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From: Konnik, Robert [mailto:robert.konnik@r-scc.com]
Sent: Saturday, August 14, 2010 12:08 AM
To: Aggarwal, Satish
Cc: Ray, Sheila; John White
Subject: Comments on DG-1240

Attached are comments on the draft regulatory guide 1240. This is a complicated subject and is still evolving in the standards. The issue on MV cables in wet locations that is not associated with equipment qualification can be confused with techniques that are to evaluated the qualified condition in regards to IEEE 383 or 323. I think there is a lot of history, and we also cannot lose sight of how valuable this can be in looking at what will work for 40 years (since cables are getting to this age now in nuclear plants). I applauded the effort and hope my comments are helpful. Please let me know if there is any question on the comments.

Sincerely,

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SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = R.A. Jervey (raj)
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DG-1240 Comments

There is nearly 40 years of history with cables in nuclear power plants. Some have had problems and have been replaced. When examined closely, the ones that did not follow IEEE 98 for Arrhenius aging and did not rigorously follow IEEE 383 did not have good performance history. Those that have followed Arrhenius and IEEE 383 rigorously are still operating. This performance history and rigorous qualification should also be given due consideration. The qualified condition still needs to be determined and the cable must still pass the appropriate qualification test per IEEE 383 before condition monitoring can be done. The quality of the design and qualification is still the important issue.

Cables should be designed for the most stringent areas in the plant, which includes the highest temperature, highest radiation, highest humidity, and wetting/submersion. In this case, there would not be any concern if the cable is routed in different environments.

Cables which may be wetted or submerged should be designed for the worst case condition. This would be for extended wet condition/submergence. Note, whatever term is used such as wet rated, submerged, etc, the condition of the cable being in water for long periods of time is what is assumed. Water treeing is now a well know condition that should be designed for. When medium voltage cables are sold to utilities per ICEA S-97-682 and AEIC standards accelerated water treeing testing is one method used to look at water tree susceptibility. Historical performance of cables should also be used to see if the history and testing shown good performance in water long term. Some cables have a very long history in of good performance in water, while others do not.

It is important to learn from the history and cable failures. Most of the MV cables that have failed in less than 40 years due to water treeing could be predicted to do so based on similar cable performance in the rest of the Industry. It is important to learn from this history and use time proven materials. DC testing done in the past with MV cables in wet locations after 5 years or so of use, has actually been shown to be a possible failure mechanism of suitable cables. Testing may introduce problems. The fix for poor performing designs and materials was not to use these anymore, and use the materials that would pass the most stringent tests and had a good field performance.

The DC step test may be trended for shielded. This may provide some useful information or not depending upon the materials. It is generally not of much use on a nonshielded cable, of which most LV power and control cables are. This is generally used for MV cables in wet locations. It has not been shown to be able to be used in equipment qualification testing as a qualified condition.

Polymer indenter is generally not applicable to hard materials such as polyethylene or hard EPR formulations. It is generally only suitable for soft rubbery materials. This test is not limited to LV cables. Power cables may have internally generated heat that makes it more difficult to correlate the jacket condition verses the insulation, but this would also be the case on LV or MV. Generally this technique is correlated to thermal changes only. Radiation along with thermal changes may be hard to correlate, especially if chain scission from radiation is a primary mechanism, since this may soften as the heat may harden. XLPE would not normally have a polyethylene jacket. I assume this is supposed to be CSPE. Whatever jacket is used, it must be controlled with a safety related function, have Arrhenius aging done, and be tested in a DBE and the qualified condition and rate changes defined. Note, this information needs to be added to IEEE 383 on how to specifically do this in the qualification process.

Item 6, the DF test should be changed to only be applicable to shielded MV cables as noted in the second paragraph. This test is generally used for water issues in MV cables. I do not think it can be related to surface contamination. I also have not seen it associated with cracking, and it should be noted that if insulation is cracked, it is not likely to hold voltage, and is way beyond end of life.

Insulation resistance is maybe used on many cables, but would not provide results that can be trended unless the cable was shielded, and even then the result will probably not correlate to a reliable qualified condition. Polarization index is generally used on motors, nit cables. I have not seen information indicating that polarization index would generally be applicable to cables to show radiation or aging damage. Insulation resistance is sensitive to aging and end effects.

I do not think partial discharge is applicable to jacket testing. Partial discharge is not sensitive to water trees, since if there is water in the void, there is no partial discharge. It may be somewhat sensitive to electrical trees. Even if the cable is shielded, if the shield is not a low enough resistance path, it may not be able to be used. I do not think it has been sown to be suitable on nonshielded cables, so last sentence should be changed. This also does not correlate to EQ and the qualified condition, but maybe suitable for some shielded MV cables in wet locations. General PD testing does not provide locations and size of defects.

I do not think TDR has been proven to do what is claimed here. It has not been shown to be able to be trended and correlated to the qualified condition. I suggest deleting this.

It is hoped LIRA will be able to do what is claimed here, but testing is just being done. It shows potential, but additional information is needed to confirm the claims being made here.

I do not think infrared imaging thermography has been proven to be able to do what is claimed here, and I suggest this be deleted. I do not see how it is applicable to jackets and how it can be trended for insulation, etc.