

**Subsurface Transformers and Network Protectors Subcommittee
Task force / Working Group Report**

Document #: _____ n/a _____

Document Title:

Corrosion Effects on Subsurface Transformers

Chair: Will Elliott Vice-Chair Justin Minikel

Secretary Audrey Siebert-Timmer Per Cent Complete 0

Current Draft Being Worked On: _____ n/a _____ Dated: _____ n/a _____

TUESDAY,

Meeting Date: October 29, 2019 Time: 3:15 PM

Attendance:	Members	<u>22</u>
	Guests	<u>46</u>
	Total*	<u>68</u>

* For details of attendance, please refer to AMS system of the Transformers Committee

Meeting Minutes / Significant Issues / Comments:

1. Will Elliott called the meeting to order at 3:15 PM.
2. As this is the first meeting a blank roster was circulated followed by the introduction of attendees stating their name and company affiliation.
 - a. Attendees wishing to join the task force indicated this on the paper rosters for the meeting.
3. Will Elliott reviewed IEEE Essential Patent Claims and SA Copyright Policy. No issues were raised.
4. Quorum verification. Not a working group; quorum not required.
5. George Payerle made a motion, seconded by Tom Dausat, for approval of the revised agenda. Motion was unanimously approved.
6. New Business:
 - a. Presentation by Tom Dausat on progress on corrosion testing per C57.12.32-2019 titled "GE & AkzonNobel Coating Salt Spray Interim Testing to ASTM B117"
 - i. Painted samples were also tested (not required per new revision to C57.12.32).
 - ii. Question on why both 3x4 vs 3x6 samples were tested. These dimensions were pulled from past and current enclosure integrity standards. A comment was made that these two sizes may be an artifact from an old standard where they were used to help identify uncoated vs painted samples during testing.
 - iii. Question on how rust was removed from the samples. Presented results used DI water and a non-metallic abrasive pad. Comment was made that this is not the most repeatable method and that chemical methods are more reliable.
 - iv. Comment was made that the C57.12.32-2019 standard has a very limited cleaning procedure.
 - b. Presentation by Will Elliott on "Procedures and Equipment for Field Corrosion Testing"

Subsurface Transformers and Network Protectors Subcommittee Working Group Report

- i. Submersible Cu/CuSO₄ reference electrode recommended
 1. Example electrode: <https://www.certifiedmtp.com/m-c-miller-ionx-submersible-copper-copper-sulfate-electrode/>
 2. Noted that Ag/AgCl electrode could be used, but has been noted as problematic by some references:
<https://www.mcmiller.com/assets/site/docs/Articles/mp%20article%20sub.pdf>
- ii. Shared data from Liz Sullivan on temperature and potential measurements from a Dominion vault (Norfolk, Virginia location).
- iii. Tom Dauzat recommended five or more utilities take measurements in a minimum of five vaults ideally every 20 days.
 1. Volunteers: Igor Simonov from Toronto Hydro, Ben Garcia from SCE, Matt Enders from Oncor, Liz Sullivan from Dominion, Brad Kittrel from Con Edison, Ramadan Issack from AEP.
 2. Will Elliott to write detailed procedure including recommending measurement equipment and send to above volunteers.
- iv. Discussion on what the utility data will be used for:
 1. Ideally it could be used to generate a local map, and ultimately a larger map (e.g. North America). This map could be used to develop a guideline that, based on the vault environment / corrosion potential, could recommend tank materials / protection systems.
 2. Concern that the map data is constantly changing and would become obsolete quickly. Discussion that this data could simply be a starting point if the Task Force determined a map was not appropriate.
 3. Concern that practical inventory management will hinder implementation if the guide recommends multiple tank materials for a specific utility. It likely will be cost prohibitive and difficult to allocate to special material tanks to specific vaults locations.
- c. Presentation by Bill Byrd from Columbia Corrosion Control on an "Introduction and Experience with Corrosion in Underground Vaults (via conference phone)
 - i. Reviewed causes of corrosion and corrosion prevention methods. Refer to presentation for details. The key causes of corrosion which were noted included:
 1. Dangers of dissimilar metals, particularly copper and its alloys
 2. Inadequate coatings, both on the equipment and any other exposed metal in the vault
 - ii. For potential measurements Bill Byrd recommended to use a Miller LC4: <https://www.mcmiller.com/lc-4-5-voltmeter-5203>
 - iii. Question on effectiveness of coatings. Coatings can be very effective in eliminating dissimilar metal contact (e.g. copper vs steel).
 - iv. Question on magnesium anodes in a vault, utility experience found that a magnesium anode coated the transformer so much that utility could not operate the mechanical switches or tap changer. Discussion that Magnesium anodes are the most powerful anode you can buy. It is important to never hook up Magnesium to Aluminum as it forms an acidic product which eats away at the Aluminum. Aluminum anodes tends to pacify and will stop working, generally Zinc anodes are preferable.
 - v. Impressed current (active) cathodic protection rather than sacrificial anode (passive) cathodic protection can also be used to mitigate corrosion in more extreme environments.
 1. It was noted that impressed current systems can be connected backwards, which can cause accelerated corrosion.
 - vi. Changing water level in vaults is a challenge. Cathode protection only works when it is below water. Water compositions vary significantly.

Subsurface Transformers and Network Protectors Subcommittee Working Group Report

- vii. Due to limited time the question period was cut short. Bill Byrd encouraged members to reach out if they have specific questions. His contact information is included in the slides.
7. Next meeting: March 22-26; Charlotte, North Carolina, USA
 - a. Will Elliott will forward presentations to George Payerle to upload to the website.
8. The meeting was adjourned at 4:30 PM.

Attendees requesting Task-Force membership:

William Elliott (General Electric)
Justin Minikel (EATON Corporation)
Audrey Siebert-Timmer (IFD Corporation)
Martin Bachand (Cloverdale Paint Inc.)
Thomas Dauzat (General Electric)
Matthew Enders (Oncor Electric Delivery)
Chris Guertin (Cloverdale Paint Inc.)
Roger Hayes (General Electric)
Ramadan Issack (American Electric Power)
Brian Klaponski (Carte International Inc.)
Dwight Parkinson (EATON Corporation)
George Payerle (Carte International Inc.)
Adam Sewell (Quality Switch, Inc.)
Avijit Shingari (Pepco Holdings Inc.)
Igor Simonov (Toronto Hydro)
Travis Spoone (EATON Corporation)
Paul Su (FM Global)
Liz Sullivan (Dominion Energy)
Michael Thibault (Pacific Gas & Electric)
Robert Tinsley (Cloverdale Paint Inc.)
Alan Traut (Howard Industries)
John Vartanian (National Grid)

Submitted by: Audrey Siebert-Timmer

Date: 29 October 2019