Minutes of the IAPWS Sub Committee on Seawater (SCSW), London, September 1st 2013

Michael Hiegemann, September 1st 2013
Alan Harvey opened the joint session of TPWS, IRS and SC SW at 11:00 am.

1. Jan Sengers remembered IAPWS member William Marshall, who passed away on August 19th 2013. Bill Marshall was working in different working groups of IAPWS.

2. Ingo Weber and Rich Pawlowicz open the session for IRS and SC SW.

3. Appointed for clerks of minutes are Jan Ruby for TPWS and Michael Hiegemann for IRS and SC SW.

4. **Advisory Note No. 5 "Industrial Calculation of the Thermodynamic Properties of Seawater" was approved by the working groups and recommended for adoption by the IAPWS committee, after the report of the evaluation task group.**

5. Results of the Task Group "Supercooled Water as a Reference for Seawater" were reported by Jan Hruby. Recommendations for future work were given. It turns out that IAPWS-95 can be extrapolated for the purposes of the seawater formulation. In the discussion it was stated that the requirement for high precision volumetric data and the need for accurate speed of sound data should result in the formulation of an ICRN. **A task group on the properties of supercritical water was proposed with members Vincent Holten, Jan Sengers and Olaf Hellmuth.**

6. Sebastian Herrmann introduced the OPAL webspace containing material for the different IAPWS working groups.

7. Wolfgang Wagner reported on work being done on the possible changes of the uncertainty estimates for IAPWS-95. **A task group with member Wolfgang Wagner, Martin Trusler and Alan Harvey was appointed to create a revised release of the uncertainties of IAPWS-IF95.**

8. Hans-Joachim Kretzschmar reported about the proposed "Guideline on the Fast Calculation of Steam and Water Properties in Computational Fluid Dynamics Using the Spline-Based Table Look-Up Method (STM)". The need for fast evaluation of fluid properties was repeated again, particularly with respect to backward evaluations. Shortcomings of the table look-up method being subject of the "IAPWS Guideline on the Tabular Taylor Series Expansion Method (TTSE) for Calculation of Thermodynamic Properties of Water and Steam" were reminded as they delivered the motivation for the development of a spline based method. This method was applied with a given grid size and respective deviations to the original IAPWS-IF97 were discussed. **The guideline is ready for evaluation and the working group was asked to continue the work with**

the target to deliver the final version of the document for adoption in the next year. The work group consists of Francisco Blangetti, Kioshi Miagawa, Rainer Pawellek, Adam Nowi and Ingo Weber.

9. The Task Group "Industrial Survey" will be discontinued but may be reactivated after the release of the Guideline on the Spline based Method. The Task Group "Advisory Notes" (Ingo Weber, Bert Rukes, Michael Hiegemann and Alan Harvey) has considered the existing Advisory Notes and has one further proposal concerning the IAPWS documents relevant for industrial application under preparation that is supposed to be ready for adoption in the 2014 meeting.

10. Rainer Feistel presented results of the Task Group on "Extension of Range of Formulation for Thermodynamic Properties of Sea Water". Most important is the publication of recent measurement of density by Safarov and al. as well as measurements of sound speed by Rohden and Rudtsch and of vapor pressure by Safarov et al. to be published soon. The latter work should be extended to higher temperatures, however, there is no funding secured yet.

11. The results of the Task Group "Transport Properties of Seawater" were presented by Andre Anderko and Alan Harvey. A model for thermal conductivity initially developed for general electrolyte solutions was combined with the thermal conductivity model for pure water used for industrial calculations. **A draft of an IAPWS Guideline on the thermal conductivity of sea water has been prepared and is ready for evaluation. Appointed for the evaluation are Reiner Feistel, Rich Pawlowicz and Kioshi Miagawa**. There is no need for a respective recommendation for oceanographic use. A model for viscosity is being developed for general electrolyte solutions similarly. It is expected to be specialized for sea water calculations later.

12. Rich Pawlowicz reported on the work of the "Joint Committee on the Properties of Seawater". The membership list was presented. Several workshops of the different work groups will be held and a list of new and upcoming publications was given.

13. Reiner Feistel explained the cooperation of IAPWS with BIPM. A strategy paper was prepared by CCT in January 2013 with focus on thermometry, with metrology for pressure, temperature and humidity being mentioned explicitly. It is expected that IAPWS will be continue to participate in this collaboration. A Euromet project on seawater issues is organized in four work packages, coordinated by Petra Spitzer. Results of the group on the comparison of conductance ratio from different contributors were given. H. Wolf is coordinating a follow-on project called "Metrology for oceanographic observables".

14. Reiner Feistel and Jeremy Lovell-Smith presented a proposal for a guideline on a virial equation for the fugacity of water in humid air. The proposed equation would provide a

computationally efficient and simple method of calculating fugacity relative to methods using IAPWS-95 at the cost of increased error especially at high pressure. A general discussion occurred but no decision was taken.

15. Roland Span presented results of the task group on heavy water, executed by a joint team of NIST and Ruhr-University Bochum. A preliminary new equation for heavy water is available and considerable advancements and open issues in the liquid region and in the region around the critical point were discussed. It is expected that a new draft release on heavy water will become available in 2014.