

Materials Science for Severe Accident and Fukushima-Daiichi Decommissioning Workshop 2019

Hosted by JAEA, Fukushima, Japan, as FRC (Fukushima Research Conference)

10-12 July 2019

@Spa Resort Hawaiians, room 'OHANA' (10th of July)

@Naraha R&D Center, Multipurpose room & The 2nd meeting room (11th of July)

@J-village, J-village Hall (12th of July)

Draft Agenda

July 10th

8:00 Bus: Iwaki station (JR) to Spa Resort Hawaiians

8:00 Bus: Iwaki Washington Hotel to Spa Resort Hawaiians via Iwaki station

8:40 Arrive at Spa Resort Hawaiians, registration[#]

[#]The details of registration are shown in later pages.

9:00 – 9:15 Opening

- Welcome (K. Okamoto, JAEA)
- Introduction of three days schedule (A. Sudo, JAEA)

**Session-1 SA-code, FDNPS, modeling (chairs: N. Andrews(SNL), T. Yamashita(JAEA))
(9:15-12:10)**

(20 min. presentation + 5 min. discussion)[#]

[#]All participants are requested to take into account presentation guidelines.

See the last page for details.

- CoreSOAR Core Degradation State-of-the Art Report Update: Summary and Conclusions (T. Haste, Imperial College)
- Importance of core-material enthalpy for core-material relocation behavior and final debris distribution/characteristics (I. Sato, JAEA)
- Uncertainty Analysis of the Likely State of BWR Core Materials Prior to the Relocation of Those Materials into the Lower Plenum Under Fukushima-Daiichi-like Conditions (C. Allison, ISSRS)

Coffee break (10:35-10:50)

- MELCOR V2.2 Uncertainty Analysis of Corium Composition and Relocation to the Lower Plenum at Fukushima Daiichi Unit 2 (L. Albright, SNL)
- Development of a Severe Accident Code CINEMA (JH. Song, KAERI)
- About the use of CALPHAD data for in-vessel corium pool modeling at macro- and meso-scales (R. Le Tellier, CEA)

Lunch (12:10-13:00)

Group photo is taken before lunch.

Session-1 (cont.) (13:00-13:50)

- Development and validation of MAVR-TA code for simulating of the fission products release and transport during severe accident (Y. Shmelkov, Kurchatov Institute)
- Present status of the THS-15 tests, CAPS proposal RPV integrity technical position paper (J. Zdarek, NRI)

Session-2 High temperature experiment, measurement (chairs: SM. An(KAERI), A. Pshenichnikov(JAEA)) (13:50-17:15)

(20min. presentation + 5min. discussion)[#]

[#]The instruction for oral presenter is shown in the last page.

- Lessons learnt from the use of thermodynamic calculations for corium spreading experiments (C. Journeau, CEA)
- European post-test analysis round robin on a corium concrete sample representative of reactor case (M. Kiselova, NRI)
- Recent high-temperature simulation experiments for elucidating severe accident phenomena (W. Villanueva, KTH)

- The NUCLEA Database for Corium Applications: State of Validation
(M. Barrachin, IRSN)
- Study of phase equilibria in the U-Zr-Fe-O system on the RASPLAV experimental platform
(V. Almiashhev, NITI)
- Boron behaviour issue during control blade degradation at the beginning phase of postulated scenario for 1F Unit 2 accident reproduced in the CLADS-MADE-01 test
(A. Pshenichnikov, JAEA)
- Experimental investigations on penetration failure for Fukushima Dai-ichi BWR's -RPV bottom head
(SM. An, KAERI)
- Fuel Coolant Interaction and materials effects for Severe Code Applications
(P. Piluso, CEA)

Break (17:15-19:00)

Participants of reception can take your rest. There are a shopping mall, meeting space, pools, hot spring bath, café, tavern and so on.

Participants who "NOT" participate to the reception can use a shuttle bus bound for Iwaki station. Please contact JAEA staff on the details.

Reception + Hawaiian show (19:00-21:30)

Buffet style dinner with free drink (open bar) is served in 'OHANA' (same room). The Hawaiian show starts at 20:30 at the stage. You are requested to move from the room 'OHANA' to the stage (2 min. on foot). Your seats are premium (2nd to 6th rows). You can take photo (without flash) or video during show for yourself. Due to special policy and marketing of digital media regulation about simultaneous relay broadcasting rights Do 'NOT' make direct streaming of the show to any social network. You can upload them to social networks later.

Group photos and snapshots can be downloaded later from JAEA website.

If you want to take pictures with Hula girls, please get on the stage after the show. You are requested to show your pass.

21:40 Shuttle bus (Spa Resort Hawaiians to Iwaki station/Hirono station/J-village)

July 11th

(Bus)

7:10 Bus (Iwaki station to J-village)

(FDNPS-tour participants)

8:30 Tour bus (J-village to TEPCO)

9:30-13:15 FDNPS-tour

Participants of FDNPS-tour are requested to bring a photo ID already registered.

Participants are requested to wear a long-sleeve shirt, long trousers and socks. Skirt, half-sleeve shirt, short trousers, sandals and high heel shoes are strictly prohibited.

13:40-14:10 Lunch (in the bus on the way back to Naraha R&D Center)

(Other participants)

9:00 Bus (Iwaki station to J-village)

9:55 Bus (Hirono station to J-village)

10:20 Bus (J-village to Naraha R&D Center)

10:45-12:00 Naraha R&D center tour

Participants for technical tour of Naraha R&D center are requested to go to Exhibition room in 1st floor.

Participants "NOT" for technical tour are requested to go to Multipurpose room in 3rd floor.

12:00-13:00 Lunch

13:00-14:30 Poster session (by poster presenters who "NOT" participate to FDNPS-tour) # The instruction for poster presenters is shown in the last page.

(All)

Session-3 Thermodynamic database and modelling, fundamental research (chairs: S. Nichenko (PSI), A. Quaini (CEA)) (14:30-16:50)

(15min. presentation + 5min. discussion)#

The instruction for oral presenter is shown in the last page.

- Coupling of GEMS with MELCOR and application to fission products release in MSR (S. Nichenko, PSI)
- Modelling nuclear fuel behaviour with TAF-ID: Calculations on test VERDON-1, representative of a nuclear severe accident (E. Geiger, UOIT)
- Thermodynamic properties and modeling of binary and multicomponent oxide systems containing SrO at high temperatures (V. Stolyarova, SPSU)
- Chemical durability of Chernobyl "lava" and corium (B. Zubekhina, KRI)

- Experimental investigation of the U-Zr-Fe-O liquid miscibility gap (A. Quaini, CEA)
- Review of Leaching behavior of nuclides from spent fuels and debris (T. Sonoda, CRIEPI)
- Structural and thermo-physical characterisation of U,Zr-oxides and its application to corium formed in severe accidents (D. Bottomley, JAEA/ex-JRC)

17:00 – 18:30 Poster session (by all poster presenters)#

#The instruction for poster presenter is shown in the last page.

18:30 Bus (Naraha R&D Center to J-village/Hirono station/Iwaki station)

**19:00 Dinner buffet in J-village restaurant,
Then, “Free talk session” in a meeting room of J-village**

July 12th

(Bus)

7:35 Bus (Iwaki station to J-village)

8:35 Bus (Hirono station to J-village)

**Session-4 Accident Tolerant Fuels (chairs: M. Steinbrück(KIT), S. Yamashita(JAEA))
(9:00-12:10)**

(20min. presentation + 5min.discussion) #

#The instruction for oral presenter is shown in the last page.

- KIT activities on ATF cladding research (M. Steinbrück, KIT)
- SiC-based Accident-Tolerant Fuel Claddings – Material Properties and Behavior in Severe Accident Conditions (Y. Kato, ORNL)
- Development of Laser Heating Facility for Steam Oxidation at Extreme Temperatures (H. vu Pham, JAEA)
- MAAP5 modeling of QUENCH tests within the Westinghouse ATF development program (W. Luangdilok, Fauske & Associates, LLC)

10:40 – 10:55 Coffee break

- Preliminary study on behavior of FeCrAl-ODS/UO₂ fuels under severe accident conditions (K. Sakamoto, NFD)

- Development of Accident Tolerant Control Rod for Light Water Reactors
(H. Ohta, CRIEPI)
- Preparation of uranium and uranium-thorium nitride microspheres for production of accident tolerant fuels
(L. Gonzalez, Chalmers Univ. Tech.)

12:10 – 13:00 Lunch

Session-5 Panel discussion (Moderators: P. Piluso (CEA), M. Kurata(JAEA)) (13:00 – 15:30)

Panel Theme: Information exchange about the key issues arisen from each session and expectations to the next step, including TCOFF-2.

Conclusion

(P. Piluso, M. Kurata)

16:00 Shuttle bus (J-village to Hirono station/Iwaki station)

Poster session (a board (A0 size) is available for poster presenters)

(SA-code, FDNPS, modeling)

1. Susumu Yamashita (JAEA), Development of a melting process simulation code for fuel assemblies based on computational fluid dynamics and materials science models
2. Kenta Inagaki (CRIEPI), Application of Particle Method for The Internal Flooding Analysis in The Nuclear Power Plant Buildings
3. Naoki Sano (INSS), Analytical evaluation on fuel damage progression in the SFD 1-4 test
4. Anton Pshenichnikov (JAEA), Analysis of the video data from Fukushima Dai-Ichi Unit-2 pedestal debris inspection in comparison to the CLADS-MADE-01 debris
5. Hiroshi Madokoro (JAEA), Re-assessment of a severe accident analysis code against BWR core degradation tests
6. Penghui Chai (JAEA), Preliminary work for evaluating the heat balance condition in the lower head with relocated core materials by STAR-CCM+ software
7. Xin Li (JAEA), Sensitivity analysis of core slumping and alternative water injection in Fukushima Dai-Ichi Nuclear Power Plant unit 3
8. Shinji Yoshikawa (JAEA), Inverse analysis of steam and hydrogen generation history of Fukushima Dai-ichi Nuclear Power Plant unit 3
9. DongGun Son (KAERI), Evaluation of thermal load in the lower plenum of SMART reactor during the severe accident with CINEMA code package in Korea
10. Ayumi Itoh (TITECH), Simplified fuel liquefaction model based on U-Zr-O ternary system under severe accident progression
11. Jubaidah (Waseda Univ.), MPS Method for Mechanistic Analysis of Bubble Effect on Corium Spreading over Concrete in Single and Double Channels

(High temperature experiment, measurement)

12. Adrien Pivano (CEA), Experimental and thermodynamic approach for In-Vessel retention and "Focusing Effect" application.
13. Bence Meszaros (CVR), CVR cold crucible method (tentative)
14. Saishun Yamazaki (JAEA), Oxidation and hydrogen uptake test of simulated BWR fuel bundle in steam-starved conditions
15. Ayako Sudo (JAEA), The Segregation behavior in U-Zr-Fe-O system during solidification process

16. Takuya Yamashita (JAEA), Cutting of the CMMR-4 test bundle after test by the AWJ technique
17. Junpei Imoto (JAEA), Fission product chemistry database ECUME
18. Kunihisa Nakajima (JAEA), Development of an overall correlation model for caesium chemisorption onto stainless steel
19. Fumihiro Nakamori (CRIEPI), Examination of the microstructure in insoluble Cs-bearing micro particle
20. Kinya Nakamura (CRIEPI), Core Degradation Behavior in The High-Temperature Steam Environment
21. Mara Loenartz (Bonn Univ.), The alteration behaviour of Chernobyl lava studied in situ and real time by fluid-cell Raman Spectroscopy
22. Rizky Dwi Septian (TITECH), Thermodynamic properties of silicon-caesium compounds at high temperature
23. Melany Gouello (VTT), Research at VTT on the Transport and Chemistry of Fission Products in Primary Circuit during Severe Accident in LWR

(Thermodynamic database and modelling, fundamental research)
24. Taku Nagatake (JAEA), Preliminary Study on Molten Core Behavior in Lower Part of Reactor Pressure Vessel by Using CFD codes
25. Takumi Sato (JAEA), Development of solidification and segregation model for molten corium
26. Mitsuhiro Itakura (JAEA), First-principles Calculation of Mechanical Properties of Simulated Debris (Zr,U)O₂
27. Makoto Nanko (Nagaoka Tech.), Recession of ZrO₂ scale formed on Zircaloy in molten stainless steel-B₄C at high temperatures
28. Thi Chau Duyen Le (Nagaoka Tech.), Influence of irradiation on metakaolin-based potassium geopolymer applying in the nuclear waste container
29. Xuan Thi Hoang (Nagaoka Tech.), Deposition of caesium molybdate on SS316 in dry argon gas
30. Yang Yaru (Nagaoka Tech.), Synthesis and characterization of fly metakaolin-based sodium geopolymer

31. Ngarayana I Wayan (Nagaoka Tech.), GTHTR300C Safety Graded Approach by Utilizing Fuzzy FMEA Expert Judgement Methodology
32. Kazuo Kawakami (NSSMC), Thermodynamic database for fuel debris and concrete
33. Hiroto Ishii (Osaka Univ.), Effect of oxygen defects formed on metal-oxides polycrystalline solid surfaces on liquid CsI wettability
34. Daisuke Okada (Osaka Univ.), Synthesis and characterization of metallic phase existed in fuel debris
35. Hiroshi Ogi (OECD/NEA, TCOFF project), Benchmark study on the FDNPS (Fukushima-Daiichi Nuclear Power Station) Accident using Existing Thermodynamic Databases in the OECD/NEA TCOFF# Project
36. Henghui Chen (TITECH), Thermodynamic of the B_2O_3 - Cs_2O binary system
37. Tianyuan Hong (Tohoku Univ.), Solidification analytical model of molten fuel
38. Yousuke Okamura (Tohoku Univ.), Distribution and leaching behavior of Cs and Sr in simulated MCCI product
39. Takehiro Sumita (JAEA), Dissolution behavior of solid stainless steel by its molten eutectic mixture with B_4C : experimental investigation
40. Yuta Kumagai (JAEA), Spectroscopic study of uranium materials for understanding chemical degradation of fuel debris.

(ATF)

41. Marek Mikloš (CVR), Possibilities of ATF cladding studies at CVŘ facilities
42. Marcus Hedberg (Chalmers Univ. Tech.), Production of high purity UN fuel kernels by the internal gelation process

(in addition)

43. Saurabh Sharma (TITECH), A Study on the Lessons Learned from Fukushima Daiichi Nuclear Power Plant Accident towards the Future Implementation of the India-Japan Civil Nuclear Cooperation

Registration (day-1, 10th):

- **Participants of reception (general)** are requested to pay JPY11,000 (cash only). This includes lunch box (10th), dinner buffet + drinks, Hawaiian show and one-day pass of Spa Resort Hawaiians. In Spa Resort Hawaiian, there are variety of pools, hot spring bathes, shopping mall with traditional atmosphere, massage and so on (basically, free in charge if you have a pass. You need to pay extra for massage and other special activities). To visit the open air hot spring bath is recommended, which is registered in “Guinness book” as the world biggest open air hot spring bath (approximately 1000m²). As for the pools, you are requested to bring your swimming wear and a towel (rental wears and towels are served in Hawaiians). As for the hot spring bath, it is strictly divided into male’s area and female’s area. Then, you are requested to soak in the hot spring without any towels.
- **Participants of reception (student)** are requested to pay JPY7,000 (cash only).
- You are requested to bring your entrance pass of Spa Resort Hawaiians.
- **Participants who will not participate to the reception** are requested to stay only in open area, such as a meeting room, a lunch room, entrance, café and so on. If you want to go to activity areas, you are requested to pay JPY1,000 (please contact to JAEA staff).
- **All participants** can leave your luggage in the container of bus (the container is locked) or can deposit at a meeting room (the room is ‘not’-locked). You are requested to bring valuables with you.

(day-2, 11th)

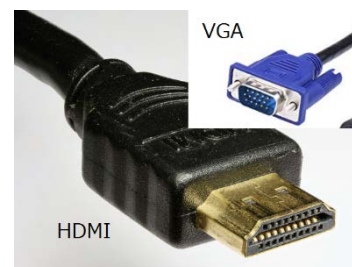
- Participants who “NOT” participate to FDNPS-tour are requested to pay JPY1,000 for Japanese style lunch box (cash only) at registration. There is no other choice at Naraha R&D Center.
- As for the participants of FDNPS-tour, the bus will depart from Iwaki station and stop by at Hirono station and J-village. Please confirm time tables of connection bus. On the way back to Naraha, the bus will stop by at Sakura mall after the tour. You can buy a sandwich or a lunch box at the mall.
- As for the participants of FDNPS-tour who will make a poster presentation, you are requested to submit your posters before the tour at the desk of J-village. Your contact person is Dr. Saishun Yamazaki of JAEA.
All participants are requested to bring an entrance pass of Naraha center and return it when you will leave.
- In the evening of 11th, free talk session will be held in a meeting room of J-village. The participants are requested to purchase drinks or snacks at a convenience store of J-village.

(day-3, 12th)

- Participants of day-3 are requested to pay JPY1,000 for Japanese style lunch box (cash only). As the other option, you can purchase a small food in the convenience store.
- Participants who need various requests for meals: Please contact JAEA staff.

Presentation guidelines:

- **Oral presentations:** 20 minutes + 5 min discussion (except Session 3).
- **Session 3 oral presentations** because of tight schedule time reduced to 15 min for presentation + 5 min for discussion.
- In the conference room there will be a JAEA's laptop and a beamer. Please prepare your USB-stick with presentation and JAEA staff will help to upload it. For any additional requests concerning your presentations (add/remove slides) please always contact JAEA's staff in charge.
- In case the presenter would like to use his/her own laptop it is highly recommended to use HDMI socket. In case of VGA-type socket or Apple products, if possible, please prepare a proper adaptor from your PC to HDMI. Organizing committee will try to support the presenters too.
- **Posters.** The poster size is A0. Each author will be assigned a number. In the Naraha research centre in the poster session room please put your poster at the specially prepared desk with a corresponding number.
- The **poster participants** who **also** take part in **Fukushima-1** NPS tour are kindly requested to give their posters in the morning of July 11th just before the tour to Dr. Saishun Yamazaki – who is in charge of the posters this day. He will attach your poster to the corresponding desk.
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Thank you for cooperation!