IEEE P2520.1 Working Group #15
Meeting Minutes
27 June 2022
WG Chair: James Covington
WG Secretary: H. Troy Nagle (Interim)
Meeting link:
https://ieeesa.webex.com/ieeesa/j.php?MTID=m50975b5f4fa5c79aa5f2069cfa643b6b

1. **Call to Order**
   Chair called meeting to order at 10:05 AM EDT. He announced that the meeting was being recorded for the purpose of preparing minutes.

2. **Roll Call and Disclosure of Affiliation**
   Affiliation FAQs: http://standards.ieee.org/faqs/affiliation.html
   The Chair asked the participants to sign-in at this link:
   https://docs.google.com/spreadsheets/d/1x3Le7jd_5h3bgiNcYMZIfjIbzE2XdE0U8Daon00O8Ks/edit#gid=0.
   The Chair asked the Secretary to check for a quorum. No new members were participating. The List of Participants is shown in **Attachment A**. A quorum was achieved (15 of the 18 voting members were present).

3. **Approval of Agenda**
   The Chair asked for approval of the agenda. Troy Nagle made the motion; Susan Schiffman seconded. Without objection to unanimous consent, the motion was adopted.

4. **Approval of Previous Meeting Minutes**
   The Chair asked for approval of the May 23 Meeting Minutes as circulated. Susan Schiffman made the motion; Duke Oeba seconded. Without objection to unanimous consent, the motion was adopted.

5. **IEEE-SA Patent & Copyright Policies**
   a. Call for Patents
      https://development.standards.ieee.org/myproject/Public/mytools/mob/slideset.pdf
      Per standard IEEE SA WG meeting practice, the Chair reviewed the required policy regarding potentially essential patents. No one raised concerns for consideration.
   b. Copyright Policy https://standards.ieee.org/ipr/copyright-materials.html
      Per standard IEEE-SA WG meeting practice, the Chair reviewed the required policy regarding copyrights. There were no questions or concerns.

6. **Technical Presentation:**
   There was no technical presentation. Instead, the major focus for this meeting was:
   - Update of activities undertaken in June
   - Application for IEEE funding
   - Updates to Level 3 pass/fail criteria
   - Updates and discussion of chemicals list

June Update and IEEE Funding:

The Chair summarized the editing progress since our last meeting. A new file is posted to iMeet Central. The Chair has submitted a proposal to the IEEE-SA/TAB for $10K in funding to support testing experiments to verify and validate the testing processes that we are proposing in this standard. Each year, these small project grants are made available to enhance and energize standards writing groups. If approved, the funding will be available this Fall.

7. Discussion of Current Draft

Level 3 Pass/Fail Criteria Options:

At this point in the meeting, the Chair gave a brief presentation on progress that has been made in determining options for the Level 3 Pass/Fail Criteria. These options were discussed:

- Mean Square Error (MSE): measures the amount of error in statistical models. It assesses the average squared difference between the observed and predicted values
- Root Mean Square Error (RMSE): more commonly applied measure of the differences between numbers
- Root Mean Squared Logarithmic Error (RMS LE): takes the log of the predictions and actual values. Deals well with errors with large numbers
- Mean Absolute Percent Error (MAPE): measures the size of the error in percentage terms

MAPE for Level 3:

- MAPE is simple and easy to understand
- Independent of concentrations
- Works badly with low values (divide by zero problem)

$$\text{MAPE} = \frac{100\%}{n} \sum_{t=1}^{n} \left| \frac{A_t - F_t}{A_t} \right|$$

- With A_t being actual true measurement and F_t the forecast
- Consider this or a variance?
- Combine with RMSE in testing phase?

It was suggested that R^2 also be considered. However, it is greatly impacted by the concentration of the test gas. Santiago Marco is known to oppose this parameter. The Chair will inquire with him about this option. Also noted is that we have previously included procedures for removing sample outliers. Can this be extended to error outliers? A consensus developed that we try MAPE and see how it performs in our upcoming trial experiments.

In the latest standard draft, the Level 3 Pass criteria are (for all chemicals and concentration):

- LVL3-1: MAPE of <5% of the tested concentration
- LVL3-2: MAPE of <10% of the tested concentration

- LCL3-3: MAPE of <15% of the tested concentration
- LVL3-4: MAPE of <15% of the tested concentration

Appendix A: The Chemicals List:

The WG then focused on progress made in finding chemicals to list in Appendix A. How many chemicals do we want to include? Here are the criteria. The chemicals should be:

- Relatively safe and stable
- Easily accessible/purchasable
- Applicable to most VOC analyzers
- Available in different forms (cylinder/liquid/permeation)

The Chair offered two sets of three chemicals available in cylinders as examples:

- isobutylene, ethanol, and propane
- n-butanol, propanoic acid, and dimethyl sulfide

Other recommendations included:

- Cylinder options: acetone, ammonia, ethanol, hexane, hydrogen sulfide, isobutylene, isopropanol, methyl mercaptan, sulfur dioxide, and toluene
- Liquid options: n-hexane, acetone, acetaldehyde, formaldehyde, toluene, benzene, n-butylamine, ethanol, isopropanol, tetrahydrofuran, acetic acid, ethyl acetate, tetrachloroethene, and ammonia

From the liquid options:

- Chemicals to demonstrate sensor array diversity: ethyl acetate, acetone, and ethanol
- Chemicals to quantify sensor array drift: tetrahydrofuran, acetic acid, and ethanol

Leffingwell.com is a source for the detection thresholds of odorous compounds.

It was suggested that the mercaptan is difficult to use.

Another important factor is maintaining the test compound concentration over the testing period. In general, the experience of WG members is that the concentration specified by the supplier is correct over the time-period that they claim in their specifications.

The chemicals in Appendix A will be listed in groups of three. We will try to give options so that the operator conducting the P2520.1 tests will be able to use the same delivery method for all three test chemicals (e.g., gas canisters, liquid transfer, or permeation devices).

The chemical listed above are missing salient odor groups (e.g., nitrogenous, and sulfurous compounds). Aldehydes were also noted to be rare.

It was recommended that we have five sets-of-three chemicals in Appendix A. At least one should have a sulfurous compound and no more than two should have ethanol. In

addition, some of the included sets might be selected for general application areas such as P2520.2. P2520.3, and P2520.4. The final list options should include chemicals from across the classes (hydrocarbons, ketones, aldehydes, benzene, amines, alcohols, ether, hydroxy acids, lipids, halocarbons, and non-organics).

Another source for chemical options is the Sigma-Aldrich (Millipore Sigma) fragrance list (e.g., geraniol, isoamyl alcohol, phenethyl alcohol, 1-octen-3-ol, and carvone).

WG members will continue to review chemical options and will be ready to continue this discussion at the next WG meeting.

8. **New Business/Activities for the Next Meeting**
   There was no New Business.

9. **Future Meetings**
   The Chair announced the next meeting of the WG will take place on July 25.

10. **Adjourn**
    The one-hour meeting time-period having expired and without objection to unanimous consent, the Chair adjourned the meeting at 11:11 AM.

Attachment A: Participants (17)

NAME	AFFILIATION
Carlos Diaz	Ambiente et Odora
Christopher Jensen	Self
Duke Oeba	Egerton University, Kenya
Ehsan Danesh	Advanced Sensing Technologies Ltd.
Ettore Massera	ENEA
Fengchun Tian	Chongqing University
Hua-Yao Li	Huazhong University of Science and Technology
James Covington	Professor, School of Engineering, University of Warwick
Katayoun Emadzadeh	Self
Krishna Persaud	University of Manchester
Paul Kagan	AWLDM Systems
Pierre Maho	Aryballe
Radislav Potyrailo	GE Research
Sandrine Isz	Alpha-MOS
Susan Schiffman	NC State University
Susana Palma	NOVA University of Lisbon
Troy Nagle	NC State University