CS114 and the issue of surge immunity is adequately covered in IEC 61000-4-5.
18	4.3.1	For RS101 provide a representative list /examples of equipment types that are susceptible to low frequency magnetic interference and provide an exception to the RS101 test for all other equipment. Eliminate the IEC referenced IEC 61000-4-9 and IEC 61000-4-10 tests as not being comparable to the RS101 test. Modify the guidelines for the IEC 61000-4-8 test to sweep the same frequency range as RS101 and to use a portable inductive coil to generate the magnetic field.	Example: Unless equipment is to be installed within x feet of conductors carrying >____amperes of ac power or unless equipment is to be installed within x feet of a transformer or ac machine operating at > ____kVA, the RS101 test does not have to be completed.
19	4.3.2	For RS103 and IEC 61000-4-3, refer to the recommendations in Item 14 and 15.	To provide alternative test levels for sub-chassis and pc boards.
20	5.1	Eliminate Surge Withstand Ring Wave test under IEC 61000-4-12.	Even the standard indicates that the Combination Wave Test under IEC 61000-4-5 is comparable.
21	5.2	For IEC 61000-4-5 Combination Wave Surge test, retain the +/- 3 kV open circuit test voltage limit. Include guidance to test any conductor exposed to lightning, such as I/O cable shields or ground wires.	There is clear evidence that with surge protection, equipment can readily pass the TR-102323-R1 test level at 3 kV and many manufacturers will test to 5 kV. Without surge protection, the equipment may appear to pass at lower levels while suffering partial damage that will increase with age.
22	5.3	For IEC 61000-4-4 EFT/Burst test refer to Item-12.	The IEEE C62.41 refers only to power ports while IEC 61000-4-4 recognizes the need to test both power and interconnecting cables. The DG-1119 does not dispute this, but does make it look like there are two separate tests. Redefine it as a single test. The reduced levels of test based on classification of equipment noted in paragraph 9 also applies to the EFT/Burst test.
23	5.3	The reduction of the test level for everything except power to 1 kV is significant. This test level should be held to at least 2 kV.	Because transient interference with the control system is one of the major EMI problems in the NPP.
24	5	Recommend the addition of a test for electrostatic discharge to provide a full complement of EM tests that can be addressed for Nuclear Power plant EM Qualification by a manufacturer.	Although, it is recognized that it has been accepted as a non-safety issue because of equipment redundancy. However, it is a revealing test.

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25	C.1 para 1and 3.	Delete cost prohibitive test requirements.	Example; The last sentence of the first paragraph appropriately clarifies that the EMI testing should be done in test facilities or laboratories. While in the first sentences of the third paragraph, it imposes a cost prohibitive and mostly impractical requirement to mandate that the same physical configuration be used as that specified for its actual installation.
26	C.1	The specified formula (End of Section-C.1) needs to be reconsidered for practical application by evaluating existing industry data.	Laboratory testing results do not support the formula. It results in conservative exclusion zone requirements.
27	C.1	Exclusion distance requirements are made more conservative.	Previous revision of the document recommended a gain of 1. The latest revision limits this assumption to unintentional transmitters (Welders, cameras etc.). Whereas for intentional transmitters (e.g. typically low power two way radios, cell phones, etc) it requires that antennae gains (typically > 1) be used in calculating the exclusion zones.
28	6	The revised guide imposes radiated susceptibility testing in the range of 1 GHz to 10 GHz. However, the frequency range for the endorsed test method (Section 4.3.2), does not exceed 1 GHz. Allow "mix and match" of the test suites above 1 GHz.	Section 6 should consistent with section 4.3.2. The IEC does not exceed 2 GHz. Only Mil Stds. Duly address the frequencies above 1 GHz.
29	6	Provide guidance on EMI testing exemptions, above 1 GHz.	Such as, certain sub-wattage high frequency devices may not pose any EMI threat to NPP equipment. Some supporting Industry data is available for consideration.

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TABLE-I (461E / IEC COMPARISION)			
MIL-STD-461E		**IEC 61000-4**	
Test	**Type/frequency range**	**Test**	**Type/frequency range**
CS101 (Power Leads only)	NM,30 Hz – 150 kHz	61000-4-13 (Power Leads only)	NM,16Hz – 2.4 kHz
		61000-4-16 (all cables, use 20 m cable for test)	CM, DC – 150 kHz
CS114 (all cables)	CM, 10 kHz to 30 MHz (use 10 m cable for test)	61000-4-16 (all cables, use 20 m cable for test)	CM, DC – 150 kHz
		61000-4-6 (all cables) (no cable length specified, but inject <.3 meter from EUT)	CM, 9kHz – 80 MHz
CS115 (all bulk cables)	CM,30 nS square pulse	61000-4-4 (direct on ac leads, all bulk cables)	CM, 50 nS, double exponential pulse, bursts
CS116 (all bulk cables)	CM, damped sinusoid, .01, .1, 1, 10, and 30 MHz	61000-4-12 (all cables subject to lightning or power disturbances)	NM or CM; Ring Wave: 0.1 MHz Damped Osc. Wave:0.1 & 1.0 MHz
RS101 (Radiated, EUT)	30 Hz – 100 KHz	61000-4-8 (Radiated EUT)	Power Frequency
		61000-4-9 (radiated EUT)	Pulse (Current Pulse: 6.4/16 uS)
		61000-4-10 (Radiated EUT)	damped Osc. Wave 0.1 and 1.0 MHz
RS103 (Radiated, EUT)	10 KHz – 40 GHz	61000-4-3 (radiated EUT)	
C62.41	Use IEC test procedures		
Surge Withstand (direct on power and shields)		61000-4-5	Pulse, combination wave
EFT (CM, direct on Power and coupled to all cables)		61000-4-4	50 nS, double exponential pulse, bursts
Ringwave (NM direct on power)		61000-4-12	100 kHz sinusoid