

**THE INTERNATIONAL ASSOCIATION
FOR THE PROPERTIES OF
WATER AND STEAM**

MEMBERS

Australia
Britain and Ireland
Canada
Czech Republic
Germany
Japan
New Zealand
Scandinavia (Denmark, Finland, Norway, Sweden)
United States of America

ASSOCIATE MEMBERS

Argentina and Brazil
China
Egypt
France
Greece
India
Israel
Italy
Switzerland

EXECUTIVE SECRETARY

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Minutes of the Meetings

of the

Executive Committee

of the

International Association for the Properties of

Water and Steam

**Rotorua, New Zealand
28th November and 2nd December 2022**

Prepared by Barry Dooley



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Minutes of the Meetings
of the
Executive Committee
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International Association for the Properties of Water and Steam

28th November and 2nd December 2022

Plenary Session. Monday, 28th November 2022. 9:00am

At 9:00 the President of IAPWS, Professor Masaru Nakahara welcomed the Executive Committee (EC) and other IAPWS members to the Executive Committee (EC) Meeting. He first asked the Chair of the New Zealand National Committee, Mr. David Addison, to welcome the EC to Rotorua, New Zealand. Addison thanked the sponsors of this IAPWS meeting. The President then officially opened the 2022 EC Meetings by introducing the National Delegates. All of the IAPWS Members except BIAPWS were in attendance, and only Italy of the Associate Member countries was in attendance. In total there were 32 people assembled for the EC meeting.

1. Adoption of Agenda

Provisional agendas had been e-mailed to all IAPWS members by the Executive Secretary in July 2022. There were no additions and the final agenda forms Attachment 1 of these minutes.

2. IAPWS Business and Appointment of Committees

2.1 IAPWS Business Since Last EC Meeting, Virtual 17th September 2021

During the year since the last IAPWS EC Meeting activity took place on the following documents with regards to IAPWS activities:

- *Release on the IAPWS Formulation 2021 for the Thermal Conductivity of Heavy Water 2020.* IAPWS 2021 Minute 6.1 indicated that the WG had approved the release and requested the EC to authorize a Postal Ballot following review by the Editorial Committee. The document was circulated for a Postal Ballot on 29th September 2021. No objections were received by 29th December 2021, so the Release became an official IAPWS document (IAPWS R18-21).
- On 19th June 2022 a postal ballot was conducted based on the recommendation of a Task Group formed by the IAPWS President which indicated that the Russian National Committee should be suspended from the IAPWS Executive Committee, with such suspension being indicated on the IAPWS website with the accompanying note: *The IAPWS Executive Committee has suspended the membership of the Russian National Committee because of Russia's war of aggression against Ukraine.* The postal ballot was completed on 18th July 2022 and the motion was approved. The Task Group and activity will be reviewed at the next IAPWS EC meeting in New Zealand (see Minute 2.6).
- On 15th June 2022 a special postal ballot was conducted at the request of the PCC Chair to undertake an additional task/project on the Corrosion Product Sampling, Analysis and Assessment Project. This International Collaboration Project (ICP) was initially approved by the Working Group Chairs and the EC in Banff at the 2019 IAPWS meetings. This additional activity will involve the collection and production of standardized Quality Control samples for corrosion products. This will ensure high quality data, minimise errors and help to produce a future world class IAPWS Technical Guidance Document (TGD). The full proposal is Attachment 2 to these minutes. No objections were received by 15th September 2022, so the additional ICP was approved.

2.2 IAPWS Highlights and Press Release

The President asked Cook to chair the development of the Highlights/Press Release on the IAPWS proceedings during the week. It was also suggested that a person from NZAPWS assist in this development and in this regard Addison agreed to assist Cook. The Clerks of Minutes from each WG were asked to provide input. The Press Release is discussed in Minute 18.1 and is Attachment 13.

2.3 Evaluation Committee on International Collaboration.

The President indicated that two proposal had been received by the Executive Secretary prior to the meeting, and that any other suggestions from WGs should be given to the Executive Secretary by the end of day. The President then reminded the EC that the Committee to review any proposals received would consist of the WG Chairmen, with the President and Executive Secretary as ex. officio members. A chairman would be chosen by the Committee. (See Minute 15.1 for further discussion on International Collaborations).

2.4 IAPWS Awards Committees for 2023

2.4.1 Honorary Fellow Award Committee

A committee of Harvey (Chairman) and Kretzschmar were selected for the 2023 Honorary Fellow award with the President and Executive Secretary as ex. Officio members.

Action: Nominations are due to the Executive Secretary by 31st January 2023.

2.4.2 Helmholtz Award Committee

The Executive Secretary reminded the EC that the Helmholtz Award selection committee for the 2023 award would consist of a member from Australia (Chair) (McAllister), BIAPWS (Morris), Canada (Palazhchenko), Czech Republic (Hruby) and Germany/Switzerland (Hellmann).

Action: Nominations are due to the Executive Secretary by 31st January 2023.

2.4.3 Gibbs Award Committee

The President reminded the EC that the Gibbs Award is awarded about every five years at each ICPWS. He then requested that the heads of National Committees, Working Groups and Sub-committees provide a nomination for the 2024 Gibbs Award by 1st May 2023 to the Executive Secretary. A Gibbs Award selection committee also needed to be formed early and the President requested that one person from each Working Group be nominated at the Friday EC meeting and the award committee will then be chosen with no duplication of country.

2.5 Update Report on 18th ICPWS

The President requested the Head of the US National Committee (Friend) to report the status details on hosting the 18th ICPWS in 2024. Friend indicated the following points:

- The U.S. National Committee will Host the ICPWS between 23rd and 28th June 2024 in Boulder, Colorado in conjunction with the triennial Symposium on Thermophysical Properties (STP)

- The logistics and activities will be integrated with ICPWS and STP being differentiated as feasible/appropriate
- Harvey and Friend will be Co-Chairs
- U.S. National Committee for IAPWS will serve as host with the organization having a Local Organizing Committee (LOC) and an International Program Committee (IPC). The IPC will include WG chairs and the Executive Secretary.
- The IAPWS IPC will provide two organizers for ICPWS sessions and one for Joint Sessions and will select and organize ICPWS papers. The joint conference will be located on the Colorado University campus at Boulder.

Friend indicated that because of the joint nature of the conference that the US National Committee will probably not need any seed money up front. But he proposed that the usual ICPWS Donation of £25,000.00GBP be approved by the EC just in case.

The EC approved this proposal unanimously.

Friend also suggested that the IPC members should meet during the week to review the draft announcement and prepare topic areas.

2.6 Situation in Ukraine

As delineated in Minute 2.1 the IAPWS EC had by postal ballot approved (18th July 2022) suspending membership of the Russian National Committee. The President requested the Chair of the Committee (Friend) to review the situation and lead a discussion of any possible IAPWS future activities. Friend indicated that there had not been any changes to the aggression and suggested to the EC that there were no reasons to change the suspended membership. Action would be initiated when there was a change in the conflict.

2.7 Other Business Requiring Extensive Discussions

No other business was raised by the EC.

3. EC Mandate to Working Groups and Membership

The following mandates were given to the WG Chairmen for action during the week.

3.1 Releases, Guidelines and Certified Research Needs.

The Executive Secretary indicated that the following ICRNs needed attention during the week: #16 Thermophysical Properties of Seawater, #22 Steam Chemistry in the Phase Transition Zone (PTZ), #25 Corrosion Mechanisms, #26 Behaviour of Aluminium in Water/Steam, #29 Uncertainties in Coolant Sampling for Low Concentration Metals, and #30 Thermophysical Properties of Supercooled Water.

3.2 Working Group Directions.

The President emphasized that each WG Chairmen should only report to the EC on Friday about those activities that need approval or discussion by the EC.

4. Preview of the IAPWS Week's Activities

President Nakahara indicated that there would be the IAPWS Symposium and a NZAPWS Workshop on Wednesday and Thursday, 30th November and 1st December 2022 respectively. The details are included in Attachments 3 and 4. He then asked each WG Chair to provide an outline of activities during the week

Following this item, the President closed the opening session of the EC at 10:02am.

Activities During the Week

The first day activities of the Executive Committee were followed by Working Group meetings, the IAPWS Symposium and NZAPWS Workshop (the programme for the week is included in Attachment 5).

Executive Committee Meeting. Friday, 2nd December 2022

President Nakahara opened the continuation of the EC Meeting at 9:04 am. All of the IAPWS Members except BIAPWS were in attendance, and only Italy of the Associate Member countries was in attendance. In total there were 18 people assembled for the EC meeting.

Nakahara asked the EC if there were any additional items that should be added to the EC Agenda. None were suggested.

5. Acceptance of Minutes of Previous Meeting

President Nakahara asked for comments and changes to the minutes of the Virtual EC meeting held on 17th September 2021. No changes were noted; thus the 2021 Minutes were accepted.

6. President's Report

President Nakahara had provided his report at the opening of the IAPWS Symposium. This is provided in these minutes as Attachment 6.

7. Thermophysical Properties of Water and Steam (TPWS) Working Group (WG)

Minutes of the TPWS WG conducted during the week are in Attachment 7. TPWS Chairman Meier discussed the following items with the EC:

7.1 Replacement of the IAPWS-95 Formulation.

Planning is beginning on what will be a large project to replace IAPWS-95. The first step will be organization and evaluation of available experimental data. The WG recommended a proposed International Collaboration project to accomplish this step (see Minute15.1).

7.2 Trace Water Measurements in Ultra Pure Gases

The PROMETH2O project (www.prometh2o.eu) is developing the European metrological infrastructure and the measurement technologies to provide a robust traceability for water measurements in ultra high purity gases, filling the gap and meeting the needs of improved trace water measurement methods and standards for the amount fraction range between 5 ppm and 5 ppb (or, equivalently, between -65°C and -105°C frost point temperature).

7.3 Second Cross Virial Coefficients of Aqueous Gas Mixtures

A Guideline for a Virial Equation of State for Aqueous Gas Mixtures will be developed based on theoretically calculated virial coefficients using ab initio potentials. This may also include enhancement factors coordinated with the PROMETH2O project. A Task Group for the development of the Guideline was appointed consisting of Fericola, Harvey, Hellmann, and Meier.

7.4 ICRN -16. Thermophysical Properties of Seawater.

This ICRN was originally adopted in 2007, revised in 2010 and 2014, and expired 2019. In the absence of members of the SCSW, TPWS appointed Hrubý and Pawlowicz as a Task Group to bring a recommendation to the 2023 IAPWS meeting.

7.5 ICRN-30. Thermophysical Properties of Supercooled Water.

This ICRN was originally adopted in 2015 and expired in 2020. This area is important enough that a new ICRN should be produced. A Task Group for the Thermophysical Properties of Supercooled Water was appointed in 2021 (Hellmuth (chair), Caupin and Lago). The Task Group was asked to prepare a closing statement for ICRN-30 and draft a new ICRN for 2022. Hellmuth resigned as Chair of the Task Group so Meier was requested to contact Caupin to check if he could lead the Task Group. If this is not possible, it will be discussed at the 2023 Meeting how to proceed.

7.6 Future of the Subcommittee on Seawater

The TPWS Chair reported that there were no attendees from SCSW at 2022 meeting, but messages had been received from Pawlowicz and Feistel during the meeting. The JCS (Joint Committee on Seawater) was active during the Covid-19 pandemic and Pawlowicz is still the Chair of JCS. Feistel resigned as Vice Chair of JCS, and no successor has yet been found. Seitz replaced McDougall as 2nd Vice Chair of JCS. Meier reported that TPWS wants SCSW to continue and that Pawlowicz, Feistel and Seitz will be asked to chair the subcommittee and plan for continuation at 2023 meeting.

7.7 TPWS Membership and Officers

The TPWS Chair proposed one new WG member:

Dr. Michal Duška (Czech Republic), Institute of Thermomechanics, Czech Academy of Science.

The EC approved the new WG member unanimously.

The TPWS Chair also informed the EC that Harvey will step down as Vice-Chair after the IAPWS 2022 Meeting.

The EC approved this new TPWS officer arrangement unanimously.

8. Industrial Requirements and Solutions (IRS) Working Group

Minutes of the IRS WG conducted during the week are in Attachment 8.

8.1 Task Group Updates

The IRS Chairman Okita provided the EC with updates on five Task Groups. None needed EC approval.

- Task Group on Categories of industrial requirements. Will continue with extended new topics such as hydrogen combustion, clouds micro and macrophysics related to aviation. It will be discussed to cooperate with ASME.
- Task Group on Wet steam properties calculation. Will continue and will interface with the International Wet Steam Modeling Project.
- Task Group on Wet steam data from operating turbines. Will continue with the key being to understand the film forming on stator blade and forming droplets from the water film.

- Task Group on ICRN for acid gas dew points. Will continue. The ICRN is withdrawn and a possible TGD to maintain reliability is considered. A white paper for the TGD will be prepared for the next annual meeting.
- Report of the joint Task Group on White paper on geothermal plant issues. Will continue. A JPAPWS 2nd draft is expected by January 2023 and possible approval of final document at the meeting in 2023 in Italy.

8.2 IRS Officers

The IRS Chair proposed di Mare as the new chair and Harwood as the new vice-chair:

Dr. Francesca di Mare, Ruhr-Universität, Bochum, Germany

Mr. Richard Harwood, Siemens Energy, Inc. USA

The EC approved this new IRS officer arrangement unanimously.

The EC thanked Okita for his excellent leadership of the IRS WG.

9. Sub-Committee on Seawater (SCSW)

Unfortunately, the SCSW Chair, Pawlowicz, could not be present for the EC meeting.

10. Physical Chemistry of Aqueous Systems Working Group (PCAS)

Minutes of the PCAS WG conducted during the week are in Attachment 9.

IRS Chairman Yoshida discussed the following items with the EC:

10.1 New Task Group on Ionization of Water

A new PCAS Task Group was proposed by Arcis and Tremaine on developing a revised formulation for the water ionization constant (K_w). A joint PCAS/TPWS Evaluation Task Group is also proposed to first review the revised formulations derived to represent the limiting conductivity of ionized water, and second to evaluate the upcoming revised correlation for K_w . The following members were suggested: Harvey, Palmer, Corti and Wang.

10.2 PCAS Membership

The PCAS Chair proposed one new WG member:

Dr. Amish Patel, University of Pennsylvania, USA, who was the 2022 Helmholtz awardee.

The PCAS Chair also informed the EC that Dr. Frantisek Marsik, Czech Academy of Science, Czech Republic, had requested to be removed from the WG.

The EC approved these WG member changes unanimously.

10.3 On-going and Continuing Task Groups

The PCAS Chair informed the EC of the following activities:

- Guideline on self-diffusion coefficient. Led by Yoshida, in collaboration with TPWS. Development is underway and will be continued.

- Guideline on ionization constant of light water. Led by Arcis and Tremaine, in collaboration with TPWS. Development is underway and will be continued.
- Geothermal White Paper. Collaboration with PCC and IRS. Development is underway and will be continued.
- Possibility of organizing a new group on radiation chemistry. Efforts to reach out to interested researchers in the field are ongoing. There has already been discussion about a joint effort with PCC.

11. Power Cycle Chemistry Working Group (PCC)

Minutes of the PCC WG conducted during the week are in Attachment 10.

PCC Chairman Addison first indicated that ~25 people from New Zealand, Asia, Europe, UK and USA participated in the PCC meetings. He then discussed the following items with the EC:

11.1 Technical Guidance Documents (TGD)

The PCC Chair provided the EC with the following updates on the TGD that were either in preparation or being considered at the 2022 EC meeting:

1. Chemistry in Geothermal plants (White Paper)
2. Corrosion Product Sampling, Monitoring for Flexible and Fast Starting Plants (White Paper and update of TGD)
3. Water Treatment of Flue Gas Condensate White Paper – Draft TGD
4. Chemistry for Electrode Boilers (White Paper)
5. FFS application in Nuclear Plants (White paper and TGD)
6. Demin Water Integrity – retired
7. Condensate Polishing Plants for HRSG plants - retired
8. Informed Alarm Systems – retired.

There is also a joint IRS/PCAS/PCC TGD proposed on Acid Dew Points. A Task Group has been established.

At the 2023 PCC meeting it is intended to review all current TGDs and develop an update/revision program (if required).

11.2 International Collaboration Projects (ICP)

The PCC Chair informed the EC that no new collaborations had been proposed but indicated that the following two current ICP were active:

- Boiler Corrosion – Canada/NZ – work continuing with expanded project but no visits due to COVID.
- Corrosion Products – SIAPWS/BIAPWS/NZAPWS – fully in progress

11.3 PCC Membership and Officers

The PCC Chair proposed the following new WG members:

1. Benjamin Loder, University of New Brunswick, Canada
2. Mads Skovbjerg, VTT Technical Research Centre of Finland, Finland
3. Duncan McAllister, Loy Yang B Power Station, Australia
4. David Rodman, Nalco Water, Australia
5. Pam Yakabuskie, Canadian Nuclear Laboratories, Canada
6. Harold Stansfield, Waltron Bull and Roberts, United States

The EC approved these new WG member changes unanimously.

The PCC Chair next indicated that Rziha will step down as PCC Vice Chair as per 2021 IAPWS meeting. Buecher (USA) was nominated by the PCC WG as PCC Vice Chair.

The EC approved these new PCC officer arrangements unanimously.

12. Editorial Committee Report

Editorial Committee Chairman Harvey reported that in the preceding year, the Editorial Committee (Harvey, Cook and Cooper) had not reviewed any IAPWS Documents prior to publication.

13. Membership and Associates

13.1 Report on Membership

First, the Executive Secretary reported that only Germany had not paid the 2022 dues by the end of October 2022.

The Head of the German National Committee proposed to the EC that a new joint IAPWS national committee be formed from the German National Committee of IAPWS and the Swiss Associate Member committee. The name of this joint committee will be German – Swiss Association for the Properties of Water and Steam (GSAPWS). It is proposed that the following people are the initial officers:

First Chairman: Kretzschmar

Second Chairman: Rziha

Deputy Chairman: Meier

Deputy Chairman: Werder

This proposal led to much discussion on joint membership, dues for joint members, and the current IAPWS dues structure. This discussion resulted in the following four motions to the EC:

- The new joint GSAPWS committee should be approved
- An invoice for the 2022 IAPWS Dues will be prepared and forwarded to GSAPWS for payment in 2022
- The invoice for the 2023 IAPWS Dues will be prepared and forwarded to GSAPWS for payment in 2023
- A Task Group (Friend and Addison) will review the IAPWS Dues structure and report back to the EC at the 2023 meetings in Turin.

The EC approved these motions unanimously.

13.2 Reports on Current Associate Members

The Executive Secretary reported on contacts with Associate Members on their IAPWS status.

Status Report on IAPWS Associate Member, Italy. The delegate of the Italian National Committee, Albo, who was present reported that the Italian National Committee is

planning to become a full member of IAPWS in early 2023 as ITAPWS. The internal approval processes are complete and INRIM have been contacting potential participants.

Status Report on IAPWS Associate Member, Greece. Mr. Antony Thanos, Chair of HIAPWS, indicated that from September 2021 an effort had been carried out to expand the list of people in Greece with an interest in IAPWS activities. Academic and research institutions in Greece were contacted, as well as Greek EPC companies with worldwide activities, Greek power plant operators and people in Cyprus. Fifteen additional people responded positively from all the above sectors, and they were added to the mailing list of HIAPWS, which now includes sixty-five members, who are regularly informed on IAPWS activities. They organized a web symposium for the members of HIAPWS in order to further communicate IAPWS activities and update the HIAPWS status.

Status Report on IAPWS Associate Member, Israel. The Head of ISRAPWS, (Nussbaum) reported that they have built a local community of Operators, Managers, Chemists, and others involved in the operation, maintenance, and design of power plants and process factories. They maintain an annual symposium for the members with information sharing and raise problems through direct personal contacts and presentations sessions.

Status Report on IAPWS Associate Member, China. The new head of the China National committee (Long) reported that the China electric power plant chemical standardization technical committee became an Associate member of IAPWS in May 2017. This group is composed of nearly 40 experts from various research institutes in China. It mainly carries out the formulation and revision of China's standards in Power plant chemistry and organizes some academic activities of power plant chemistry.

14 Executive Secretary's Report

14.1 IAPWS Bank Accounts, Financial, Auditors and IAPWS Dues

The Executive Secretary reported that IAPWS is on a sound financial footing with currently about £125,000.00GBP in total in the UK and US bank accounts. The status as at 31st October 2022 in the bank accounts had been provided to the Head of each IAPWS Member country prior to the EC meeting.

The Executive Secretary next reported that the 2021 financial statements had been forwarded to the IAPWS Auditors in January 2021. Professor Savarik in Czech Republic and Dr. Delfs of VDI in Germany had reviewed and approved the financial statements. These approvals had also been provided to the Heads of each IAPWS Member National Committee prior to the EC meeting.

The Executive Secretary proposed that these organizations be re-appointed to act as auditors. The Delegate of the Czech Republic National Committee, Novy, responded that he will have to check with the Czech National Committee and will respond then. The German Delegate, Kretzschmar, indicated positively.

The EC Approved these Actions Unanimously.

The Executive Secretary proposed to the EC that the dues structure for member countries remains unchanged for 2023.

The EC Unanimously Agreed to this Proposal in association with Minute 13.1.

14.2 Time and Place of the 2023, 2024 and 2025 IAPWS Meetings

2023 IAPWS Meetings. The Delegate of the Italian National Committee, Albo, indicated that the Italian NC confirms that the 2023 meetings are planned to be held in Turin on 3 – 8 September 2023. Full details will be provided on the website <http://iapws2023.inrim.it/>.

2024 IAPWS Meetings. The annual meetings will be held in conjunction with the 18th ICPWS which was discussed in Minute 2.5.

2025 IAPWS Meetings. The IAPWS President and Executive Secretary had reviewed past meeting locations and had asked the Head of SIAPWS, Nielsen, to review with her committee the possibility of holding the 2025 meetings. At the EC meeting she indicated that SIAPWS will be pleased to host the meetings which will be held in Helsinki between 22 – 27 June 2025.

15. Guidelines, Releases, Certified Research Needs, and International Collaborations

The President indicated that the Releases and ICRNs had been discussed within the WG Reports, so no further action was required by the EC.

15.1 International Collaboration Projects.

The President requested the Chairman of the 2022 International Collaboration Committee (WG Chairs) to report on the findings of that committee during the week. Chairman Meier reported that the following two collaboration project had been proposed:

1. *Impact of Metal Ion Complexation on the Radiation Chemistry of Acetohydroxamic Acid in Aqueous Solutions.*

IAPWS Sponsors: Dr. Jacy K. Conrad, Idaho National Laboratory, USA and Dr. Hugues Arcis, National Nuclear Laboratory, UK.

Proposed young Scientist: Ms. Elen Clayton, Dalton Nuclear Institute, The University of Manchester, UK.

Budget: £20,000 GBP (three research stays at INL and BNL)

2. *Towards a Replacement for the IAPWS Formulation 1995: Detailed Analysis of Available Data.*

IAPWS Sponsors: Dr. Allan Harvey, NIST, USA, Dr. Roland Span, Ruhr-Universität Bochum, Germany and Dr. Jan Hrubý, Czech Academy of Sciences, Czech Republic.

Proposed young Scientist: Dr. Aleš Blahut, Czech Academy of Sciences, Czech Republic.

Budget: £9,300 GBP (one stay at NIST, four visits at RUB)

The full proposals are Attachments 11 and 12. Chairman Meier indicated that the committee considered both proposals technically sound for IAPWS and recommended funding both. This led to discussion by the EC of available funds and eventually a decision to vote on each individually. EC members with an interest in either proposal were asked to leave the room.

The EC Unanimously Approved both Proposals for International Collaboration Projects.

16. IAPWS Awards

16.1 Helmholtz Award.

It was noted that the 2022 Helmholtz Awardee (Dr. Patel) provided the Helmholtz lecture at the IAPWS Symposium on Wednesday 30th November 2022. The lecture was preceded by the IAPWS President presenting the Award and reading the citation.

The Helmholtz Award Committee for 2022 had been formulated in Minute 2.4.2.

16.2 Honorary Fellow Award.

The IAPWS President also indicated that there had been two Awardees for 2022: Professor Rich Pawlowicz of Canada and Dr. Frank Udo-Leidich of GSAPWS. As neither of the awardees were present at the EC the awards were given to the heads of the respective national committees for presentation at a later suitable time.

16.3 Gibbs Award.

The President reminded the EC that the process for the Gibbs Award had been formulated at the Monday EC meeting (Minute 2.4.3). Each of the Working Group Chairs in their reports had provided the proposed member of the selection committee:

- TPWS: Meier (Germany)
- IRS: Okita (Japan)
- PCAS: Anderko (USA)
- PCC: Addison (New Zealand)

17. Election of IAPWS Officers for 2023 and 2024

The Executive Secretary indicated that according to IAPWS By-Law 8, the election of the next Vice President should be made at the end of the EC meeting in even years. The Executive Secretary indicated that together with the IAPWS President the recent history had been checked which suggested that the SIAPWS Committee should be asked to nominate one of their committee members for the position. The SIAPWS Chair, Nielsen, had been contacted and was asked to provide her committee's decision. She indicated that SIAPWS had selected her for the position.

The EC Unanimously Approved this Process and Selection.

The current President, Nakahara will step down on 31st December 2022. The current Vice President, Friend, will become the President on 1st January 2023 and Nielsen will become the IAPWS Vice President at the same time.

The EC thanked Nakahara for his leadership over the last two years which had been a tremendously difficult period for IAPWS during the pandemic with no live meetings. The EC applauded.

18. New Business

18.1 Press Release

The President mentioned that Cook (Chair) and Addison had been asked at the EC meeting on Monday to develop a Press Release. This was developed with input provided by each WG. Cook indicated that a document had been prepared. The final version is Attachment 13. The President indicated that this release will be sent to all NCs and WGs

of IAPWS and it should be distributed as widely as possible and sent to any journals and publications.

18.2 Reports from National Committees.

Written reports on progress in member countries provided during and after the EC meeting are attached to these minutes as follows:

Czech Republic	Attachment 14
USA	Attachment 15
Japan	Attachment 16

18.3 New Zealand National Committee Feedback on the 2022 EC and WG Meetings.

The Head of the New Zealand National Committee, Addison, thought the IAPWS meetings had been a great success. There had been 60 people attending for the symposium and 113 for the Workshop.

The IAPWS President thanked Addison for organizing the IAPWS week in Rotorua. Applause from EC in appreciation.

18.4 Participants

Attachment 17 provides a list of participants at the IAPWS Meetings in Rotorua, New Zealand in November/December 2022.

18.5 List of Members

An up-dated list of members of the Executive Committee, Working Groups, and Honorary Fellows will be developed by the Executive Secretary following the EC Meeting. This will be forwarded electronically to the Head of each National Committee and the Working Group Chairs.

19. Closing Remarks and Adjournment

No further business was raised by the EC. The President thanked everybody for participating at this EC meeting. The 2022 EC meeting was closed at 11:50 am.

**AGENDA for the EXECUTIVE COMMITTEE of IAPWS
Rotorua, New Zealand. 27th November – 2nd December 2022**

Monday, 28th November 2022. Opening Plenary Session (9:00 – 10:15 am)

- Opening Remarks, Welcome and Introductions by IAPWS President M. Nakahara
1. Adoption of Agenda
 2. IAPWS Business and Appointment of Committees
 - 2.1 IAPWS Business since Last Virtual EC Meeting September 2021
 - 2.2 IAPWS Highlights / Press Release
 - 2.3 Evaluation Committee on International Collaboration
 - 2.4 IAPWS Awards for 2023 (Honorary Fellow, Helmholtz, Gibbs)
 - 2.5 Update Report on 18th ICPWS (ICPWS Chairman Friend)
 - 2.6 Situation in Ukraine (Task Group Chair: Friend)
 - 2.8 Other business requiring special/extensive discussions
 3. EC Mandate to Working Groups and Membership
 - 3.1 Releases, Guidelines and ICRNs
 4. Preview of Week's WG Activities by WG Chairmen

Friday, 2nd December 2022. Executive Committee Meeting. (9:00am – 1:00 pm)

5. Acceptance of Minutes of Previous Meeting
6. President's Report
7. Report and Recommendations of Joint TPWS, IRS and the Sub-Committee on Seawater
8. Report and Recommendations of Separate IRS Meetings
9. Report and Recommendations of Separate Sub-committee on Seawater Meetings
10. Report and Recommendations of PCAS
11. Report and Recommendations of PCC
12. Editorial Committee Report
13. Membership and Associates
 - 13.1 Report on Membership. Including application of German/Swiss Committee and Members Defaulting on Dues.
 - 13.2 Reports of Current Associate Members (China, Egypt, Greece, India, Italy and Israel)
14. Executive Secretary's Report
 - 14.1 IAPWS Bank Accounts, Financials, Auditors and Dues
 - 14.2 Time and Place of 2023 (Italy) and 2024 (USA) Meetings.
15. Guidelines, Releases, Certified Research Needs, and International Collaborations
 - 15.1 International Collaborations
16. IAPWS Awards
 - 16.1 Helmholtz Award Committee
 - 16.2 Honorary Fellowship
17. Election of IAPWS Officers for 2023 and 2024
18. New Business
 - 18.1 Press Release
 - 18.2 New Zealand National Committee feedback on 2022 Annual Meeting
 - 18.3 Other items raised during the IAPWS week
19. Adjournment



Barry Dooley
13th October 2022

**Application for International Collaboration
Grant for an International Round Robin
in relation to the 2019 project
Corrosion Product Sampling, Analysis and Assessment**

Background

At the 2019 IAPWS meeting in Banff, Canada, the funding for an International Collaboration Project was granted by the EC. The purpose of the project was to make the final investigations and put the plant experience together to finalise a new TGD for corrosion product sampling and analysis for flexible plants, i.e., plant operating in a very variable mode with frequent start/stops and continuously varying load. One key result of this collaboration project is to calibrate and fine-tune the IAPWS Decay Map which was developed as part of the initial IAPWS collaboration. The initial plan was to run the project in 2020, but this was halted by the outbreak of Covid-19 worldwide. Since the beginning of 2022, work has been going on to start the project, a host site (VTT in Finland) has been found, and the project opportunity has been advertised to students in the Nordic countries. The project is expected to run from August 2022 and 6-12 months forward. Collection of plant experience, i.e., data from start-ups tracked by the proposed quantitative method developed in the first international project, is a major focus point this time. To make sure that the data sets from many plants are comparable and not hampered by analysis errors, an international round robin is proposed as an additional task of the original collaborative project, but which was not included in the submittal to the IAPWS EC in Canada. Participation in this will ensure that the methods used for later data collection for the international project are verified at the laboratories taking part and the results compared with those of a group of competent laboratories.

This application applies for an additional grant to be able to realise the round robin that is seen as a critical step to achieve the best possible data quality for calibration of the IAPWS Decay Map. The extra grant will cover the work hours and the costs of preparation and shipping of the many sample sets (around 30) to the participants worldwide, data processing, and reporting of the results.

Technical Aspects and Goals (from the original application in Banff, October 2019)

This planned activity will keep IAPWS in the leadership position with regards to corrosion products monitoring and assessment. The final goal of the activity is to develop the IAPWS Corrosion Product Decay Map that will represent the first standardized method for quantification and comparison of the effects of operational and shutdown chemistry regimes. The field tests conducted to date have demonstrated that, provided correct sampling and subsequent sample handling, on-line measurements such as turbidity and particle number/distribution are useful and reliable means to follow particle levels and transport during start-up and flexible operation. The close relation between particle size distribution (PSD) and corrosion product (CP) distribution has been demonstrated both from basic principles and experimentally. Both PSD and CP distribution follow the log-normal distribution, and this new insight leads to a change in data processing of CP data and the use of new characteristic parameters to describe the level and variability of the CPs. These findings need to be further confirmed to cover all the different chemistries typically applied in various all-ferrous and mixed-metallurgy plants. The outcome of the project will be a master thesis and key reference for the final product: The extension to the present TGD covering sampling, analysis, and assessment of CPs for plants operating in flexible mode. This will allow further minimization of CP transport and the negative consequences during operation, but the most important guidance will be the systematic method to quantify CP transport during start-up

and the IAPWS Decay Map defining the relevant guiding values. Of course, such values must be based on reliable and comparable data. Getting those within the next 1-1½ year is the focus of this project. There is a great demand for such guidance worldwide, because power plant operating in flexible mode are numerous, and the guidance so far has focused on plants in base load. The IAPWS Decay Map will allow plants to determine whether both the operating and shutdown chemistry is optimized. For combined cycle plants, it will also link very closely with the IAPWS Map for HRSG HP Evaporator deposits (IAPWS TGD). The scientific content of the project will lead to a handful of publications describing the connection between the fundamental PSD and the levels and distribution of CPs measured, the application of on-line methods as valuable tools to optimise the layup and shutdown chemistry, and the new data model leading to a change in routine data processing of CP data. In many senses, new territory is discovered in this study.

Planning of the Round Robin for 2022

The round robin is planned in detail, and an invitation to participate both in the round robin and the subsequent data collection has been set up at the SIAPWS web-site: IAPWS Round Robin and Collaborative Project for Corrosion Products. This page is not yet public, but it is ready for use introducing both purposes.

Vattenfall in Sweden has volunteered their plant in Uppsala as site for preparation of the authentic grab and filter samples to be distributed. The plant consists of several municipal waste boilers in operation around the year, so adequate sampling points and levels of iron are present.

The subtasks to produce the set of equal samples to be distributed to the participants are outlined here:

Task 1

- Initiation of Ferrozine method at lab, calibration, test on QC-samples, test on grab samples
- Data handling - set up of Excel forms for data registration

Task 2

- Initial test of sample points taking both grab and filter samples
- Sampling at a several possible sample point to select those with suitable iron levels

Task 3

- Purchase of sample bottles needed for the round robin (and chemicals for analysis)

Task 4

- Test run on selected sample points
- Sampling grab and filter samples over 1-2 hours from selected sampling point
- Analysis of samples to document suitable iron levels, stability, and equal levels between grab and filter samples

Task 5

- Sampling from selected sample points and analysis to ensure levels consistent with earlier results
- Sampling for test items, i.e., grab and filter samples for participant and test of homogeneity
- Filtration of filter samples, drying of filter in protected place

Task 6

- Selection of samples for homogeneity test
- Analysis of samples for homogeneity test
- Evaluation of samples: OK for round robin or not?

Task 7

- Preparation of QC-samples to be distributed

- Packing of grab samples, filters, and QC-samples for the participants
- Shipping of sample sets to participants

Task 8

- Registration of submitted data into Excel forms
- Data processing according to the standard ISO 13528:2015
- Preparation of graphical display of results

Task 9

- Writing of common report
- QA of report
- Distribution of report
- Informing individual participant on their lab-ID

Budget for the Round Robin

Expenses to be covered:

Task	Description of task	Budget (GBP)
1	Preparing and testing of samples	4,100
2	Lab equipment (chemical for analysis, ultrapure membrane filters, ultrapure sample bottles)	2,600
3	Boxes and wrapping for sample bottles and filters including shipping of samples to participants worldwide	2,300
4	Registration of and communication with participants including initial registration and processing of the data submitted.	3,000
	Total	12,000

Total budget is estimated to 12,000 GBP.

On behalf of IAPWS organisation in the Nordic countries (Sweden, Norway, Denmark, Finland), Britain and Ireland and New Zealand.

Monika Nielsen, SIAPWS Chair, member of PCC and the International Collaboration Project Steering Group.

Ryan Morris, BIAPWS Chair.

David Addison, NZAPWS Chair, PPC Chair.

THE 2022 IAPWS Symposium Program

- 9:00 – 9:10 **Introductory Remarks**
Prof. Masaru Nakahara - IAPWS President, Kyoto University, Japan
- 9:10 – 9:55 **Helmholtz Lecture and Award Presentation**
How do Surfaces with Nanoscale Heterogeneity Perturb Water Structure?
Dr Amish Patel Associate Professor in Chemical and Biomolecular Engineering at the University of Pennsylvania, US
- 9:55 – 10:05 **Welcome to IAPWS and the IAPWS and NZAPWS Supercritical Geothermal Symposium**
David Addison Chairperson NZAPWS, IAPWS PCC Chairperson, Principal Consultant, Thermal Chemistry Limited, NZ
- 10:05 – 10:50 **KEYNOTE:**
New Zealand's Energy and Geothermal Future. Opportunities and Challenges
Vince Hawksworth Chief Executive, Mercury NZ Limited
- 10:50 – 11:20 **MORNING TEA**
- 11:20 – 11:35 **Geothermal the Next Generation Research Programme Introduction –**
Including thoughts on Using the Fluids at the surface and drilling to access the super critical resources
Brian Carey Geothermal Resource Management Specialist - GNS Science
- 11:35 – 12:35 **Volcanism in the Taupo Zone and Geophysics**
OVERVIEW: • Magnetotellurics • Seismic Attenuation Studies - identifying rock mush • Magnetism • Depth to 560o C conditions derived for Curie Point Modelling
Pre-recorded Video Presentations
Dr Geoff Kilgour, Dr Craig Miller, Dr Ted Bertrand, Dr Stephen Banister -GNS Science
- 12:35 – 13:20 **LUNCH**
- 13:20 – 14:00 **Overview of conditions and issues**
GNS Experimental capability • Silica and anhydrite solution studies at super critical conditions
Dr Bruce Mountain, Dr Peter Rendel
- 14:00 – 14:20 **Geothermal steam sampling and online analysis of trace sodium and silica and interference removal via gas transfer membranes and sulfide to sulphate converters**
David Addison Principal Consultant, Thermal Chemistry Limited, NZ
- 14:20 – 14:50 **AFTERNOON TEA**

- 14:50 – 15:50 **MODELLING** • Methodology for national inventory of supercritical resources
Modelling to assess project potential • Deep sub critical models and the supercritical to
sub critical transition with the challenges crossing the critical point in modelling •
Modelling well outputs producing from 6 km deep supercritical wells
Chris Bromley Dr Warwick Kissling Dr John Burnell Julius Riveria GNS Science
- 15:50 – 16:10 **Geothermal Supercritical Fluid Steam Transformer Design Concepts**
Peter Rop (presented by David Addison) NEM Energy, Netherlands
- 16:10 – 16:40 **Reducing Greenhouse Gas Emissions from Geothermal Power Generation**
Ian Richardson Capability Lead - Operations Generation & Development,
Contact Energy, NZ
- 16:40 – 16:50 **Clean Energy European Metrology Network**
Dr P. Alberto Giuliano Albo Researcher, Istituto Nazionale di Ricerca
Metrologica, Italy
- 16:50 – 17:00 **OPEN DISCUSSION: Geothermal supercritical**
- 17:00 – 17:15 **Closing Remarks**
David Addison Chairperson NZAPWS,
IAPWS PCC Chairperson, Principal Consultant, Thermal Chemistry Ltd

The 2022 IAPWS Workshop Program

- 8:30 – 8:45 **Welcome to NZAPWS Future of Steam Workshop**
David Addison, NZAPWS Chairperson
- 8:45 – 9:05 **Update on IAPWS TGDs**
Barry Dooley, IAPWS Executive Secretary
- 9:05 – 9:15 **Introduction to electrode boilers in NZ, projects, issues and solutions**
David Addison, Principal Consultant, Thermal Chemistry Limited
- 9:15 – 9:35 **Orsted 's (Denmark) Experience and Issues with Electrode Boilers**
Monika Nielsen SIAPWS Chairperson / Lead Chemistry Specialist, Orsted, Denmark
- 9:35 – 9:55 **Synlait Electrode Boiler Project**
Alan Beuzenberg, Energy and Utilities Manager, Synlait
- 9:55 – 10:15 **Mataura Valley Milk Electrode Boiler Project**
Robert Barrack, Technical Director, Process Systems, Aurecon†
- 10:15 – 10:40 **MORNING TEA**
- 10:40 – 11:00 **Electrode Boilers versus Resistive Element Boilers. The Pros and Cons of each**
Brendon Stephenson, General Manager, Energy Plant Solutions
- 11:00 – 11:20 **WoolWorks Electrode Boiler Project**
Anita Zunker, Engineering Manager, PEI Group Limited
- 11:20 – 11:35 **Decarbonising steam generation by electrifying your existent fossil fuel boiler technology and case studies**
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Fabiano Gatto, General Manager - Spirax Sarco New Zealand
- 11:35 – 11:55 **OPEN DISCUSSION: Electrode boilers in NZ and water/steam related issues**
Electrode Boiler Discussion Panel Electrode Boiler Presenters
- 11:55 – 12:15 **Geothermal Industrial Steam Opportunities at the Kawerau Steam Field**
Robbie Watt, General Manager - Geothermal, Ngati Tuwharetoa Geothermal Assets Ltd
- 12:15 – 13:00 **LUNCH**
- 13:00 – 13:20 **Computational fluid dynamics (CFD) and non-linear finite element analysis (FEA) modelling for Industrial Boilers**
Paul Bosauder, Principal Engineer and Director, Sequence
- 13:20 – 13:40 **Fonterra's Future for Steam**
Tony Oosten, Energy and Climate Manager, Fonterra
- 13:40 – 14:00 **Fonterra Stirling Biomass Boiler Project**
Ian Hall Senior Engineering Project Manager, Fonterra

- 14:00 – 14:20 **Coal Boiler to Biomass Conversion Considerations**
Ian Brownlie Project Engineering Team Leader, Windsor Energy
- 14:20 – 14:25 **AUSAPWS Update**
Justin West AUSAPWS
- 14:25 – 14:35 **Application of IAPWS TGDs to solve industrial steam plant problems – Dissolved Oxygen Case Study**
Justin West Industrial Water Services - Australia
- 14:35 – 15:00 **AFTERNOON TEA**
- 15:00 – 15:20 **OPEN DISCUSSION: Future of Steam in NZ All Presenters**
- 15:20 – 15:40 **Industrial boilers analyser considerations**
Mar Nogales Swan Analytical Switzerland
- 15:40 – 16:00 **Considerations for Future Utility Systems Combining Biomass and Electrode Boilers** Dr Marty Atkins Senior Lecturer, School of Engineering - The University of Waikato
- 16:00 – 16:20 **Water as a Working Fluid in Industrial Heat Pumps**
Dr Tim Walmsley Senior Lecturer, School of Engineering - The University of Waikato
- 16:20 – 16:40 **Formation Mechanism and Microscopic Structure of Corrosion Protective Coating for Steam Piping by Film-Forming Amine**
Dr Ken Yoshida Associate Professor - Tokushima University
- 16:40 – 17:00 **New Generation Film Forming Substances for Industrial Applications**
Bill Snodgrass Product Application Engineer, Veolia Water Technologies and Solutions
- 17:00 – 17:20 **Industrial applications for FFS in NZ**
Marty Templeton Managing Director, Visentia
- 17:20 – 17:30 **Closing Remarks**
David Addison NZAPWS Chairperson



Schedule of IAPWS Meetings

Rotorua, New Zealand. 27th November – 2nd December 2022

(All technical meetings will be at the Novotel Rotorua Lakeside)

Sunday 27 Nov.	6:00 – 7:30 pm	Welcome Reception and Registration Rotorua Novotel
Monday 28 Nov.	9:00 am	Executive Committee - Opening Plenary Session
	10:15 am	Coffee / Tea Break
	10:30 am	TPWS/IRS Joint Meeting (To set agendas for the week and to conduct IAPWS Business, thus allowing remainder of week for technical matters)
	10:30 am	PCAS and PCC Separate Meetings (To conduct IAPWS Business, thus allowing remainder of week for technical matters)
	12:00 pm	Lunch
	1:30 pm.	TPWS/IRS Joint Meeting
	1:30–3:30 pm	PCC and PCAS Joint Meeting
	3:30 pm	PCC and PCAS Separate Meetings
Tuesday 29 Nov.	9:00 am	PCAS and TPWS Joint Meeting
	9:00 am–Noon	PCC WG Meeting
	9:00am	TPWS/IRS Joint or Separate Meetings
	10:30 am	TPWS/IRS Joint or Separate Meetings
	10:30 am	PCAS Separate Meeting
	12:00 pm	Lunch
	1:30 pm	TPWS/IRS/PCAS/PCC Joint Meeting.
	1:30 pm	PCAS and IRS Joint Meeting
	3:30 pm	PCC and PCAS Separate Meetings

Wednes. 30 Nov.	9:00 am–5:00 pm	IAPWS Symposium Supercritical and Subcritical Geothermal Steam Chemistry
	6:30 pm.	IAPWS Dinner/Banquet. (Te Puia, Rotorua. https://www.tepuia.com)
Thurs. 1 Dec.	9:00 am–5:00 pm	NZAPWS Workshop The Future of Industrial Steam in New Zealand
	9:00 am	TPWS/IRS Separate or joint WG Meetings or Part of Workshop
	9:00 am	PCAS Separate WG Meeting or Part of Workshop
	12:00 pm	Lunch
	1:30 pm	Separate meetings of Working Groups (if needed)
Friday 2 Dec.	9:00 am	Executive Meeting (9:00am - 1:00pm) (Will include at least one member from each National Member Delegation)
	1:30 pm	IAPWS Technical Visits (Geothermal Power Station/Facility – Mercury Kawerau or Geothermal. Tuwharetoa Travel arranged to leave at 1:30pm)

TPWS - Thermophysical Properties of Water and Steam WG

SCSW - Subcommittee on Seawater

IRS - Industrial Requirements and Solutions WG

PCAS - Physical Chemistry of Aqueous Solutions WG

PCC - Power Cycle Chemistry WG

Barry Dooley

23rd November 2022