



**IAEA**

International Atomic Energy Agency

# **Technical Meeting on the Benefits and Challenges of Fast Reactors of the SMR Type**

**Hosted by the  
Government of Italy**

**through  
Interuniversity Consortium for Nuclear Technology Research CIRTEN**

**24–27 September 2019**

**Milan, Italy**

**Ref. No.: EVT1803539**

**AGENDA**

## MEETING ORGANIZATION

<i>General Chair</i>	<i>Mr Pietro Agostini</i>
<i>Honorary Chair</i>	Mr Georgii Toshinskii
<i>Chair of Local Organizing Committee</i>	Mr Marco Ricotti
<i>Scientific Secretaries</i>	Mr Vladimir Kriventsev Mr Frederik Reitsma Mr Chirayu Batra

## METING SESSIONS

<i>Session</i>	<i>Title</i>	<i>Chair</i>
<i>Session I</i>	Sodium Cooled Fast SMRs	Mr Vladimir Kriventsev Mr Akira Yamaguchi
<i>Session II</i>	HLM Cooled Fast SMRs	Mr Didier de Bruyn Mr Janne Wallenius
<i>Session III</i>	Molten Salt Fast SMRs	Mr Jiri Krepel
<i>Session IV</i>	Economic Aspects and Fuel Cycle of Fast SMRs	Mr Georgii Toshinskii
<i>Session V</i>	Safety Aspects of Fast SMRs	Mr Paul Gauthe Mr Hiroki Hayafune
<i>Session VI</i>	Technology and Research in Support of SMR Development	Ms Lixia Ren Mr Iurii Ashurko

## GROUP DISCUSSIONS

<i>Group Discussion</i>	<i>Title</i>	<i>Chair</i>
<i>Group Discussion I</i>	In-factory construction	Mr Janne Wallenius
<i>Group Discussion II</i>	Technological challenges to be resolved	Mr Vladimir Kriventsev
<i>Group Discussion III</i>	Benefits of fast SMRs including market needs	Mr Marco Ricotti

Day 1, Tuesday, 24 September 2019					
<i>Start</i>	<i>End</i>	<i>Topic</i>	<i>Speaker</i>	<i>Duration</i>	
10:00	10:05	Opening by IAEA	Mr Vladimir Kriventsev, IAEA	0:05	
10:05	10:10	Welcome Remarks by POLIMI	TBD, Politecnico di Milano	0:05	
10:10	10:20	Self-Introduction of Participants	All	0:10	
10:20	10:25	Nomination of the Chairperson	All	0:05	
10:25	10:30	Discussion and Approval of the Agenda	All	0:05	
10:30	10:50	Meeting Objectives + IAEA Activities in FR	Mr Vladimir Kriventsev, IAEA	0:20	
10:50	10:50	<b>Session I: Sodium Cooled Fast SMR, Chairs: Mr Vladimir Kriventsev, Mr Akira Yamaguchi</b>			
10:50	11:20	ID-6: Large Eddy Simulation of Thermal Striping in the Upper Internal Structure of the Prototype Gen-IV Sodium-cooled Fast Reactor	Mr Dehee Kim, KAERI, Korea, Rep. of	0:30	
11:20	11:40	<b>Coffee Break</b>			<b>0:20</b>
11:40	12:10	ID-10: SMR CADOR : an inherently safe small SFR as a response to the dilemma 'safety vs cost'	Mr Paul Gauthé, CEA, France	0:30	
12:10	12:40	ID-23: Feasibility study of small sodium cooled fast reactors	Mr Hiroki Hayafune, JAEA, Japan	0:30	
12:40	14:00	<b>Lunch Break</b>			<b>1:20</b>
14:00	14:30	ID-27: A preliminary study of autonomous and ultra-long life hybrid micro-modular reactor cooled by sodium heat pipes	Mr Seoungdong Jang, KAIST, Korea, Rep. of	0:30	
14:30	14:50	<i>Summary: I. Sodium Cooled Fast SMR</i>	Mr Vladimir Kriventsev, IAEA	0:20	
14:50	14:50	<b>Session II: HLM Cooled Fast SMR, Chair: Mr Didier De Bruyn, Mr Janne Wallenius</b>			
14:50	15:20	ID-1: Thermal Hydraulic Safety Analyses in Support of SEALER	Mr Kevin Zwijzen, Mr Ferry Roelofs, NRG, Netherlands	0:30	
15:20	15:50	ID-2: LFR-SMR: affordable solutions for all needs	Mr Luciano Cinotti, Hydromine, Luxembourg	0:30	
15:50	16:10	<b>Coffee Break</b>			<b>0:20</b>
16:10	17:10	<b>Group Discussion I: In-factory construction</b>	Mr Janne WALLENIUS, KTH, Sweden	<b>1:00</b>	
17:10	17:30	Wrap-up of Day 1	Meeting Chair	0:20	
17:30		<b>End of Day 1</b>			

Day 2, Wednesday, 25 September 2019				
Start	End	Topic	Speaker	Duration
9:30	9:30	<b>Contd...Session II: HLM Cooled Fast SMR, Chair: Mr Didier De Bruyn, Mr Janne Wallenius</b>		
9:30	10:30	ID-4: Inherent Self-Protection, Passive Safety and Competitiveness of Small Power Modular Fast Reactor SVBR-100	Mr Georgii Toshinskii, IPPE & AKME-Engineering, Russia	1:00
10:30	11:00	ID-7: CLFR-300, an Innovative Lead-cooled Fast Reactor Based on Natural-driven Safety Technologies	Mr Zhao Chen, CGN, China	0:30
<b>11:00</b>	<b>11:20</b>	<b>Coffee Break</b>		
11:20	11:50	ID-15: Conceptual Design of China Lead-based Mini-Reactor CLEAR-M10d	Mr Chao Liu, INEST, China	0:30
11:50	12:20	ID-24: Lead Fast Reactor technology: a promising option for SMR application	Mr Giacomo Grasso, ENEA, Italy	0:30
12:20	12:50	ID-30: SEALER-UK: a 55 MWe lead-cooled reactor for commercial power production	Mr Janne WALLENIUS, KTH, Sweden	0:30
<b>12:50</b>	<b>14:00</b>	<b>Lunch Break</b>		
14:00	14:30	Supplementary presentation on Underground Nuclear Power Plants	Mr Didier DE BRUYN, SCK•CEN, Belgium	0:30
14:30	14:30	<b>Session III: Molten Salt Fast SMRs, Chair: Mr Jiri Krepel</b>		
14:30	15:00	ID-8: INNOVATIVE MODELLING APPROACHES FOR MOLTEN SALT SMALL MODULAR REACTORS	Mr Eric Cervi, Mr Marco Ricotti, Politecnico di Milano, Italy	0:30
15:00	15:00	<b>Session IV: Economic Aspects and Fuel Cycle of Fast SMRs, Chair: Mr Georgii Toshinskii</b>		
15:00	15:30	ID-22: A CHARACTERIZATION OF THE FINANCIAL RISK PROFILE OF FAST SMRS	Ms Sara Boarin, Politecnico di Milano, Italy	0:30
<b>15:30</b>	<b>15:50</b>	<b>Coffee Break</b>		
15:50	16:50	<b>Group Discussion II: Technological challenges to be resolved</b>	Mr Vladimir Kriventsev, IAEA	1:00
16:50	17:05	Supplementary presentation of H2020 proposal on BONSAI-SMR: Baseline for Nuclear Safety Assessment of Innovative SMR	Mr Paul Gauthé, CEA/GIF, France	0:15
17:05	17:15	Wrap-up of Day 2	Meeting Chair	0:10
17:15		<b>End of Day 2</b>		

Day 3, Thursday, 26 September 2019				
Start	End	Topic	Speaker	Duration
9:30	9:30	<b>Contd...Session IV: Economic Aspects and Fuel Cycle of Fast SMRs, Chair: Mr Georgii Toshinskii</b>		
9:30	10:00	ID-16: EVALUATION OF POTENTIAL SAFETY AND ECONOMIC BENEFITS AND CHALLENGES OF MODULAR SODIUM-COOLED FAST REACTORS	Mr Iurii Ashurko, IPPE, Russia	0:30
10:00	10:00	<b>Session V: Safety Aspects of Fast SMRs, Chairs: Mr Paul Gauthé, Mr Hiroki Hayafune</b>		
10:00	10:30	ID-3: Experience in physics design and safety analysis of small and medium sized FBRs	Mr Riyas Abdul Salim, IGCAR, India	0:30
10:30	11:00	ID-25: Numerical assessment of sodium fire incident	Mr Takashi Takata, JAEA, Japan	0:30
11:00	11:20	<b>Coffee Break</b>		
11:20	11:50	ID-26: ALFRED PROTECTED LOSS OF FLOW ACCIDENT EXPERIMENT IN CIRCE FACILITY	Mr Fabio Giannetti, La Sapienza, Italy	0:30
11:50	12:20	ID-28: A Passive Safety Device for SFRs with Positive Coolant Temperature Coefficient	Mr Yonghee Kim, KAIST, Korea, Rep. of	0:30
12:20	13:30	<b>Lunch Break</b>		
13:30	13:30	<b>Session VI: Technology and Research in Support of SMR Development, Chairs: Ms Lixia Ren, Mr Iurii Ashurko</b>		
13:30	14:00	ID-5: MYRRHA Technology and Research Facilities in support of Heavy Liquid Metal SMR Fast Reactors	Mr Rafael Fernandez, SCK•CEN, Belgium	0:30
14:00	14:30	ID-18: Introduction of the U.S. DOE Versatile Test Reactor Project	Mr Florent Heidet, ANL, USA	0:30
14:30	15:00	ID-21: Estimation of minimal critical size of bare iso-breeding core for 8 selected fast reactors in Th-U and U-Pu fuel cycles	Mr Jiri Krepel, PSI, Switzerland	0:30
15:00	15:20	<b>Coffee Break</b>		
15:20	15:50	ID-9: A MULTIPHYSICS APPROACH TO LFR ANALYSIS	Mr Marco Sumini, University of Bologna, Italy	0:30
15:50	16:50	<i>Summary: II. HLM Cooled Fast SMR; V. Safety Aspects of Fast SMRs; VI. Technology and Research in Support of SMR Development (20 mins each for the Chairs)</i>	Mr Didier DE BRUYN, SCK•CEN, Belgium; Mr Paul Gauthé, CEA/GIF, France; Ms Lixia Ren, CIAE, China	1:00
16:50	17:00	Wrap-up of Day 3	Meeting Chair	0:10
17:00		<b>End of Day 3</b>		

<b>Day 4, Friday, 27 September 2019</b>					
<i>Start</i>	<i>End</i>	<i>Topic</i>	<i>Speaker</i>	<i>Duration</i>	
9:30	9:30	<b>Discussion session</b>			
9:30	10:30	<i>Group Discussion III: Discussion on benefits of fast SMR including market needs</i>	Mr Marco Ricotti, Politecnico di Milano, Italy	1:00	
10:30	10:50	<i>Coffee Break</i>			<b>0:20</b>
10:50	10:50	<b>Closing Session</b>			
10:50	12:30	Meeting Report, Closing Remarks, Discussion on the Publication etc.	Meeting Chair and IAEA	1:40	
12:30	<b>End of Day 4</b>				
<b>End of Meeting</b>					

## Participants

<i>Name</i>	<i>Country</i>	<i>Organization</i>
<i>Mr Rafael Fernandez</i>	Belgium	SCK•CEN
<i>Mr Didier DE BRUYN</i>	Belgium	SCK•CEN
<i>Mr Gustavo Rubio Anton</i>	Belgium	Bel V
<i>Mr Mateusz Malicki</i>	Belgium	Tractebel-Engie
<i>Mr Yizhe Liu</i>	China	CIAE
<i>Ms Lixia Ren</i>	China	CIAE
<i>Mr Zhao Chen</i>	China	CGN
<i>Mr Chao Liu</i>	China	INEST
<i>Mr Kamil Tucek</i>	EC	JRC
<i>Mr Paul Gauthé</i>	France	CEA/GIF
<i>Mr Waletr Klein-Hesling</i>	Germany	GRS
<i>Mr Andrei Rineiski</i>	Germany	KIT
<i>Mr Riyas Abdul Salim</i>	India	IGCAR
<i>Mr Giacomo Grasso</i>	Italy	ENEA
<i>Mr Pietro Agostini</i>	Italy	ENEA
<i>Mr Marco Ricotti</i>	Italy	POLIMI
<i>Mr Paride Meloni</i>	Italy	ENEA
<i>Mr Antonio Cammi</i>	Italy	POLIMI
<i>Ms Sara Boarin</i>	Italy	POLIMI
<i>Mr Marco Sumini</i>	Italy	University of Bologna
<i>Mr Marco Lanconelli</i>	Italy	University of Bologna
<i>Mr Eric Cervi</i>	Italy	POLIMI
<i>Mr Stefano Lorenzi</i>	Italy	POLIMI
<i>Mr Fabio Giannetti</i>	Italy	La Sapienza
<i>Mr Akira Yamaguchi</i>	Japan	U-Tokyo
<i>Mr Takashi Takata</i>	Japan	JAEA
<i>Mr Hiroki Hayafune</i>	Japan	JAEA
<i>Mr Yonghee Kim</i>	Korea, Rep. of	KAIST
<i>Mr Dehee Kim</i>	Korea, Rep. of	KAERI
<i>Mr Chinyung Kim</i>	Korea, Rep. of	KAIST
<i>Mr Seoungdong Jang</i>	Korea, Rep. of	KAIST
<i>Mr Luciano Cinotti</i>	Luxembourg	Hydromine
<i>Mr Kevin Zwijsen</i>	Netherlands	NRG
<i>Mr Georgii Toshinskii</i>	Russia	AKME-Engineering
<i>Mr Nikita Rtishchev</i>	Russia	Rosatom Overseas
<i>Mr Alexander Levchenko</i>	Russia	SSL
<i>Mr Iurii Ashurko</i>	Russia	IPPE
<i>Mr Janne Wallenius</i>	Sweden	KTH
<i>Mr Jiri Krepel</i>	Switzerland	PSI
<i>Mr Florent Heidet</i>	USA	ANL

## IAEA

<i>Name</i>		
<i>Mr Vladimir Kriventsev</i>	Scientific Secretary	IAEA

## Administrative Support

<i>Name</i>		
<i>Ms Khurshida Abdurasulova</i>	Team Assistant, NPTDS	IAEA