



ENERGY AND ENVIRONMENT DEPT. «DIPARTIMENTO
DESTEC» – GRNSPG (San Piero a Grado)

UNIVERSITA' DI PISA
56100 PISA - ITALY

[2] OECD/NEA/CSNI – MADRID 2020 SM THE ESTABLISHED CAPS

F. D'Auria

***OECD/NEA/CSNI
SPECIALISTS MEETING ON TRANSIENT THERMAL-HYDRAULICS IN
WATER COOLED NUCLEAR REACTORS (SM-TH)***

1st TPC Meeting, CIEMAT, Madrid (Spain), Jan.30, 2020

CONTENTS



- ✓ **FOREWORD**
- ✓ **EXTRACTS FROM THE CAPS DOCUMENT**
- ✓ **FINAL NOTES**

TIME SCHEDULE OF THE CAPS

- 1) PROPOSAL OF SM DISCUSSED AMONG W-GAMA BUREAU MEMBERS IN **SPRING 2019**
- 2) GREEN LIGHT FOR THE PROPOSAL AT THE W-GAMA BUREAU MEETING OF **JUNE 2019** (PARIS)
- 3) APPROVAL OF THE PROPOSAL AT W-GAMA MEETING OF **SEPT 2019**
- 4) APPROVAL OF THE PROPOSAL (MINOR CHANGES REQUESTED) AT PRG MEETING OF **NOV 2019**
- 5) APPROVAL OF THE PROPOSAL AT CSNI MEETING OF **DEC 2019**

PROJECT OBJECTIVES 1 OF 2

CSNI has a long-lasting history in nuclear thermal-hydraulics. This was established during the 70's decade in previous century and testified by milestone type of reports and Specialists Meetings issued or held in the last 50 years .

Namely, five groups of key reports can be distinguished:

- ✓ **The SOAR: TPCF, TECC, BWRS, and, more recently, the Scaling (and the passive System) reports;**
- ✓ **The validation reports: a couple dozen ISP on thermal-hydraulics and the SET and the ITF related Validation matrices reports, including identification of phenomena.**
- ✓ **The uncertainty related reports: more details in the 'justification' row below.**
- ✓ **The CFD application & advancement activities, including synthesis views, conference documentation (noticeably CFD4NRS) and pioneering activities (e.g. the uncertainty in CFD prediction)**
- ✓ **Documentation of OECD project starting from LOFT: more details in the 'justification' row below.**

Specialists Meetings in the area of thermal-hydraulics are listed under the row 'justification' below. Furthermore, a specific activity has been started in 2004 dealing with transfer of competences. This is called THICKET.

PROJECT OBJECTIVES 2 OF 2

Thus one 'indirect' objective is to maintain the competence of CSNI in the area of thermal-hydraulics.

The main 'direct' objective is to discuss the achievements and defining the needs of safety research in nuclear reactor accident thermal-hydraulics.

In particular:

- To report on the major achievements accomplished in recent years.
- To discuss the maturity of nuclear thermal-hydraulics for evaluating safety of existing reactors, identifying strengths and drawbacks of the current analysis approaches.
- To define the needs and priorities of research on safety-related thermal-hydraulics, particularly under accident conditions.

PROJECT SCOPE

The large part of the scope (*90% may provide an idea*) deals with the water cooled nuclear reactors, the operation and the related design and beyond (i.e. Design Extended Conditions, part a, or DEC-a) design basis accident conditions before loss of geometric integrity for the core. Sub-channel and containment codes are included when connected with system TH codes. Coverage is expected for selected water cooled SMR with main reference to those in advanced design state or in construction like NuScale, CAREM, SMART and Russian water cooled prototypes.

From the viewpoint of numerical codes and procedures, system codes (and related modelling, including 3D) and related uncertainty evaluation and experiments (primarily integral type), together with phenomena, will keep the main attention (*90% may provide an idea together with the previous part of the scope*).

Focus will be put on thermal-hydraulic aspects and implications, connected with system TH codes, of:

- 1. Neutron physics modeling.**
- 2. Nuclear fuel modeling.**
- 3. 3D modelling (e.g. fuel bundle; CFD included).**
- 4. Spent Fuel Pool, SFP (basically thermal-hydraulics of SFP).**
- 5. Severe accidents (basically until core degradation becomes significant and in any case looking at TH aspects)**

PROJECT JUSTIFICATION 1 OF 2

As can be noted from historical records, Specialist Meetings on Thermal-hydraulics have been held from mid 70's to the beginning of this decade and have been proved to be insightful establishing the "current state" at the time and the targets for further research:

- 1) **Toronto, 1976**, Aug. 3-4, CSNI Specialists Meeting on Transient two-phase flow
- 2) **Paris, 1978**, June 12-14, 2nd CSNI Specialists Meeting on Transient Two-Phase Flow
- 3) **Pasadena, 1981**, March 23-25, 3rd CSNI Specialist Meeting on Transient Two-Phase
- 4) **Aix-en-Provence, 1992**, April 6-8, CSNI Specialist Meeting on Transient Two-Phase Flow - System Thermal-hydraulics
- 5) **Annapolis, 1996**, Nov. 5-8, OECD/CSNI Workshop on Transient Thermal-hydraulic & Neutronic Codes Requirements
- 6) **Ankara, 1998**, June 29 -July 1, OECD/CSNI Seminar on Best Estimate Methods in Thermal-Hydraulic Analyses - Ankara (Tr)
- 7) **Barcelona, 2000**, April 10-13, OECD/CSNI Workshop on Advanced Thermal-Hydraulic and Neutronic Codes: Current and Future Applications
- 8) **Barcelona, 2011**, Nov. 16-18, OECD/NEA/CSNI Workshop on Best Estimate Methods and Uncertainty Evaluations,

PROJECT JUSTIFICATION 2 OF 2

Furthermore, in the period from 2011-2019 the following additional activities, [which can be connected with the current proposal although they are entirely different](#), were successfully carried out in the area (being either WGAMA activities or closely-related to them):

- I) **THICKET Seminars to present key findings (series started in 2004, then 2008, 2012, 2016 and now 2020, scheduled);**
- II) **'Internally' financed Projects like BEMUSE (finished 2012), PREMIUM (2012 -2017), SAPIUM (started 2018 and continuing), Scaling (SOAR published in 2017), ISP50 (finished 2016), Passive systems (on-going since 2017);**
- III) **'Externally' financed international projects like PKL, ROSA/LSTF, ATLAS and PANDA.**

It should be emphasized that while THICKET deals with well settled knowledge transfer and management, the TH-SM is aimed to be a brainstorming technically-based event intending to outline the key thermal-hydraulics needs for the future.

Furthermore, in the same period 2011-2019, Russia, China, India, Argentina and Romania joined NEA and will have interest in contributing to the plan of future activities in thermal-hydraulics and in getting a comprehensive picture of what has been done and of remaining issues.

All the [items](#) above highlight the timeliness of bringing experts together and come out with a statement of the current state of safety-related thermal-hydraulics and the specific needs in the short- and mid-term.

Needless to say that the picture for nuclear thermal-hydraulics coming from the on-going Senior Experts Group (CSNI-SESAR, expected to complete the activity in 2020) will be considered (at least one paper presented).

USERS AND RELATION TO OTHER PROJECTS

USERS

A spectrum of experts from National Safety Authorities, Research Laboratories, Universities, Vendors and Utilities are expected to be the end users for the information discussed at the Meeting and the participants to the Meeting.

RELATION TO OTHER PROJECTS

Linkages to other CSNI or other NEA activities are provided in the row 'Justification'. Furthermore differences from similar activities and additional peculiarities of the SM-TH are discussed below:

A) Differences related to NURETH, NUTHOS, ICONE, ICAP, etc. Conferences: **A1) The area covered in the SM-TH is restricted (90%) to the areas of interest of CSNI during the last 1-2 decades; A2) Only Specialists in TH with several year of expertise in the area are making presentations;** A3) All presenters are invited; A4) All papers are discussed in Plenary Sessions; A5) Each (or the majority) of presentations will take around 1 hour (including discussion); A6) Feedback from the presentation are analyzed in post-meeting activities .

B) Differences related to THICKET: B1) 3-5 Specialists in Thermal-hydraulics are making presentation in THICKET while a 10-times large number is expected in the SM-TH; B2) as already mentioned THICKET focus is on transfer of information to young scientists, while SMTH focus is to discuss relevant information, including controversial topics (of low interest to THICKET); B3) THICKET is a training activity.

SAFETY SIGNIFICANCE AND TECHNICAL GOALS

SAFETY SIGNIFICANCE

Priority attention will be devoted to

- Keeping the expertise.
- (Attempting to) depict the future of research in nuclear thermal-hydraulics.
- Pin-pointing the limitations and the current way to overcome those limitations (e.g. uncertainty analysis).

Criteria 1, 2, 3, 4 in section 5.1 (Prioritizing Criteria) of CSNI Operating Plan and Guidelines 2017-2022 [NEA/CSNI/R(2017)17, issued 16-Feb-2018] are matched by the proposed activity.

TECHNICAL GOALS

Technical goals defined in section 4.1.2 of CSNI Operating Plan and Guidelines 2017-2022 [NEA/CSNI/R(2017)17, issued 16-Feb-2018] are concerned by the present activity and synthesized as follows:

- A) To develop and to maintain databases in key areas;
- B) To initiate new cooperative research projects.

Related to item B) at least one paper will be devoted to the Database issue.

KNOWLEDGE MANAGEMENT AND MILESTONES

KNOWLEDGE MANAGEMENT

All papers will be invited or “stimulated”. Some space may be left to open contributions which (according to the Technical Program Committee) may provide a valuable input for the objective.

MILESTONES

- 1) Endorsement by WGAMA Bureau members (May 14, 2019).
- 2) Endorsement by WGAMA members (September, 2019)
- 3) Endorsement by PRG (October, 2019)
- 4) Endorsement by CSNI (December, 2019)
- 5) 1st TPC meeting (January 2020), 1.5 full days
- 6) Jan. 31, 2020 – Letter to invited and stimulated speakers
- 7) March 31, 2020 – Deadline for summaries
- 8) 2nd TPC Meeting (around April 30, 2020): approval of abstracts.
- 9) Sept. 30, 2020 – Deadline for final papers
- 10) Sept. 2020 – 3rd TPC meeting : finalization of the program
- 11) Dec. 2020 – Specialists Meeting
- 12) December 2021 Report submitted to CSNI

EXTRACTS FROM THE CAPS DOCUMENT



LEAD ORGANIZATION AND COORDINATION & PARTICIPANTS

LEAD ORGANIZATION AND COORDINATION

The Workshop will be hosted by CSN and CIEMAT in CIEMAT headquarters in Madrid. CSN and CIEMAT offered to be the local organizers in charge of logistics and facilities. UNIPI is available to support the technical organization. Coordination will come from the organizations of the members of the WGAMA Bureau: USNRC, CEA (not current member but proposed in Technical Program Committee [TPC]), IRSN, CIEMAT, KAERI, JAEA and KTH (all CSNI member organizations). Proposed names of TPC members are:

F. Barré, K-Y. Choi, F. D'Auria, L. Herranz, D. Jacquemain, R. Lee, H. Nakamura, M. Sanchez Perea (F. Barré should propose somebody from CEA and/or EdF, Nakamura, in case of difficulty to participate in the activities may also nominate somebody from Japan)

TPC members are expected to meet two times before the SM-TH and to meet at the end of the SM-TH.

PARTICIPANTS

All WGAMA organizations are expected to participate and will be invited to attend the SM-TH. Special role is foreseen for NEA- NSC (1-2 paper will be stimulated from NSC also to coordinate future activities in the area). EC and IAEA will also be invited (tentatively one paper each). Effort will be made to have new NEA Countries (listed under 'Justification').

Tentatively (TPC will finalize the proposal below) and assuming 3.5 meeting days:

- 4 speakers each morning (each one 1 hr given): total 16 speakers
- 7 speakers each afternoon (each one ½ hr given): total 21 speakers
- 37 papers discussed.

ALL TOPICS OF CAPS TO BE FULFILLED

PROGRESSING WITH THE ORGANIZATION (E.G. INSIGHTS INTO PREVIOUS OECD/NEA/CSNI TH SM & BEST SOLUTION TO ACHIEVE THE PLANNED GOALS OF THE SM) MAY JUSTIFY MINOR CHANGES, E.G. «PARTICIPANTS».