**Minutes of meeting of working group**
**Industrial Requirements & Solutions (IRS)**

Niagara Falls, Canada, 18-23 July 2010

Remark: Most of the IRS meetings were held as joint meetings with TPWS (marked by *). Of these joint meetings the IRS minutes cover the topics chaired by the IRS chairman.

1. Opening Remarks; Adoption of Agenda

Chairman W. Parry welcomed the WG members to Niagara Falls. The agenda was adopted with slight adjustments.

2. Appointment of Clerk of Minutes

P. Murphy was appointed clerk of minutes.

3. Web Space for Working Material for WGs TPWS, IRS, and SC SW *

See TPWS minutes.

4. Potential International Collaborative Projects. *

See TPWS minutes.

5. Guideline on an Equation of State for Humid Air in Contact with Seawater and Ice, Consistent with the IAPWS Formulation 2008 for the Thermodynamic Properties of Seawater. *

See TPWS minutes.

6. Editorial Changes on the Revised Release on the Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam (IAPWS-IF-97).

Dr. Wagner presented a brief history of the current Industrial Formulation, IF-97, followed by a discussion on the range of validity between 273.15 K and 273.16 K. Dr. Wagner then showed that the current description of this region is not correct and proposed new wording. Dr. Wagner then stated that the current Release does not give guidance on the estimate of uncertainties of specific enthalpy, and proposed adding a new sentence to the end of the subsection. J. Hruby presented K. Miyagawa's test report accepting the proposed changes. The WG unanimously voted to recommend to the EC that the editorial changes be adopted.

7. Editorial Changes on the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use (IAPWS-95. *

See TPWS minutes.

8. Revision of the Revised Release on the Pressure along the Melting and Sublimation Curves of Water. *

See TPWS minutes.

9. Transport Properties of Water and Steam. *

See TPWS minutes.

10. Industrial Requirements and Solutions for Steam Property Calculations.

H.-J. Kretzschmar presented required industrial formulations for both thermodynamic and transport properties. H.-J. Kretzschmar then gave a quick update on the development of steam table look-up methods. P. Murphy then gave a presentation on the future of the industrial steam properties. P. Murphy showed a brief history of the industrial steam properties and the changing needs of industry. P. Murphy showed the increasing use of CFD in industrial analyses, along with the need for steam tables in current CFD analysis. He also showed the lack of standards (both the steam tables and the interpolation routines) in the use of steam tables in CFD analysis. He then presented that there is a lack of industrial requirements for speed, accuracy, consistency of steam table methods. Once the industrial requirements are known then, assessments can be made of different steam table sizes and interpolation routines.

During these presentations, discussions on the following took place:

1. Need for $D_2O$ industrial properties. W. Parry agreed to talk to the Canadian delegation about the industrial needs for D2O properties.

   W. Parry talked with P. Tremaine concerning the need for an industrial formulation for D2O. P. Tremaine felt that an industrial formulation for $D_2O$ was not necessary, but an improved scientific formulation for D2O to replace the present formulation would be desirable.
2. Prioritization of the industrial requirements.
3. Need for the industrial requirements for speed, accuracy, and consistency new fast calculation of steam properties using steam lookup tables. This new fast method would have application in CFD calculations.
4. Industrial requirements for dependent and independent variables in new fast calculation method using steam lookup tables.

For items 2 through 4, it was decided that an industrial survey is needed to determine these requirements.

11. Nucleation of Water from Supercooled Steam and Revision of ICRN-1 5 on Metastable Steam.*

See TPWS minutes.

12. Properties of Humid Air and Humid Combustion Gases. *

See TPWS minutes.

13. Properties of Seawater. *

See TPWS minutes.

14. Reports on Other IRS Activities. *

See TPWS minutes.

15. Membership -- Appointment of New Chair

I. Weber was elected new chairman of IRS, replacing W. Parry. N. Okita was elected new vice-chairman, replacing I. Weber. These changes take effect at the conclusion of the annual meeting.

P. Murphy, A. Novy, M. Hiegemann were elected as members of the WG

The Japanese National Committee informed IRS that their member, Mr. Oguchi has retired from their committee, and recommended to conclude his membership in Working Group IRS.

16. Other Business

Mission Statement

It was decided that the mission statement for the WG should be:

> **To identify and prioritize industrial requirements for water, steam, aqueous systems and work with other IAPWS working groups to deliver solutions which meet them.**

Industrial Survey Task Group

A task group was set up to determine the list of companies to include in an industrial survey to determine industrial needs and requirements, develop the industrial survey, develop IAPWS material to send with the survey, send the survey to the identified companies and to the national committees. This task group includes: W. Parry (Chair), B. Rukes, M. Hiegamann, A. Novy, N. Okita, J. Cooper, and P. Murphy.

ICRN #23 – Dew Point of Combustion Gases

N. Okita gave an update on ICRN #23. There is a new dew point equation in the ASHRAE handbook, published 2009. This equation gives a different result that the Japanese handbook. A new equation for the dew point of combustion gases was published in the Oil& Gas Journal in September 2009. N. Okita will investigate this new information as soon as possible; if the ICRN needs to be revised, he will prepare a revised document for the next IAPWS meeting.

Industrial Requirements and Solutions for Steam Property Calculations Task Group

P. Murphy and M. Kunick have been added as members of this task group.

Advisory Note Task Group

Investigate whether the current system of advisory notes is sufficient to ensure that IAPWS formulations are used correctly. This task group will include W. Parry (chair), B. Rukes, M. Hiegemann.

17. Preparation of the Report to the EC

Chairman W. Parry and the Clerk of the Minutes, P. Murphy prepared the report to the EC.

18. Adjournment

W. Parry closed the IRS meeting.