Power Cycle Chemistry Working Group (PCC WG)
Banff, Canada, September 30 – October 3, 2019

1. Amendments / Adoption of Agenda

Attendees were warmly welcomed by Rziha. The agenda was adopted with no changes. The agenda is attached as PCC Attachment A.

Need to check and update PCC members list and contact details - circulated

2. Appointment of Clerk of Minutes

David Addison (NZAPWS) was appointed as clerk.

3. Approval of Minutes of PCC WG in Prague, 2018

The Prague minutes circulated previously by Rziha were accepted with no changes.

4. Review of Actions from last PCC WG Meeting

- Finalisation and approval of TGD's – air in leakage, FFS for industrial plants
- Review of current ICRNs to be done as part of the meeting
- Any new proposals for International Collaboration (IC) needs to be raised no later than midnight tonight.
    - One IC already received for continuation of corrosion product monitoring by Executive Secretary

5. IAPWS TGDs

This session was chaired by Dooley.
Dooley provided background on the purpose of the TGDs which is to be the basis of guidelines worldwide (started in 2008). Highest level of guidance for fossil and biomass plants worldwide. The benefit of IAPWS documents is that they bring together both academia and industry to provide scientifically robust guidelines and form the basis of plant guidelines.
Dooley requested that the separate TGD WGs arrange to meet during the ICPWS week to progress activities.

- Need to get approval for latest TGDs
    - FFS for industrial plants – TGD
        - Discussed and no objections raised from PCC, approved to be sort from EC
    - Revision of FFS in Fossil and Combined Cycle – TGD
        - Discussed and no objections raised from PCC, approved to be sort from EC
    - Generator water cooling - TGD
        - Discussed and no objections raised from PCC, approved to be sort from EC

- Progress on draft TGDs
    - Demin Water – Draft TGD

        - No progress in the last year. Table of contents drafted, wanting to progress in the next 12 months, need to revise STG. New member is Judy Weir (NZAPWS). Need to meet during week.

    - Flue Gas Condensation – Proposed TGD
    - Electrical boilers – Proposed TGD

- Need to progress on White Papers (Pre TGD Documents)
    - Corrosion product sampling for flexible plants – White paper
    - FFS in Nuclear – White paper
        - No progress in the last year, subcommittee to meet during meeting to work on project. See PCC Attachment B for minutes of this meeting.
    - Geothermal – White paper
        - Progress made, drafting
    - Condensate polishing – White paper
        - No progress

Need to have refreshment/review of existing TGDs.

- AVT – needs incorporation of aluminium specifically

5.1 Film Forming Substances (FFS) for Industrial Plants

TGD completed and final edits made for final approval. Discussed and no PCC objections. To be submitted to EC for final approval at EC meeting.

5.2 Film Forming Substances (FFS) for Nuclear Plants

Cook (STG chair) reported no progress in 2018/2019. Subcommittee to meet during meeting to continue work on white paper.

5.3 Demin Water Integrity

Henderson (new STG chair) reported no progress in 2018/2019 from Joy (previous STG chair) and project handed to him now and to be restarted. Judy Weir (Thermal Chemistry/NZAPWS) to working group to assist Henderson with writing. Current 2019 STG members – McCann, Buecher, Bellows, Hirano (Terada), Rziha, Khalifa, Shinotsuka, Ichihara, and Holl

5.4 Corrosion product (CP) sampling and analysing (white paper)

Thomsen (STG chair) provided an outline of the soon to be issued white paper – produced like a TGD. Will be provided to the PCC after the Banff meeting for review and comment. Need for more data from PCC members to help with data analysis.

A draft IAPWS ‘decay map’ has been produced for the white paper that could be used by sites to optimise preservation and start-up chemistry.

An international collaboration has been completed in 2018/2019 with field tests carried out by a student– Maja Skou Jensen (Aarhus University, Denmark) at multiple plants in Denmark, the UK and Australia. She did a great job and her work has been inputted into the white paper

- Use of proxy methods – filter iron, turbidity, particle counting/sizing to build data sets and understanding

- Operating chemistry and degree of optimisation is reflected in CPT on start up
- Layup and storage practices very important for CPT on start up (generation of more corrosion products)
- Key learning is particle size of iron corrosion products varies with operating conditions – total iron is extremely sensitive to variation in particle size
- Majority of particles detected < 2 microns. "Normal" commercial particle size analysers used in plants only detect down to 2 microns so miss the bulk of particles.
- Plants tested with FFS showed lower median particle size on the HRSG evaporator samples
- OT/AVT(O) tends to have ~ 1 micron median particle size detected
- Proxy methods can be used to track the CPT during start up and transient

Need particle counter – 0.5 to 30 micron range, cost effective design, field robust etc – challenge to instrument vendors to develop and provide such a instrument
More work needed for mixed metallurgy units – not covered in this project
Outline of additional field tests given – filtered iron, 0.45 micron filter, 1L of sample, then filter digestion and analysis. Matches to particle size analysis well.

- Question raised about using 0.2 micron filters – considered not much difference but project run out of time to test this
- Question about samples/iron drop out of solution on the bottles before filtration – was looked at, samples made up sitting for 1 to 10 to 20 days and no statistical difference noted in results once analysed.
- Question: Was different filter types looked at? Looked at cation exchange filters, found to be very high in iron so not used. Used the same Millipore type for all the testing.

Overall summary of the White Paper work

- Key questions from Dresden 2017 all answered based on the work done since then
- Close correlation between transients of FW bulk flow and spikes of particles
    - Useful for tracking CPT during transient loads
- Filtered iron method simple and correlates well with particle based proxy-methods – digestion then analysis
- Close correlation between CPT and bulk flow changes – change in turbulence in bulk flow brings solids into suspension
    - Sometimes seen (< 5% of incidents) during steady load conditions – something else going on.
- Iron oxide transport covered both corrosion products and exfoliated oxides from high alloyed steels in SH/RHs
- Proxy method – continuous FW/Boiler – trend is most important
- Using on condensate – measure of oxide exfoliation on start up
- Feedwater – start up – use of IAPWS "map" to guide plant
- IAPWS decay map – time starts at first fire, time from first fire, Fe and Cu on axis's. Provides colour indication bands for data fit.
- White paper ready for PCC review and comments and additional data (standard spreadsheet and plant questioner)

- Want to test different types of plants and chemistry and design and metallurgy - good and bad examples
- Target to be ready in 2020

ACTION: Working group to meet and consider revision of current TGD to include new filter/digestion method. Addison/Dooley/Thomsen
Comment – Fandrich - issues also present with cycling nuclear plants. Be good to have a statement to say results/methods applicable also for Nuclear plants. Will review white paper and provide comment
Dooley presented on oxide growth and oxide behaviour in steam water cycles outlining research over the last 40 years on oxides and exfoliation. No influence from cycle chemistry

5.5 Geothermal (white paper)

Addison (STG chair) reported white paper drafting based on known (already covered under current TGDs)/and unknowns and TGD outlining underway along with drafting of possible ICRNs but progress slower than expected. Being driven by NZAPWS (Addison) and JAPWS (Nobuo). Considered critical task for 2019/2020 for NZAPWS and JAPWS so major push will be made. Need to include more members of JAPWS as well as other geothermal people in Indonesia, Philippines, Iceland, Turkey and Russia

5.6 Condensate Polishing for HRSG Plants (white paper)

No progress in 2018/2019, Khalifa (STG chair) not attending Banff 2019

5.7 Water Cooled Generator TGD

Completed by Svoboda (STG chair) with assistance from Dooley. TGD completed and final edits made for final approval. Discussed and no PCC objections. To be submitted to EC for final approval at EC meeting.

5.8 Flue Gas Condensation – Proposed TGD

5.9 Proposals for new TGDs

5.9.1 Cycle Chemistry for Oil Recovery Systems/Oil Refineries
Commonly found with very poor water/steam chemistry and no idea what to do – need for improved guidance.

Idea is to take a base line and then a set of customisation conditions – similar to the Industrial FFS TGD and spell out basic chemistry requirements

Robust discussion held around complexity of doing this and information already in IAPWS TGDs

Could possibly be done via a “IAWPS PCC Advisory Note” – advice on how to use the current TGDs for these plants – how to review and assess the plant then customise currently TGD knowledge to develop the plant specific advice for water/steam chemistry

ACTION: Consider development of an advisory note for this or a TGD. Task group to be formed to work on it. Dooley (Chair), Members – Addison, Thomson, West/Henderson, Fricke, Hater, Zohm, Myszczyszyn. To consider how this could be done and report back for IAPWS 2020

5.9.2 Laboratory Management and Instrument Validation
Nothing been done since raised in 2018 – possible add onto revised S&A TGD

5.9.3 Flue Gas Condensation
Nordic speciality with district heating – FGC can allow for up to 20% more heat to be extracted from the same fuel and produce extra potential make up water. Technology for water collection and treatment tricky.
Potential outline provided

- Flue Gas Cleaning Technology Options
- Treatment of condensate
- Design considerations
- Operation of plants
- Customisation section
- References

ACTION: Nordic STG set up – move to straight TGD drafting rather than white paper to target for next year (2020). Led by Nordic IAPWS members – Chair Thomsen

PCC Chair Comments – TGD should be supported, broadens IAPWS applicability and consistent with environmental changes in European industry

Dooley Comments – be good to add more international representation to the working group if possible. Perhaps other IAPWS members – Russia, Czech Republic etc

STATEMENT: PCC accepts and supports proposal for TGD development

ACTION: Thomsen to try to attract more international members
ACTION: Dooley to be added to STG

5.9.4 Smart Alarms
Raised as a possible – may be better to be added as a update to S&A TGD or as a possible "advisory note". Could be added as "words" to the current TGD.
Need to clearly define terms as well
ACTION: Consider adding to currently TGD as a revision – description of smart alarms etc. Task group to be formed to work on it. Chair – Powalisz, Dooley, Buecher, Henderson, Jere Espo (SIAPWS). Need revision/draft by November 2019 to meet TGD timeline for a revision.

5.9.5 Electrical Boilers
Discussion of recent experiencers and issues with electrical boilers – both examples immersion electrode boilers – one for steam (NZ) and one for hot water under nitrogen pressure (Denmark)
ACTION: Form "Pre White Paper Working Group" with NZAWS and SIAPWS to share experiences and learnings – Addison, Thomson, Nielsen and report back at 2020 IAPWS re if worth a white paper/TGD

5.10 Revision of Currently Published TGDs

5.10.1 AVT
Aluminium management needs to be added

5.10.2 PT/CT
No changes needed

5.10.3 Sampling
Smart alarms to be possible added

5.10.4 CPS – base load conditions TGD

ACTION: New filter iron/digestion method to be added via separate paper to be published in PPChem then added to original TGD. Addison, Dooley, Thomson to developed to meet November 2019 timeframe for TGD revision

5.10.5 Steam Purity
No changes needed

5.10.6 Carryover
No changes needed

5.10.7 HRSG Evaporator Tubes
No changes needed

5.10.8 FFS
No changes needed

5.0 Joint PCAS and PCC WG Meeting

Update on FFS and Possible Influences on Oxide Growth Mechanisms around Generating Cycles – B Dooley

Influence of FFS on oxide growth mechanisms not well understood

ACTION: Need ICRN between PCAS and PCC re influence of FFS on oxide growth mechanisms and missing knowledge. To be developed Dooley, Lister, Yoshida, Tremaine, Wolfgang, Fandrich

5.0 Japan IAPWS discussion

New Japanese JAPWS PCC Chairperson introduced – Shinichi Terada (Toshiba) and the Japanese PCC process outlined.

Japan issues – historical IAPWS TGDs vs JIS information – specifically around the use of oxygen scavengers in all ferrous plants

ACTION: Need closer interaction between JAPWS PCC and other PCC working groups to further foster knowledge transfer and increased collaboration – specific focus for geothermal – NZAPWS/Addison to ensure closer collaboration in that area.

6.0 Canada Oil Sands Water/Steam related Discussions

Canada oil sand issues discussed and Water Treatment Development Centre and CRIN outlined. Clear advantage for them to have IAPWS involvement going forward related to water/steam issues - formation of IAPWS subcommittee related to Oil and Gas processing.

ACTION: Rziha and Dooley to coordinate the consideration of the formation of a subcommittee with Canada industry representatives

7.0 Progress Reports 2018/2019

Main activities are the further development of the TGDs as described above.
Releases of new TGDs, FFS for Industrial plants, Generator Cooling etc

8.0 Future PCC Activities

As already outlined in current TGD progress/status as described above

Concept of TGD Advisory Notes as used by other IAPWS group raised
Thomson raised idea of an advisory note for Statistical Treatment of Corrosion Product Data. Dooley suggested this as better as an IAWPS guideline.
ACTION: Thomson to draft with support from McCann

9.0 International Collaboration

There are one current collaboration and one completed collaboration and one new collaboration for 2019:

Cook/Addison – Test rig at the University of New Brunswick (Canada) on corrosion of boiler steels in presence of mixed contaminants (chloride, sulphate). The aim of the work is to verify or adjust boiler limits. The test rig has been set up and experiments ongoing. The preliminary data is promising was reported at ICPWS 2018. Schedule and budget is on track. Additional funding approved in 2018 for an additional student with funding to commence in 2019.
ACTION: Note to PCC to be issued by Cook asking for suitable IAPWS member country for student to undertake this work

Thomsen - Maja Skou Jensen (Aarhus University) has been completed now as of 2019 with results incorporated into the white paper and Maja's thesis
ACTION: Rziha to upload to PCC Maja's thesis and advise PCC when this is done
ACTION: Status to be reported to the EC – Thomson

New proposal in 2019 for CPS related IC "Application for International Collaboration: Corrosion Product Sampling, Analysis and Assessment– Thomson nominated IC and provided documentation. Continuation of the previous work to provide more data for the PCC CPS project.
ACTION: Rziha to submit to EC

10.0 ICRNs – Review and Possible New Additions

Status of ICRN#22 "Steam Chemistry in Turbine Phase Transition Zone" reviewed. ICRN to be closed and PCC to provide closing statement
ACTION: Dooley to produce closing statement

Status of ICRN#25 "Corrosion Mechanism, related to the presence of contaminates in steam/water circuits, particularly in boiler water" – Still ongoing as part of PCC IC project (Canada/NZ)
ACTION Rziha to request EC for extension to 2024

Status of ICRN#26 "Behaviour of Aluminium in the steam water cycle" – work has been completed on this and work recommended by Dooley to be incorporated in current AVT TGD. Can be closed
ACTION: Rziha to produce closing statement

New ICRNs for 2019
ACTION: Need ICRN between PCAS and PCC re influence of FFS on oxide growth mechanisms and missing knowledge. To be developed Dooley, Lister, Yoshida, Tremaine, Wolfgang, Fandrich

It is expected as part of the Geothermal working group that new ICRNs will be required as part of the white paper work
ACTION: Addison/Okita to draft and provide to PCC chair prior to 2020 IAPWS meeting

11.0 PCC Public Relations / Contribution to Press Release

The PCC WG has been active with various TGD production (FFS for industrial plants, air in leakage, generator cooling and with White Paper production (corrosion product sampling, geothermal etc). IAPWS has also supported various events worldwide to raise awareness of IAPWS. The conference on FFS in Heidelberg (3rd one) was highlighted as being particularly successful. The presentations are not directly available to IAPWS members but can be purchased from the PowerPlant Chemistry journal for half of the registration cost. The next FFS will be held in March 2020 (10th to 12th March) in Strasburg, France. Another IAPWS event is the European HRSG forum, held in 2019 in Athens, Greece, 2020's which had a excellent contribution from the Greek industry and hopefully assisted with the reanimation of the Greek IAPWS group. The next meeting will be in EHF in May 2020 in Strasburg (26-28 May). Another IAPWS support related meeting is the Australasians Boiler/HRSG user group held in Brisbane, Australia from the 30th October to the 1st of November 2019. All of these IAPWS support meetings/conferences have assisted with promoting IAPWS internationally and assisting the formation of National Committees

IAPWS sponsorship for relevant technical conferences can be obtained via applying via email to the IAPWS Executive Sectary for approval.

For the ICPWS, the press release will be prepared by Cook (University of New Brunswick).

12.0 Changes in PCC Membership and Election of Officers

The following WG members were elected and welcomed to PCC:

1. Neil Fricke, Suncor Energy, Canada
2. Tetsuya Sawatsubashi, Mitsubishi Heavy Industries, Japan
3. Shinichi Terada, Toshiba, Japan
4. Arja Lehikoinen, Valmet, Finland
5. Burkhard Zohm, Doosan Babcock, United Kingdom

Michael has been PCC chair for 9 years. Discussion with Dooley and Addison at Banff re future. Suggested to remain until 2021 and then handover to Addison (to be elected via IAPWS process).

Michael Rziha was elected to continue as WG chair. There are two vice-chairs: Paul McCann continues.

Frank-Udo Leidich wishes to step-down as vice-chair of PCC but wishes to stay as a corresponding member of the PCC

Nominations to be sort for a third vice chair to be elected at IAPWS 2020 -please send to Rziha.

13.0 Adjournment

ENDS

Summary of Actions from PCC 2019

Number	PCC Area	Action	Whom By	Due Date	Comment
1	Corrosion Product Sampling	Working group to meet and consider revision of current TGD to include new filter/digestion method.	Addison, Dooley, Thomsen	Prior to November 2019	
2	Corrosion Product Sampling	New filter iron/digestion method to be added via separate paper to be published in PPChem then added to original TGD	Addison, Dooley, Thomson	To developed to meet November 2019 timeframe for TGD revision	
	Corrosion Product Sampling	Development of a advisory note for Statistical Treatment of Corrosion Product Data.	Thomson to draft with support from McCann	Prior to IAPWS 2020	
3	Oil and Gas and Refinery Plants	Consider development of an advisory note for this or a TGD. Task group to be formed to work on it.	Dooley (Chair), Members – Addison, Thomson, West/Henderson, Fricke, Hater, Zohm, Myszczyszyn.	To consider how this could be done and report back for IAPWS 2020	
4	Flu Gas Condensation	Thomson to attract more international members to working group and commence work on drafting to TGD. Dooley to be added to	Thomson and task group	TGD ready for IAPWS 2020 approval as per normal TGD timeline	

		task group			
5	Smart Alarms	Consider adding to currently Instrumentation TGD as a revision – description of smart alarms etc. Task group to be formed to work on it.	Chair – Powalisz, Dooley, Buecher, Henderson, Jere Espo (SIAPWS).	Need revision/draft by November 2019 to meet TGD timeline for a revision.	
6	Electrical Boilers	Form "Pre White Paper Working/Task Group" with NZAWS and SIAPWS to share experiences and learnings	Addison, Thomson, Nielsen	Report back at 2020 IAPWS re learnings and if worth a white paper/TGD	
7	Oxides and Film Forming Substances	Need ICRN between PCAS and PCC re influence of FFS on oxide growth mechanisms and missing knowledge.	Dooley, Lister, Yoshida, Tremaine, Wolfgang, Fandrich	TBC	
8	JAPWS PCC Group and Closer Collaboration	Need closer interaction between JAPWS PCC and other PCC working groups to further foster knowledge transfer and increased collaboration – specific focus for geothermal	NZAPWS / Addison to ensure closer collaboration in that area.	Ongoing	

9	Canada oil sand water/steam issues	Coordinate the consideration of the formation of a subcommittee with Canada industry representatives to foster closer technical sharing of knowledge	Rziha and Dooley	Over the next 12 months	
10	IC – Boiler Corrosion	Note to PCC to be issued by Cook asking for suitable IAPWS member country for student to undertake this funded work	Cook	November 2019	
11	IC – Corrosion Product Sampling	Rziha to upload to PCC Maja's thesis and advise PCC when this is done and Status to be reported to the EC – Thomson	Rziha and Thomson	October 2019	
12	IC – Corrosion Product Sampling	New proposal in 2019 for CPS related IC "Application for International Collaboration: Corrosion Product Sampling, Analysis and Assessment– Thomson nominated IC and provided documentation. Continuation of the previous work to provide more data for the PCC CPS project.	Rziha to submit to EC	October 2019	

13	Status of ICRN#22 "Steam Chemistry in Turbine Phase Transition Zone"	Completed and included Steam Purity TGD	Dooley to produce closing statement	November 2019	
14	Status of ICRN#25 "Corrosion Mechanism, related to the presence of contaminates in steam/water circuits, particularly in boiler water"	Project still in progress as IC project	Rziha to request EC for extension to 2024	October 2019	
15	Status of ICRN#26 "Behaviour of Aluminium in the steam water cycle"	Completed and to be included in update of AVT TGD	Rziha to produce closing statement		
16	Geothermal ICRNS	As part of White Paper work ICRNS expected	Addison/Okita to draft and provide to PCC chair prior to 2020 IAPWS meeting	IAPWS 2020	

Attachment: PCC WG Meeting Agenda

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Power Cycle Chemistry Working Group (PCC WG)

Banff, Canada
29th September – 4th October 2019

Sunday September 29th, 19:00 Welcome Reception and Registration

Monday, 30 Sept.

- **09:00 am Executive Committee – Opening Plenary Session**
- 10:15 am Coffee / Tea Break

1) 10:30 – 12:00 – PCC WG Meeting

a) Amendments / Adoption of Agenda

b) Appointment of Clerk of Minutes

c) Approval of Minutes of PCC WG in Prague, 2018

d) Review of Actions from last PCC WG Meeting

e) IAPWS TGD's – (Barry Dooley)

a) Final approval for the TGD Chemistry in Generator Cooling Water

b) TGD`s Film Forming Substances (FFS)

(1) Wolfgang Hater - Investigations on the durability of the protective FFA film

(2) Hayden Henderson - The AGL experience with Film-Forming Substances

(3) Final approval for the TGD for Industrial Plants

c) Amended FFS TGD "Application of Film Forming Substances in Fossil, Combined Cycle, and Biomass Power Plants".

☞ **12:00 – 13:30 Lunch**

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2) 13:30 – ca. 17:00 PCC WG Meeting (Coffee Break will be announced separately)
Continuation IAPWS TGD

d) Film Forming Substances (**FFS) for Nuclear Plants**

(1) Kristine Liao - Film Forming Product Qualification at Darlington Nuclear Generation Station

e) **Monitoring Corrosion Products in Flexible** (cycling and two-shifting) Plants (white paper)

(1) Karsten Thomsen - Presentation on field test of proxy-methods for CP monitoring

(2) Karsten Thomsen - Update on field test based on Maja Skou Jensen`s work

(3) Karsten Thomsen - Round robin on analytical methods and the implications for the TGD recommendations

(4) Karsten Thomsen - New knowledge/recommendations to be included in the present and new TGD

(5) Barry Dooley – Oxide Growth and Oxide Behavior in Steam Water Cycles

Tuesday, 1 October

09:00 – 12:00 - PCC WG Meeting

Continuation IAPWS TGD

f) **Geothermal** (white paper)

(6) David Addison -Geothermal reboiler chemistry issues – application of IAPWS TGD's to solve water/steam issues

g) **Proposals for new TGD's**

I. Cycle Chemistry Guidance for Oil Recovery Systems

II. Laboratory Management and Instrument Validation

III. Flue Gas Condensation

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IV. Smart Alarms

V. Revisions of Currently Published TGD

☞ **12:00 – 13:30 Lunch**

13:30 – 15:30 Joint PCAS & PCC WG Meeting

Discussion and presentation about film-forming substances

(1) Barry Dooley – Influences of FFS Films on Oxide Growth Mechanisms around Generating Cycles

(2) Additional presentations / speakers to be confirmed

15:30 – ca. 17:00 PCC WG Meeting

(1) David Addison - Electrode boilers – water/steam chemistry considerations

(2) Monica Nielsen - Trouble-shooting water chemistry in an electric boiler

(3) Tetsuya Sawatsubashi - Determination of the presence of Chlorides on Steel Surfaces

Wednesday, 2 October

☞ **09:00 16:00 IAPWS SYMPOSIUM**

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Thursday, 3 October

09:00 – 12:00 - PCC WG Meeting

Presentations

(1) Melonie Myszczyszyn - WTDC – water treatment development center – new water testing facility built in Fort McMurray

(2) Adele Zenide- CRIN Water Theme – new water connectivity network initiative to connect entrepreneurs to water challenges to government research/funding

PCC WG Business:

a) Progress Reports 2017/2018 and Future PCC Activities

b) International Collaboration

c) ICRNs – Review and Possible New Additions

d) PCC Public Relations / Contribution to Press Release

e) Changes in PCC Membership and Election of Officers

f) Adjournment

☞ **12:00 – 13:30 Lunch**

☞ **18:30 IAPWS Dinner / Banquet**

Friday, 4 October Executive Meeting (09:00 – 13:00)

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Power Cycle Chemistry Working Group (PCC WG)

Minutes of Meeting
IAPWS PCC - Nuclear Subcommittee

Attendees:	W. Cook (chair)	C. Stuart
	D. Lister	K. Liao
	W. Hater	G. Pringle
	J. Fandrich	P. Tremaine
	S. Shulder	S. Weerakul

Date: October 1, 2019

Opening remarks – W. Cook

- Three questions for this sub-committee on FFS for nuclear plants document
    1. Is there still a need for this IAPWS white paper or TGD?
    2. What will be the scope and intent of the document?
    3. Who is going to help develop the document?

Comments on Question 1:

- JF indicated that this document is still highly needed to highlight the potential application for nuclear secondary systems but also to identify gaps in knowledge.
- Must highlight the differences between fossil and nuclear plants including:
    - Qualification requirements
    - Various steam generator configurations
    - Potential degradation issues (thermal, radiation etc)
- KL suggested that the document would be useful for utilities considering FFS applications but it should include a summary of operating experience from the few applications that have been conducted
- DHL commented that most nuclear utilities already adhere to “guidance” documents from other organisations. Suggested this document is useful but perhaps should not be a “guidance” document.
- Discussion ensued with the result that everyone agreed the document is needed and that IAPWS can provide leadership in this area, even for nuclear plant applications.

Comments on Question 2:

- The document should not be an addendum to the current FFS TGDs, it must be a stand-alone document.
- The document should provide a summary of previous nuclear plant applications of FFS
- The document should be limited to application for preservation during lay-up conditions
- The document will emphasize key FFAs as per other IAPWS TGD and that the complete contents of any FFS for application in a nuclear plant must be disclosed, no proprietary compounds will be accepted for nuclear plant application.
- The document will highlight current knowledge gaps and acknowledge work ongoing in these areas.

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- The document will describe some of the qualification activities needed to make application to nuclear regulator to approve their use.

Comment on Question 3:

- J. Fandrich will contribute significantly to the development of the document
- D. Lister will also contribute, sections to be determined
- W. Cook will oversee and administer the development of the document
- K. Liao, C. Stuart and W. Hater indicated they or someone from their organizations will assist with document review and editing.

ACTION: W. Cook to develop skeleton of FFS for nuclear application document and to circulate to Jorg Fandrich by October 18th, 2019.

ACTION: W. Cook & J. Fandrich will finalize document skeleton and W.Cook will circulate to sub-committee and assign duties by October 31st, 2019.

ACTION: Sub-committee to write document sections and have prepared for review and comments by January 31, 2020.

Prepared by:
William Cook
Nuclear subcommittee chair

October 4th, 2019