

**DRAFT Agenda for the IAPWS Working Group
Industrial Requirements and Solutions (IRS)
Boulder, CO, USA, June 23rd – June 28th, 2024**

TPWS/IRS-1. Opening Remarks; Adoption of Agenda

TPWS/IRS-2. Appointment of Clerk of Minutes

TPWS/IRS-6. Industrial Requirements and Solutions for Property Calculations (joint with WG TPWS and SCSW)

- 6.1 Report on a white paper for acid gas dew points (N. Okita)
- 6.2 Report of the Task Group “Categories of industrial requirements” (N. Okita, chairs or representatives of other WG)
- 6.3 Report of the Task Group “Wet steam properties calculation” (A. Nový, J. Hrubý, R. Span, K. Meier, F. di Mare, S. Senoo, M. Kunick)
- 6.4 Translation of IF-97 Fortran routines into other programming languages (A. Nový)
- 6.5 Proposal for the Development of an Industrial Formulation for the Thermodynamic Properties of Water and Steam based on SBTL (M. Kunick)

PCC/PCAS/IRS-7.

- 7.1 Dew Point of Low Sulphur Exhaust Gas (N. Okita, same as 6.1)

IRS-8. International cooperations/projects/challenges for IRS (Francesca di Mare, N. Okita)

IRS-9. Status of each task of industrial Requirements and Solutions

- 9.1 Report of the Task Group “Categories of industrial requirements” (N. Okita, chairs or representatives of other WG)
- 9.2 Report of the Task Group “Wet steam properties Calculation” (A. Nový, J. Hrubý, K. Orlov, R. Span, K. Meier, Francesca di Mare, S. Senoo, M. Kunick)
- 9.3 Report of the joint Task Group “Wet Steam Data from Operating Turbines” (S. Senoo, N. Okita, A. Anderko) [Joint with PCAS]
- 9.4 Report of the joint Task Group on ICRN for acid gas dew points (N. Okita, S. Senoo, T. Němec) [Joint with PCAS]
- 9.5 Report of the joint Task Group “White paper on geothermal plant issues” (N. Okita, Francesca di Mare, D. Addison, S. Terada) [Joint with PCC]
- 9.6 Translation of IF-97 Fortran routines into other programming languages (A. Nový, jointly with TPWS)
- 9.7 Calculation of mixture properties of steam and non-condensable gases (N. Okita)
- 9.8 Proposal for the Development of an Industrial Formulation for the Thermodynamic Properties of Water and Steam based on SBTL (M. Kunick)

IRS-10. Other Business

IRS-11. Membership

IRS-12. Preparation of the Formal Motion to the EC

IRS-13. Adjournment

June, 17th, 2024

F. di Mare (Chair)

Minutes of the IAPWS working group IRS, Boulder, USA, June. 23 - 28, 2023

(Numbering of the topics follows IRS agenda)

TPWS/IRS-1. Opening Remarks; Adoption of Agenda [Sunday Morning]

N. Okita (on behalf of IRS Chair F. di Mare) opened the IRS (joint with TPWS) 23. June 2024 meeting for IRS. Agenda was adopted without changes.

TPWS/IRS-2. Appointed Richard Harwood as a clerk of minutes for IRS

TPWS/IRS-6. Industrial Requirements and Solutions for Property Calculations (joint with WG TPWS and SCSW)

6.1 Report on a white paper for acid gas dew points (N. Okita)

N. Okita presented a report on a white paper for acid gas dew points.

TODO:

Consult with PCC which is better, TGD or Guideline? Later, with PCC confirmed that firstly TG drafts a white paper then decides which is better (see 7.1)

6.2 Report of the Task Group “Categories of industrial requirements” (N. Okita, chairs or representatives of other WG)

N. Okita presented the current list of items. Some discussion and comments were raised.

TODO:

Some item should be considered to ICRN. The list itself should be internal use within IRS. Later, with PCC confirmed that white paper is considered an internal document within WG.

6.3 Report of the Task Group “Wet steam properties calculation” (A. Nový, J. Hrubý, R. Span, K. Meier, F. di Mare, S. Senoo, M. Kunick)

TG leader A. Nový is absent, then no updated.

6.4 Translation of IF-97 Fortran routines into other programming languages (A. Nový)

Some discussion regarding the verification values arose: every implementation must reproduce all figures and all digits. - no updates

TODO:

A. Nový's e-mail comment is to be considered as follows:
Activity aimed to provide validation tests and requirements to check that the custom specific IF-97 implementation fully complies to the IF-97 standard. This should require testing of sample values, limits and out of limits handling, error handling, backward functions consistency, regions boundaries behavior, etc.

6.5 Proposal for the Development of an Industrial Formulation for the Thermodynamic Properties of Water and Steam based on SBTL (M. Kunick)

M. Kunick presented paper with results. The Task Group “Proposal for the Development of an Industrial Formulation for the Thermodynamic Properties of Water and Steam based on SBTL” was set up. The task group members are di Mare, Kunick, Pawellek, Hruby, Kretschmar and Okita.

TODO:

Evaluate whether IAPWS-95 or IAPWS IF-97 should be used as a basis for a new industrial formulation for water and steam. IAPWS-95 is generally preferred, but the calibration of models in the steam power industry should be avoided, which also renders IF-97 an option. Heat cycle calculations need to be performed for this purpose with IF-97 and IAPWS-95. Once a basis is chosen, SBTL property functions shall be developed and evaluated.

PCC/PCAS/IRS-7**7.1 Dew Point of Low Sulphur Exhaust Gas (N. Okita, same as 6.1)**

The same topic as 6.1. N. Okita provided status of tasks and what are PCC tasks and received commitment from PCC for support to complete the White Paper. The type of output (TGD or Guideline) will be discussed once after the white paper is finished.

TODO:

One month to review of the white paper within TG, then circulate in the PCC-WG for review. The discussion of the type of output will be followed.

8. International cooperations/projects/challenges for IRS (Francesca di Mare, N. Okita)

No international cooperations/projects/challenges to be reported.

9. Status of each task of industrial Requirements and Solutions

9.1 Report of the Task Group “Categories of industrial requirements” (N. Okita, chairs or representatives of other WG)

See 6.2

9.2 Report of the Task Group “Wet steam properties Calculation” (A. Nový, J. Hrubý, K. Orlov, R. Span, K. Meier, Francesca di Mare, S. Senoo, M. Kunick)

See 6.3

9.3 Report of the joint Task Group “Wet Steam Data from Operating Turbines” (S. Senoo, N. Okita, A. Anderko) [Joint with PCAS]

TG leader S. Senoo is absent, then no updated.

9.4 Report of the joint Task Group on ICRN for acid gas dew points (N. Okita, S. Senoo, T. Němec) [Joint with PCAS]

Same as 6.1

9.5 Report of the joint Task Group “White paper on geothermal plant issues” (N. Okita, Francesca di Mare, D. Addison, S. Terada) [Joint with PCC]

No update. See PCC minutes.

9.6 Translation of IF-97 Fortran routines into other programming languages (A. Nový, jointly with TPWS)

Same as 6.4.

9.7 Calculation of mixture properties of steam and non-condensable gases (N. Okita)

No update. Later, discussion with Ian Bell, NIST during the ICPWS confirmed that EOS-CG is a new model of GERG-2008. REFPROP could be used for EOS-CG substituting parameters.

TODO:

Confirm REFPROP can calculate by ECS-CG parameters substituting GERG-2008 parameters.

10. Other Business

No other business

11. Membership

It has been unanimously confirmed to propose new IRS members, Prof. Markus Schatz, Helmut Schmidt University and Mr. Benedikt Lea, Ruhr University.

12. Preparation of the Formal Motion to the EC

Prepared by N. Okita

13. Adjournment

Adjourned at about 12:00 July 23, 2024