出國報告（出國類別：其他）

參加第 23 屆國際核工會議

服務機關：核能研究所
姓名職稱：曾哲聰　研究員
派赴國家：日本
出國期間：104 年 5 月 16 日~104 年 5 月 22 日
報告日期：104 年 6 月 23 日

摘　要

參加第23屆國際核工會議，The 23rd International Conference on Nuclear Engineering (ICONE 23)。國際核工會議近年來每年舉辦，除了四年前日本發生311大地震，當時身為主辦國的日本，為了因應國內的重大災難而將會議暫時中止。此會議是由美國機械工程師學會(American Mechanical Engineering Society, ASME)主導，過去大致是由美國、歐洲、亞洲（日本）三地輪流舉行。近年來，由於中國在核能上的蓬勃發展，會議於2005年首度在北京舉辦之後，大致演變為四地區輪流主辦的趨勢。今年國際核工會議為第23屆，簡稱ICONE 23，於日本千葉舉行。

日本福島事故之後，核電發展在國際上經歷了一段時間的廣泛檢討，此次會議觀察到新建機組占全球多數的中國幾乎已重回發展的道路，從核電規劃、建造新電廠、燃料製造、安全分析、電廠營運、擬訂國家設計規範等各個階段的論文都有，參加的單位涵蓋產學研，層面相當完整。至於穩定使用核能的國家，譬如美國、法國以及恢復中的日本，因為新建機組相對較少，重點反而是在既有電廠的安全改善與延役。日本雖然尚未有機組恢復運轉，但是後續的努力與準備看來相當充分。至於國內現況，龍門電廠機組已經進行封存與停建，而其它各核電廠仍是現階段電力的穩定來源。參與國際會議，掌握核能安全營運的發展趨勢，蒐集相關技術資訊，有助於因應國內需求，規劃並執行必要之研發工作。

目　次

（頁碼）

一、目 的

ICONE 23 國際核工會議由日本機械學会(The Japan Society of Mechanical Engineers, JSME)，ASME，以及中国核学会(China Nuclear Society CNS)共同承辦，日本為地主國，因此大會行政事務主要仍由 JSME 負責。國際核工會議探討所有核能相關議題，若由核電廠實務來看，從運轉中電廠、開發中機組、第四代反應器等皆有探討。此外日本福島一廠事故發生四年來，電廠除役的進度以及後續管理規劃也是一個重要的議題，各項工作都成為各國關心與學習的重點。此次參與該會議，經由各個場次的論文發表，或是簡報與座談，廣泛蒐集國際上核燃料與零組件分析、材料性質測試與驗證等，對維護國內核電之安全營運都是很重要的資訊，可以協助於國內核燃料及材料相關領域應用以及核電安全營運必要研發工作之規劃與執行。

二、過 程

5/16 ~ 5/16	台北 → 日本 千葉
5/17 ~ 5/21	參加ICONE 23會議
5/22 ~ 5/22	千葉 → 台北

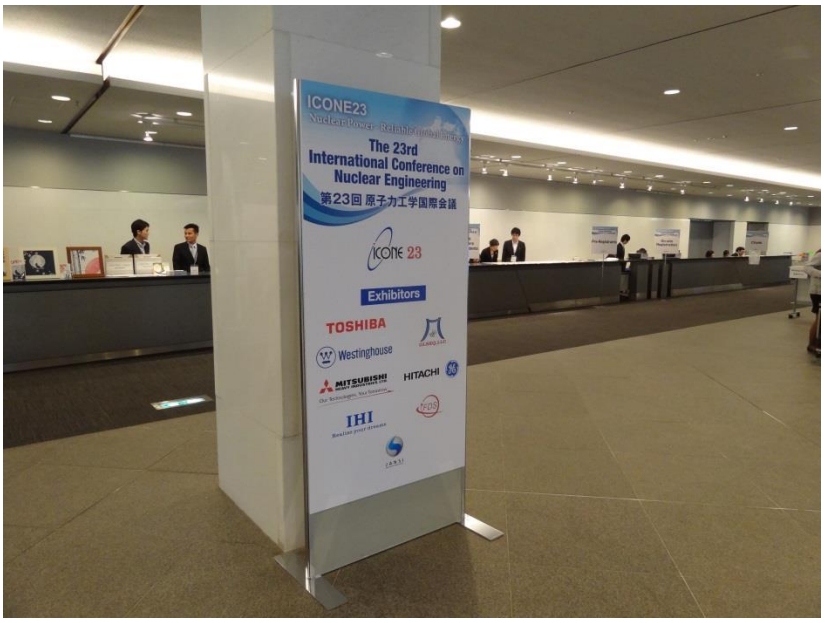
三、心 得

第 23 屆國際核工會議於 2015 年 5 月 17 日~21 日在日本千葉海濱幕張國際會議場(Makuhari Messe International Conference Hall)舉行，該會議場為三層樓建築，大小會議室會共十餘間，是大型研討會的理想地點。會議開幕式以及特別邀請之來賓演講設於 2 樓 Convention Hall，寬廣的空間足夠全員參加。

大會議程區分成兩大類：(1) Panel Session，(2) Technical Session，議程再依據不同領域與研究範疇，分場次同時進行。Panel Session 以目前國際核能界受關切的重要議題為主，邀請各國在該領域之代表人士報告，簡報內容不列入大會論文，也未提供現場聽眾。每個主題大約安排五位講者，簡報後各別於現場接受問題，最後由主席主持座談，亦可再接受聽眾提問進行討論。這一類的探討內容主要是策略規劃、研議中議題發展、跨組織合作計畫執行等。

Technical Session 顧名思義，為大會安排由作者進行口頭簡報之正式研究論文。不論屬性偏重工程實務的需求，或是學術性的探討，其探討主題範圍比較小，但討論的內容也相對比較明確。大會另外也安排專供研究生發表的海報論文展專區，並進行評比。日本為會議主辦國，以地主國地利之便，各機構所發表之論文數量最多，同時也給予年輕研究人員歷練的機會。中國目前興建中的核電機組高達 24 座，而全球總數也不過 68，這種效應也反映在本次會議上，在某些特定領域，其所發表的論文數量已成為多數。

大會於國際會議場外觀以及會議之報到櫃台與行政服務支援中心分別如下 2 圖，會議依據探討主題來區分，總共有下列 21 項。



1. TRK-1 Plant Operations, Maintenance, Engineering, Modifications, Life Cycle and Balance of Plant
2. TRK-2 Nuclear Fuel and Materials
3. TRK-3 Plant Systems, Structures, and Components
4. TRK-4 Radioprotection and Nuclear Technology Application
5. TRK-5 Next Generation Reactors (including GIF Symposium)
6. TRK-6 Advanced Reactors

7. TRK-7 Nuclear Safety and Security
8. TRK-8 Codes, Standards, Licensing, and Regulatory Issues
9. TRK-9 Fuel Cycle, Radioactive Waste Management and Decommissioning
10. TRK-10 Thermal-Hydraulics
11. TRK-11 Computational Fluid Dynamics (CFD) and Coupled Codes
12. TRK-12 Reactor Physics and Transport Theory
13. TRK-13 Nuclear Education, Public Acceptance and Related Issues
14. TRK-14 Instrumentation and Controls (I&C)
15. TRK-15 Fusion Engineering
16. TRK-16 Beyond Design Basis Events
17. TRK-17 Innovative Nuclear Power Plant Design and New Technology Application
18. TRK-18 Student Paper Competition
19. TRK-19 Plenary and Panel Session
20. TRK-20 CFD Seminar and Workshops
21. TRK-21 Fukushima Special Session

以下筆者就與業務比較有關聯的議題，摘要提出說明：

(一) Technical Session 2-1: Fuel Modeling

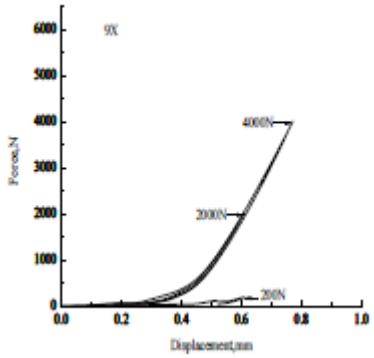
1. ICONE23-1029: A SELF-ORGANIZING NEURAL NETWORK FOR PCI FAILURE PREDICTION

此報告是由西安交通大學提出，基本概念是將加拿大 CANDU 核電廠的燃料營運破損紀錄，以類神經網絡作經驗學習，嘗試應用於核燃料 PCI 之預測分析。這是一種跨領域應用的想法，聽眾中有來自加國的人員，對使用數據的淵源有清楚了解，並質疑其適用性。由於 PCI 對燃料運轉績效與電廠負載追隨有緊密關聯，本文具有創新想法，雖期待由燃耗值與運轉功率增加量來預估燃料因 PCI 而造成

破損的機率，但除了破損統計數字之外，與燃料行為分析的探討與連結比較少，應用性尚待更深入的研究。

2. ICONE23-1721: Experimental and finite element analysis of the compression properties of spacer grid of NHR200-Ⅱ fuel assembly

此文由北京清華大學核能與新能源技術研究院發表，主要是針對中國自行開發之 Nuclear Heating Reactor (NHR)使用的燃料格架(Spacer)進行有限元素(Finite Element, FE)分析。主要目的是驗證 FE 模式建立與分析方法的準確性，以格架實體剛性(Stiffness)量測數據為基準，確認本文分析方法有其實際應用價值，整組格架、格架彈簧的 FE 建模與格架剛性實測數據如下圖：



整體評估結果顯示，FE 分析可以有效應用於未來之設計或評估，可以減少組件實體測試次數，降低開發成本。

3. Mechanistic Modeling of UO2 Oxidation in the Dry Storage Condition

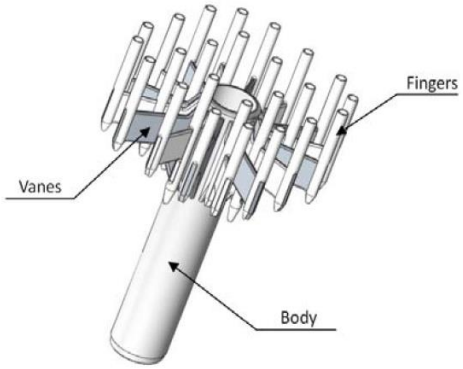
本文由韓國慶熙大學進行現場報告，完整內容並未於大會之論文集中提供。主題與國內推行中的用過核子燃料乾式貯存相關，研究的緣起是探討貯存容器與燃料棒可能殘留之微量水氣與燃料丸發生作用。因為燃料丸氧化會造成體積膨脹，進而擴大造成燃料棒護套破裂，影響到燃料未來再取出時應維持之完整性。報告內容分成實驗與理論計算兩部分，將核電廠實際運轉使用的燃料丸，放置於實驗

室進行不同環境條件的氧化實驗。相對於國內，一個私立大學有能力從事放射性物質核燃料實驗，可見核電在韓國國家發展中的重要性與該校的學術地位。

計算的部分是運用 ORIGEN 程式，對該用過核子燃料假設不同程度的燃耗，分析出所有分裂產物之後，扣除屬於氣態的部分，再評估對應的體積變化，藉此計算出不同燃耗值的燃料丸氧化程度。以業界觀點而言，若使用真正照射過的燃料進行氧化實驗，可以直接獲得數據。但從事照射過燃料的實驗，必須有高放射性實驗室，因涉及核子保安，需要嚴密的安全管制，因此大部分國家，類似這種實驗室都是由政府機關執行。不過就學術觀點而言，本文仍有其參考價值。

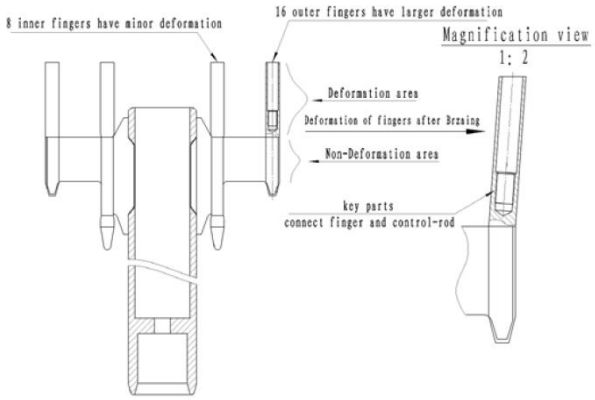
4. ICONE23-1173: Analysis for the Brazing Deformation of AFA3G Spider

本論文由中國中核建中核燃料元件有限公司提出，分析對象是由法國設計之壓水式反應器，配備 AFA3G 型式燃料之爐心，其所搭配使用之爪型控制棒，於製造時所遇到的問題與解決方案。該反應器之爪型控制棒外觀如下圖，中間是結構主體，連結向外伸展呈放射狀之葉片，最外端則是棒狀中子吸收體(Finger)，整體外觀如同爪子。此種設計與西屋公司壓水式反應器相近，外觀也與國內核三廠所使用的控制棒近似。



整組爪型控制棒製作是以硬焊(Brazing)技術，將單根的棒狀中子吸收體與放射分布之葉片組合在一起。所發現問題是焊接後變形不均，Finger 彼此之間的平行度不良，如下圖所示。雖然品管檢驗仍在允收範圍之內，但該公司仍尋求解決分案。改善分兩方面進行，硬體上：修改焊接時，棒狀中子吸收體的固定夾具，

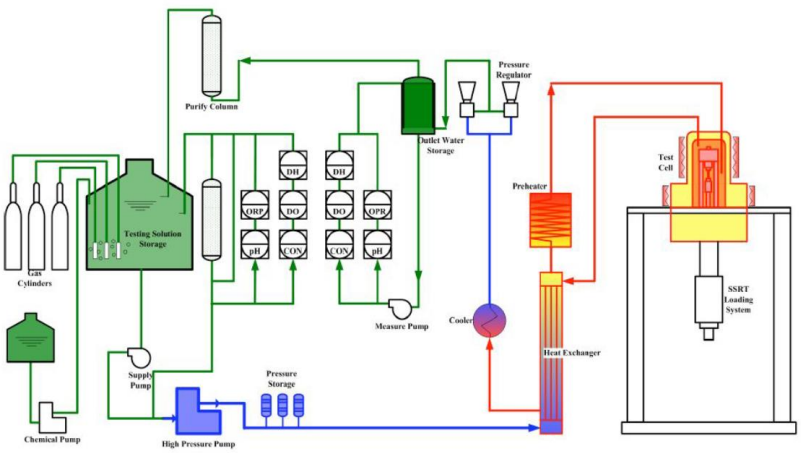
焊接時位置準確性與對心可以獲得更佳控制。軟體上，則調整焊接之冷卻速率，製造品質最終獲得改善。



(二) Technical Session 2-4: Irradiation Damage and Stress Corrosion Cracking

1. ICONE23-1158: Effect of oxidation chemistry of SCW on stress corrosion cracking of austenitic steels

本文由中國核動力研究設計院(Nuclear Power Institute of China, NPIC)發表，這是有關第 4 代反應器(Generation IV Reactor)的研究，對象是 Supercritical Water Reactor (SCWR)，NPIC 於 2009 啟動百萬瓦級 SCWR 的研究，代號為 CSR 1000。就合宜材料選取，該機構已對 20 餘種材料進行機械與腐蝕特性研究，本文專就 HR3C 材料在超臨界環境下的應力腐蝕(Stress Corrosion Cracking, SCC)特性提出成果報告；SCC 實驗設計如下圖，材料元素成份如下表：



Chemistry composition (wt%)										
C	Mn	Si	P	S	Cr	Ni	Fe	Nb	N	Cu
0.060	1.200	0.225	0.017	0.003	24.92	21.00	Bal.	0.500	0.230	0.040

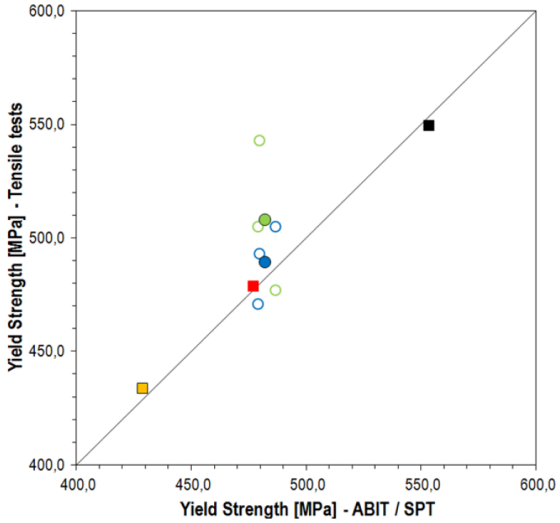
Mechanical properties		
Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)
360/355	815/810	60/58

HR3C 於 SCW 環境：620℃、應力 25 MPa 條件下，試片呈現沿晶破裂趨勢；溶氧 200~500 μg/kg 之環境破損加速，對延伸量與機械強度也有些微效應。整體而言，HR3C 於 SCW 環境下為延晶脆性破裂。現場有聽眾提問，材料成份中氮(N)元素含量相對偏高，是否是為了機械強度的需求，但也因而影響破裂行為。講者則僅回覆材料供應來自日本，並未由 CSR 1000 反應器之系統設計與需求面做更深入的說明。

2. ICONE23-1682: Innovative approach of semi-destructive mechanical testing techniques for quantification of irradiated NPP structural materials degradation

本文由捷克所提出，為研究計畫「Development of innovative semi-destructive method of high active material evaluation for nuclear reactor components lifetime assessment」之執行成果報告，主要嘗試應用於俄羅斯所設計 WWER 型反應器材料照射後劣化特性評估。文中提出兩種創新的材料測試方法分別為：Small Punch Testing (SPT)，Automated Ball Indentation Test (ABIT)。

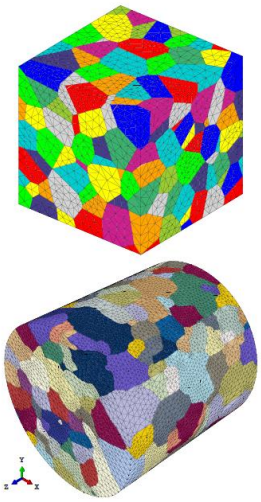
東歐國家使用的俄羅斯反應器對國內較為陌生，其所參考之設計規範與西方國家慣用準則有所差異；相似之處是當電廠使用一段時間，或是進入延役規劃時，重要組件之材料機械性質測試與劣化評估便成為電廠是否可以持續運轉，且為安全主管機關接受的必要資訊。本文所提出的創新方法主要是為了減少材料測試所需的試樣數目，以 IAEA 參考材料 A533B (JRQ)為標的，現階段 ABIT、SPT 之測試結果與標準拉伸測試比較，有極佳的一致性，如下圖所示；未來完整應用則仍需更多數據進行驗證。



3. ICONE23-1741: Polycrystalline Simulations of Local Stress Distributions in Neutron Irradiated Austenitic Stainless Steels

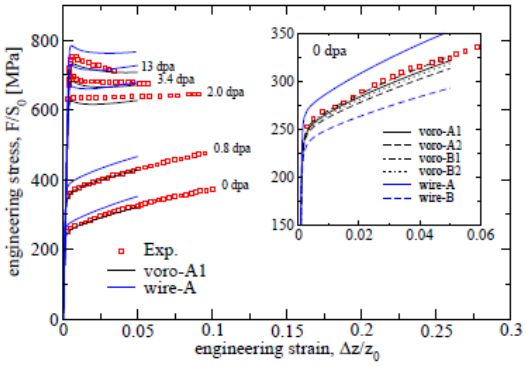
本文是有限元素分析應用，由斯洛維尼亞與法國共同合作，以法國 CEA (Atomic Energy Commission)所建立的晶體塑性分析模式 CAST3M，搭配商用套裝軟體 ABAQUS 進行不鏽鋼中子照射後局部應力分布之微結構模擬分析。不鏽鋼受到中子長期照射之後，造成微結構改變，影響材料局部以及整體機械性質；模式建構基本概念是材料受到照射之後產生晶格缺陷(Defect)、缺陷之串接以及與差排(Dislocation)的交互作用。由微結構模擬分析，也可以同時承受應力以及腐蝕環境下，發生輻射促進應力腐蝕龜裂(Irradiation Assisted Stress Corrosion Cracking，IASCC)之敏感性。

該研究之晶體有限元素模式如下圖所示，有限元素建模參數設計如下表，左圖上方對應於表中之 voro-B2 模式，左圖下方則對應於 wire-B 模式。本文分析之理論基礎涉及材料未照射與照射兩種情境，其所應考慮之黏塑性(Visco-Plastic)力學參數頗為複雜，詳細內容必須回溯 CEA 所開發之 Cast3M 模式，本文並未詳述，此處僅提出分析結果與實驗數據之比較。



model	type	grains	elements	orientations
voro-A1	analytic	216	10370	random
voro-A2	analytic	216	38350	random
voro-B1	analytic	343	17499	random
voro-B2	analytic	343	64331	random
wire-A	realistic	377	141968	realistic
wire-B	realistic	377	141968	random

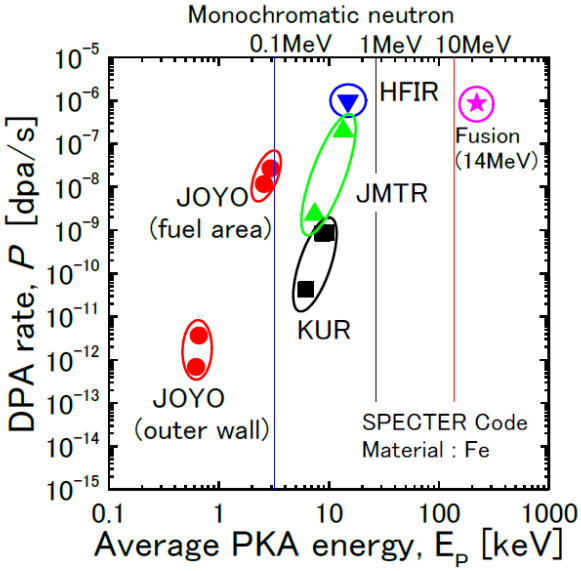
以 304L 不鏽鋼為例，對 5 種不同照射程度(0 dpa, 0.8 dpa, 2.0 dpa, 3.4 dpa, 13 dpa)，dpa (Displacement per Atom)比較材料拉伸特性量測數值與分析結果，應力與應變趨勢如下圖。其中，紅色圓圈狀標誌為實驗數據，曲線為分析結果，整體趨勢吻合。但是進行分析時，若選用不同模式，對材料的剛性判斷仍有差異，對有限元素模擬分析而言，是常見的現象。

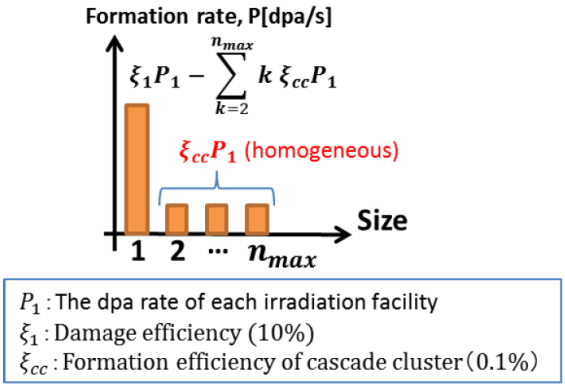


4. ICONE23-1859: Rate theory analysis of irradiation damage in metal: Neutron energy dependence

本文由日本京都大學與 JAEA 聯合發表，主要是探討反應器結構鋼材照射後缺陷形成與累積的數值模擬方法；以反應率原理為基礎，運用電腦來進行反應率方程式的數值近似解。照射缺陷形成的孔隙(Void)與差排的作用，孔隙的串接等效應隨後也造成材料的膨脹(Swelling)現象。照射劑量以 dpa 來表示，所選用的研

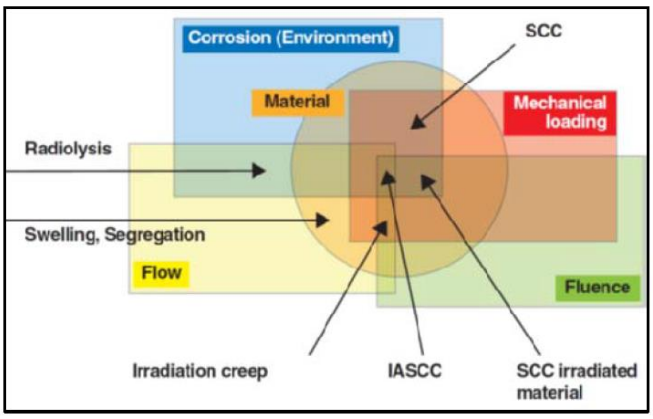
究用反應器數據，中子能量涵蓋範圍極具代表性，數據之分佈與缺陷生成模擬概念分別如下圖。模擬分析之數值近似解，譬如缺陷密度、孔隙密度、孔隙半徑、膨脹量對溫度、時間等的結果皆很完整，但計算與材料檢驗數據的比較未於論文中探討，因此實務上應用性仍有待觀察。



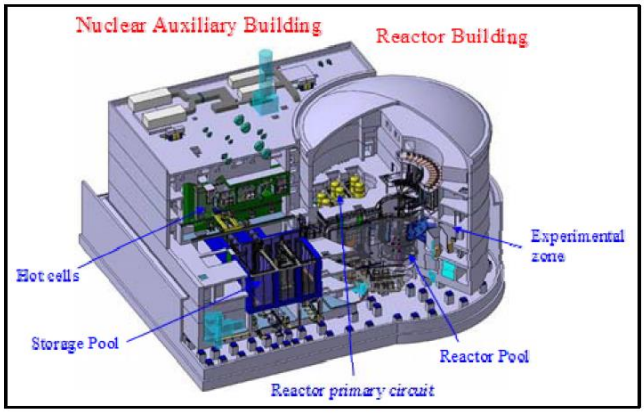


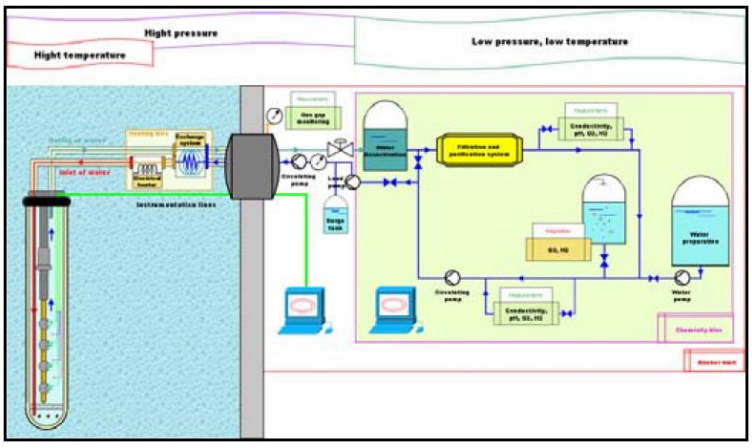
5. ICONE23-2044: Irradiation assisted stress corrosion cracking and the Jules Horowitz material test Reactor

本文介紹於法國 Jules Horowitz material test Reactor (JHR)進行 IASCC 研究的實驗設計、規劃與設施建立現況，該反應器是一個專供材料照射實驗的反應器。文中首先對近年來，發生於 BWR 或是 PWR 核電廠內部組件發生劣化的機制進行重點回顧，對輻射狀況下，承受應力與化學環境的反應器內部組件，不論是鋼材或是鎳基合金，在不同環境交互作用下，發生 IASCC 的機制如下圖所示。



法國 JHR 尚在建造中，位於法國 CEA 之 Cadarache 設施場所，具備最先進的安全概念。JHR 是水冷式反應器，保留彈性的應用環境，可以從事多種實驗，提供直接的量測數據。為了因應未來 50~60 年的需求，它可以提供不同反應器設計的環境模擬實驗，譬如水冷卻、氣體冷卻、或是金屬冷卻的測試環路。至於中子通率以及能譜分布，也有廣大範圍的選擇，並提供暫態的模擬實驗能力。反應器整體設計與環路實驗設施概念分別如下 2 圖。

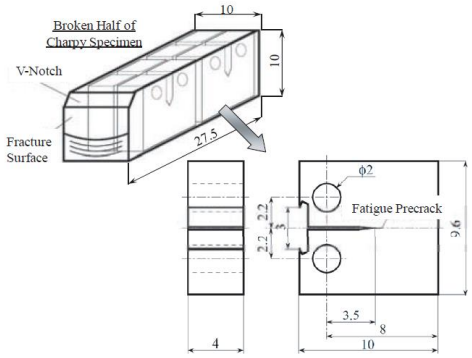


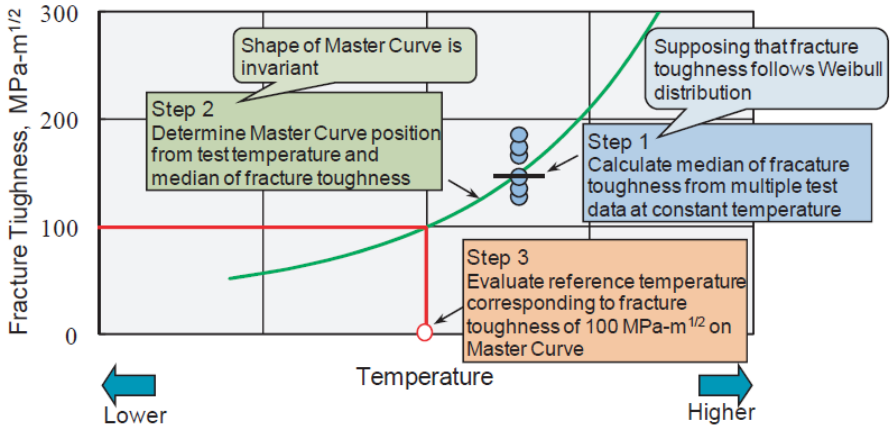


(三) Panel-6: Plant Life Management of LWR

講者共有 6 位：Koji Yamada (Chubu Electric Power Company)，Naoki Soneda (Central Research Institute of Electric Power Industry)，Curtis Smith (US Department of Energy)，Regis Nhili (Material Ageing Institute, Electricite de France)，Zhengcao Li (Tsinghua Universty)，Deping Kong (China National Nuclear Corporation)。

日本中部電力公司提出參與 IAEA 的合作計畫階段成果報告，主要是介紹該公司旗下的 BWR-5 反應器(應該是濱岡核電廠第 3、4 號機組)的使用評估，包含壓力容器材料脆性與混凝土之評估結果。日本電力中央研究所(CRIEPI)介紹該機構所開發的 Miniature C(T) Specimen 試片製作與測試技術應用方法，各個核電廠建廠之初所置入的壓力容器監視樣品相當珍貴，CRIEPI 所開發技術在於建立監視樣品完成衝擊試驗後，將其重新製作成試片，評估再利用的可行性。試片製作與鋼材破裂韌性評估應用概念如下 2 圖。





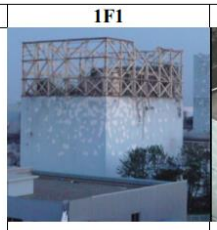
日本於福島事故之後，國內所有核電廠運轉安全重新評估，部分核電廠已經陸續通過安全審查，若獲得地方政府同意即可恢復運轉。日本核電機組甚多，這些年來有關安全的相關議題，譬如反應器壓力容器鋼材照射後脆性劣化評估技術仍然持續進行中。核電廠壓力容器在商業運轉期間，皆會定期取出建廠時期即放置在壓力容器內的監視樣品，進行機械性質測試，以確保安全。核研所過去也曾執行過國內核電廠壓力容器監視樣品的機械性質測試，並開發出將試片焊接重組的技術，日本的研究與國內作法有異曲同工之效。

日本業界也同時將機率破壞力學(Probability Fracture Mechanics)引進研究範疇，不過現階段尚未向安全主管機關提出應用上的申請。既有電廠繼續運轉的安全評估當然有其必要性，不過這是屬於比較舊材料規範所作的研究，數據對於未來新建核電廠的應用相對有限。與談幾位講者的共識為：這些研究對年輕的工程師會是很好的訓練機會，有明確的法規要求，一定的驗證程序，包含材料特性實驗與數值分析，經由實務參與，應可養成一位稱職的工程師，順利銜接新建的電廠。不過分析程式或是相關工具，更新比較慢，因此與其它從業領域比起來，對年輕人的吸引力相對較為薄弱。

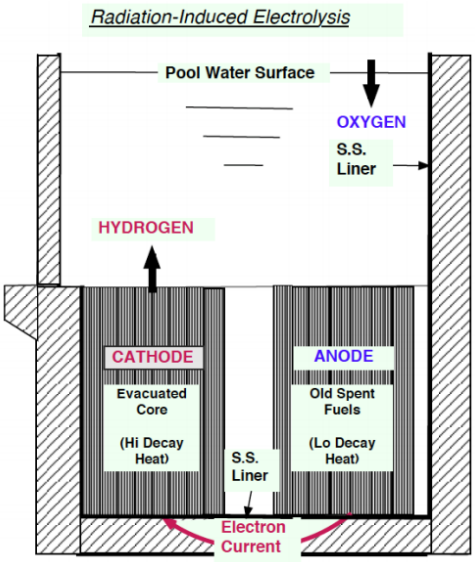
(四) Technical Session 2-7: Fuel Cladding Behavior in Accidents and Corrosion Product Release

1. ICONE23-1093：”Radiation-Induced Electrolysis (III)” - A Potential Root Cause Of Hydrogen Explosions in The Fukushima Daiichi Accident –

這篇論文由日本獨立研究人員所提出，作者由日本舊制原子力安全委員會退休。福島事故時東京電力公司福島一廠第 3、4 號機組因為產生大量氫氣，而造成廠房爆炸，有別於這幾年的主流看法，本文提出另一種論點。回復到福島一廠發生事故時，各機組的狀態如下表，而作者提出的輻射引發電解產生氫氣的概念如下圖：

Unit	1F1	1F2	1F3	1F4 SFP
Photo				
	Mar.12, 2011	Apr. 10. 2011	Mar. 22, 2011	Mar. 22, 2011
Explosion	3/12, 15:38	~3/15, 06:14 (Note-1)	3/14, 11:01	3/15, 06:12 (Note-2)
Last DW Vent	3/12, 14:30	Note-3	3/13, 12:30	NA

Note-1: At ~06:14, 3/15, an "explosive sound" was heard by the control room staffs. TEPCO's official view is no hydrogen explosion in 1F2.
Note-2: The total fuel assemblies were stored in SFP (Spent Fuel Pool).
Note-3: RPV depressurization through SRV at 3/15, 01:10. Suppression Chamber Pres. down-scaled to zero at 3/15, ~06:14 spontaneously. D/W pressure was 730 kPa(abs).



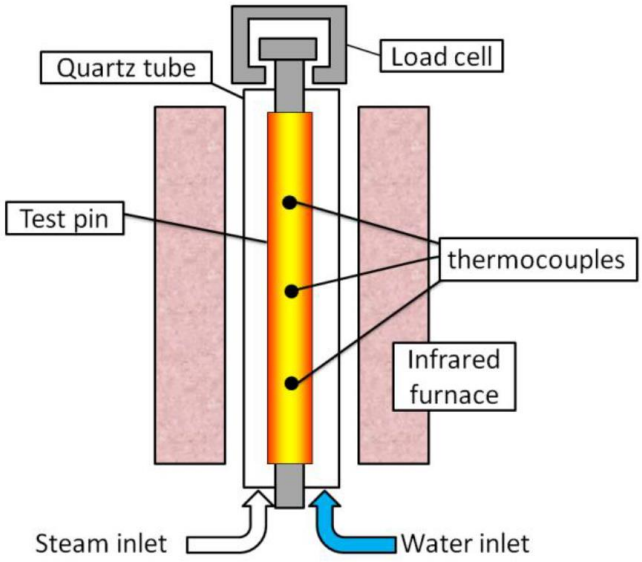
本文提出之氫氣產生反應機制有其學理上的依據，其參考文獻顯示，過去已有分析結果發表。在分析模式上，影響的參數有燃料池水溫度、池水對流速度、輻射劑量(用過燃料燃耗值與數量)等。而現階段機制模式推導過程中，僅能就各個參數，驗證或測試機制的合理性。因尚無研究機構投入模擬實驗，因此無數據可供驗證。本所在日本福島事故之後，亦曾投入核電廠用過燃料池燃料護套因為氧化而產生氫氣的相關研究，此論文的後續發展值得持續追蹤。

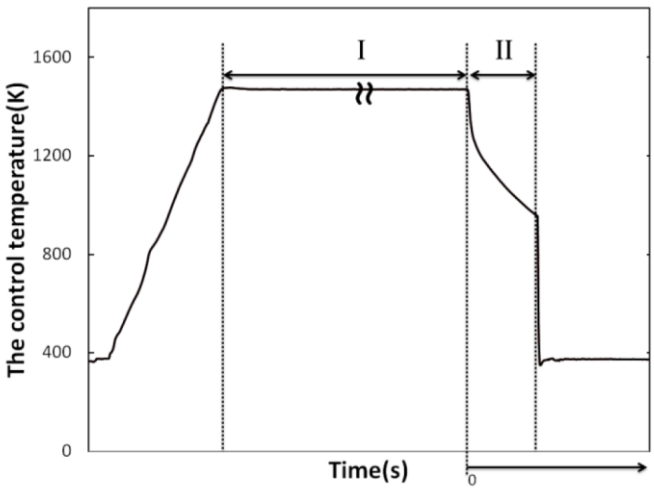
2. ICONE23-1408：Axial Load Behavior Analysis of Zircaloy-4 cladding under LOCA Quench Conditions

本文是日本 JAEA 的研發工作，嘗試將原本使用於 Reactivity Insertion Accident (RIA)的軟體 RANNS 應用在 Loss of Coolant Accident (LOCA)分析上。LOCA 是輕水式

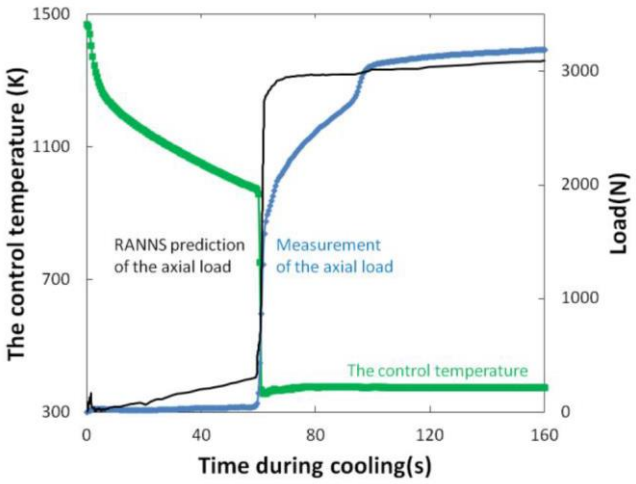
商用反應器的設計基準事故，預期因為冷卻水流失，燃料棒護套溫度升高，內部壓力造成燃料棒吹脹現象。當緊急冷卻水注入爐心之後，對護套則造成焠火效應，本文以 RANNS 來探討此種情境下，護套在軸方向的熱機行為。

配合程式分析，JAEA 同時進行實驗，使用 PWR 反應器常用的 9.5 mm 鋯合金護套，裝填氧化鋁製作的模擬燃料丸，組成測試燃料棒。完整的實驗設計與升溫及淬火控制概念如下列 2 圖，第一階段溫度大約升高到 1200℃，於第二階段大約降回到 700℃。





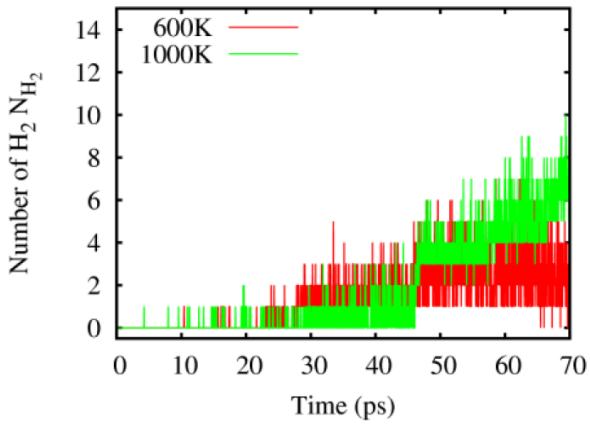
RANNS 原本的鋯合金氧化模式原本是配合 LOCA 分析，因應情境改變，也重新修正。護套軸向載荷的程式分析與實驗數據比較如下圖，JAEA 嘗試由溫度變化與護套管壁雙面氧化與單面氧化的數據來釐清其差異性，此部分尚在進行中。

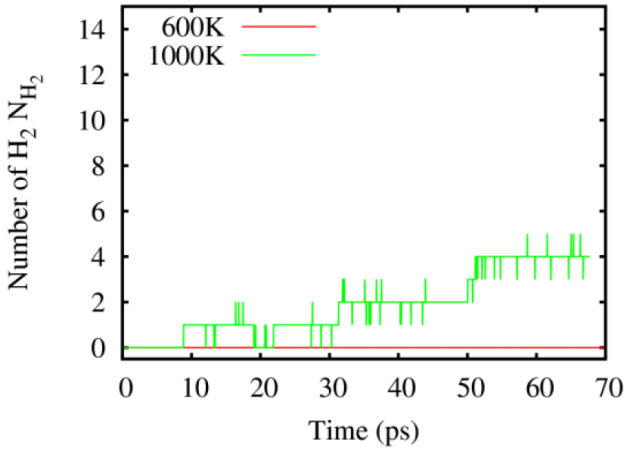


3. ICONE23-1558 ： Comparative Molecular Simulation Studies of Oxidation Reactions and Hydrogen Release for Zirconium Metals and Silicon Carbide Severe Accident Conditions

本文是一個純理論分析研究，福島事故之後，各方都在尋求能夠對抗 LOCA 事故的核燃料護套材料，以避免類似鋯合金，因為可能的快速氧化而產生大量氫氣。文中比較鋯合金與 SiC 於事故時的氧化速率分析結果，嘗試驗證新護套材料的優異性。工具為美國國家實驗室 Sandia National Laboratories 所開發之分子動力學分析程式 Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS)，研究由 JAEA 與美國賓州州立大學共同合作。

兩種溫度，600℃與 1000℃高壓蒸氣環境下，鋯合金與 SiC 兩種材料的分析結果如下列 2 圖。上圖中，鋯合金於 1000℃環境下，氫分子產生量明顯高於 SiC。進行程式模擬分析涉及參數甚多，目前結果僅能做為定性討論，尚不適合從事定量比較。





本次參加第 23 屆國際核工會議，心得摘要如下：

1. 中國國家能源局發布的「能源發展戰略行動計畫（2014～2020 年）」指出，到 2020 年，大陸核電裝置容量必須達到 5,800 萬千瓦，興建容量達 3,000 萬千瓦以上。也就是說，五年之後，中國的核電發電量將會是現在的三倍。該計畫顯示中國核能產業已經擺脫之前日本福島核災為帶來的陰霾，核能政策已重回原來的發展道路，而觀察本次會議的論文發表也印證了這個情況。
2. 中國以內需來推動核能工業，規劃或興建中的核電廠機組數量佔全球多數，建廠經驗不斷累積之後，已經推廣國外市場。不同的核能事業集團，各自發展，從本次會議的投入來觀察，中國在核能工業已經完成全方位的佈局。除了電力供應上的規劃，最基本的國家自主設計規範也已經開始研議。過去發展階段雖然引進多元的設計，譬如加拿大 CANDU、法國 PWR、西屋 AP 1000 等系統，但整合成自己設計的努力也已經啟動。

3. 以核電廠運轉為核心，周邊產業，譬如新材料開發與驗證、核燃料設計與製造、運轉安全分析技術等，也是蓬勃發展。初始建廠及運轉技術也許是來自原廠，但是引進的相關技術熟稔之後，很明確看出各集團逐步轉換成自主技術的努力。幾個大學，譬如清華大學、上海交通大學、哈爾濱工程大學、西安交通大學等，都有相關論文發表。年輕工程師或是學者、研究生，部份對自己所從事的研究，在面對聽眾提問時也許一時無法說出全貌，但這種透過與實務結合所建立的研發能力，不出數年，將成為業界堅強的技術後援。
4. 反觀其它穩定使用核能的國家，譬如法國、美國以及恢復中的日本，因為新建機組少，重點反而是在既有電廠的安全改善與延役。以法國為例，80 年代核電快速成長，目前運轉中機組共有 53 部，成為國家穩定的能源。但機組若維持以 40 年為設計年限，預期 2022 年之後，電力的供應能力卻是異於 80 年的持續成長，將反轉而成為直線下降。為防範此種趨勢可能造成的電力缺口，法國電力公司成立了 Material Aging Institute，專為核電廠可能必須面對的長期運轉進行研究。
5. 歐美國家與日本工業基礎實力雄厚，使用核能經驗豐富，ASME 的規範也是西方國家核能工業安全組件的參考核心。但就現實面而言，若新建機組數量不多，更新、精益求精的動力自然不足。此外由參與人力來看，這些國家的從業人員年齡層相對較高，如何培育年輕的專業技術人員，避免在安全評估、運轉維護上造成人力斷層，將是一大隱憂。
6. 本所為政府機關，依據政策執行所屬業務，現階段核電仍是國家重要的穩定能源，即便是核電廠進行除役，仍需特殊專業技術。國內核能領域人才早已出現斷層，在前景不看好的情況下，要吸引優秀人力原本不易。因此，如何有效運用國際研發資訊，建立溝通管道，掌握關鍵性議題，以有限資源協助維護國內核電安全，誠為當務之急。

四、建議事項

(一) 國內核能發電未來去向，應由能源供應的穩定度與合理配比為依歸，而核電安全與後端營運則是全民是否能夠接受的關鍵因素。本所長期以來建立技術，協助國內核電廠安全營運，成效顯著。為拓展研發能力，對國際核工會議宜持續關注，儘可能派員參與，掌握國際發展現況。

(二) 日本在福島事故之後，有一段時間暫時處於零核電狀態，但是各方面的發展仍持續進行。政府成立了原子力規制委會來負責核電廠重新啟動的安全審查，此外配合部分電廠除役規劃，另外成立了國際廢爐研究機構，基礎或是基本研究則由各大學與 JAEA、CRIEPI、NFD 等機構進行。重整之後，各層組織的任務與分工相當明確，國內可依據業務需求，擬定議題建立合作對象。

(三) 國內核能發電已將近 40 年，各個機組也一直維持良好的運轉績效。核能研究所核子燃料及材料組擁有國內唯一，具有照射過核子燃料與材料檢驗能力的高放射性實驗室（簡稱熱室），對運轉安全與後端營運等議題也曾投入相關研究。建議維持設施運轉之核心技術與能力，繼續對國內特定需求提供必要之協助。

附錄

ICONE23 會議議程

Conference Program

May 18 (Mon.)

12-1. Experiment & Cross Section

May 18 (Mon.), 14:00 - 16:00, 1F Room 101B

Chair: **Junxia Wei** (Institute of Applied Physics and Computational Mathematics, China)

Co-Chair: **Yoshihiko Ishii** (Hitachi, Ltd., Japan)

12-2. New Method

May 18 (Mon.), 16:30 - 18:30, 1F Room 101B

Chair: **Toru Obara** (Tokyo Institute of Technology, Japan)

Co-Chair: **Yohei Kamiyama** (Mitsubishi Heavy Industries, Ltd., Japan)

4-1. Radioprotection and Nuclear Technology Application

May 18 (Mon.), 14:00 - 16:00, 1F Room 102A

Chair: **Toshiharu Muramatsu** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Ivo Kljenak** (Jozef Stefan Institute , Slovenia)

5-1. HTGR-1

May 18 (Mon.), 14:00 - 16:00, 1F Room 103

Chair: **Akira T Tokuhiro** (Purdue University, United States)

Co-Chair: **Kazutaka Ohashi** (Fuji Electric, Japan)

5-2. HTGR-2

May 18 (Mon.), 16:30 - 18:30, 1F Room 103

Chair: **Hiroyuki Sato** (Japan Atomic Energy Agency, Japan)

7-1. Probabilistic Risk Assessment

May 18 (Mon.), 16:30 - 18:30, 1F Room 104

Chair: **Atsushi Ui** (Central Research Institute of Electric Power Industry, Japan)

7-7. Safety principles, standards, risk management and source term

May 18 (Mon.), 16:30 - 18:30, 1F Room 105

Chair: **Takeshi Yamada** (Hitachi-GE Nuclear Energy, Ltd., Japan)

2F Convention Hall

Opening. Nuclear Power - Reliable Global Energy

May 18 (Mon.), 09:00 - 09:20, 2F Convention Hall

Chair: **Akihide Kugo** (Japan Nuclear Safety Institute, Japan)

Co-Chair: **Asif H Arastu** (Unisont Engineering, Inc., United States)

Zhijian Zhang (Chinese Nuclear Society, China)

Speakers: **Shojiro Matsuura** (Chairman, Japan Nuclear Safety Institute)

J. Robert Sims (President, American Society of Mechanical Engineers)

Jean-Pol Poncelet (Secretary General, European Nuclear Society)

Lixin Shen (Secretary General, Chinese Nuclear Society)

Plenary-1. Nuclear Power - Reliable Global Energy-1

May 18 (Mon.), 09:20 - 10:45, 2F Convention Hall

Chair: **Kazuyuki Takase** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Yassin Hassan** (Texas A&M University, United States)

Jinquan Yan (Shanghai Nuclear Engineering Research & Design Institute, China)

Speakers: **Ryoji Doi** (Director General, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry of Japan)

John E. Kelly (Depty Assistant Secretary, US Department of Energy (Chair, Generation IV International Forum))

Jean-Claude Bouchter (French Alternative Energies and Atomic Energy Commission)

Zhongtang Wang (Chief Engineer, State Nuclear Power Technology Corporation)

Chadaram Sivaji (Counsellor (Science & Technology), Embassy of India)

Plenary-2. Nuclear Power - Reliable Global Energy-2

May 18 (Mon.), 11:05 - 12:30, 2F Convention Hall

Chair: **Tetsuaki Takeda** (University of Yamanashi, Japan)

Co-Chair: **Robert Stakenborghs** (ILD, Inc, United States)

Suyuan Yu (Tsinghua University, China)

Speakers: **Hideki Toyomatsu** (Vice president, Kansai Electric Power Company)

Danny Roderick (President/CEO Westinghouse Electric Company)

Vaćlav Bartuška (Ambassador, Czech Republic)

Zengguang Lei (Vice President, Chinese Nuclear Society / Chief Engineer, China National Nuclear Corporation)

Moon Hee Chang (President, Korean Nuclear Society)

18-1. Thermalhydraulics 1

May 18 (Mon.), 16:30 - 18:30, 2F Convention Hall B-1

Chair: **Jan Stepanek** (Czech Technical University in Prague, Czech Republic)

Co-Chair: **Congmin Zhang** (Harbin Engineering University, China)

2F Convention Hall B-2

18-9. Computational Fluid Dynamics

May 18 (Mon.), 16:30 - 18:30, 2F Convention Hall B-2

Chair: **Tomas Romsy** (Czech Technical University in Prague, Czech Republic)

Co-Chair: **Rui Guo** (Waseda University, Japan)

2F Room 201B

11-1. Fuel Assemblies Simulations and Related Issues

May 18 (Mon.), 14:00 - 16:00, 2F Room 201B

Chair: **Sofiane Benhamadouche** (Electricite De France R & D, France)

Co-Chair: **Yacine Addad** (Khalifa University, United Arab Emirates)

11-2. Natural Convection Heat Transfer

May 18 (Mon.), 16:30 - 18:30, 2F Room 201B

Chair: **Elia Merzari** (Argonne National Laboratory, United States)

Co-Chair: **Akihiro Uchibori** (Japan Atomic Energy Agency, Japan)

15-1. Fusion Engineering

May 18 (Mon.), 14:00 - 16:00, 2F Room 202

Chair: **Yican Wu** (Institute of Nuclear Energy Safety Technology, Chinese Academy of Sciences, China)

Co-Chair: **Eiji Hoashi** (Osaka University, Japan)

15-2. Fusion Reactor Safety

May 18 (Mon.), 16:30 - 18:30, 2F Room 202

Chair: **Tomoaki Kunugi** (Kyoto University, Japan)

Co-Chair: **Leigh Winfrey** (Virginia Tech, United States)

10-1. Natural Circulation & Convection

May 18 (Mon.), 14:00 - 16:00, 3F Room 301A

Chair: **Chikako Iwaki** (Toshiba Corporation, Japan)

Co-Chair: **Asif H Arastu** (Unisont Engineering, Inc., United States)

10-2. Passive Cooling Systems

May 18 (Mon.), 16:30 - 18:30, 3F Room 301A

Chair: **Asif H Arastu** (Unisont Engineering, Inc., United States)

Co-Chair: **Chikako Iwaki** (Toshiba Corporation, Japan)

3F Room 301B

10-11. Boiling Heat Transfer

May 18 (Mon.), 14:00 - 16:00, 3F Room 301B

Chair: **Hiroyasu Ohtake** (Kogakuin University, Japan)

Co-Chair: **Manish Kumar Agrawal** (Indian Institute of Technology Indore, India)

10-12. LOCA & Transient Analyses I

May 18 (Mon.), 16:30 - 18:30, 3F Room 301B

Chair: **Manish Kumar Agrawal** (Indian Institute of Technology Indore, India)

Co-Chair: **Hiroyasu Ohtake** (Kogakuin University, Japan)

3F Room 302

2-11. Advanced Material Evaluation

May 18 (Mon.), 14:00 - 16:00, 3F Room 302

Chair: **John Sulley** (Rolls-Royce, United Kingdom)

Co-Chair: **Masahiko Osaka** (Japan Atomic Energy Agency, Japan)

3F Room 303

Panel-1. Energy Policy with Nuclear Power & Continuous Safety Improvement

May 18 (Mon.), 14:00 - 16:00, 3F Room 303

Chair: **Hiroshige Kikura** (Tokyo Institute of Technology, Japan)

Co-Chair: **Leon Cizelj** (Jozef Stefan Institute, Slovenia)

Speakers: **Toru Nakatsuka** (Agency for Natural Resourcses and Energy, Ministry of Economy, Trade and Industry of Japan)

Leon Cizelj (Jožef Stefan Institute)

Panel-5. Fukushima Report and Decommissioning / Decontamination & Waste Management of NPPs

May 18 (Mon.), 16:30 - 18:30, 3F Room 303

Chair: **Koji Okamoto** (The University of Tokyo, Japan)

Yasuo Koizumi (Japan Atomic Energy Agency, Japan)

Akehiko Hoshide (Toshiba Corporation, Japan)

Speakers: **Jun Matsumoto** (Tokyo Electric Power Company)

Toshihiko Fukuda (Nuclear Damage Compensation and Decommissioning Facilitation Corporation)

Takashi Sato (International Research Institute for Nuclear Decommissioning)

Fumihisa Nagase (Japan Atomic Energy Agency)

Takao Nakagaki (Waseda University)

3F Room 304

2-1. Fuel Modeling

May 18 (Mon.), 14:00 - 16:00, 3F Room 304

Chair: **Soosung Kim** (Korea Atomic Energy Research Institute, Korea)

Co-Chair: **Uddharan Basak** (IAEA, India)

Yoshihiro Isobe (Nuclear Fuel Industries, Ltd., Japan)

2-2. Material Challenges for GEN IV Fast Reactors and HTGR - I

May 18 (Mon.), 16:30 - 18:30, 3F Room 304

Chair: **Emmanuel Horowitz** (EDF, France)

Co-Chair: **Carsten Schroer** (Karlsruhe Institute of Technology (KIT), Germany)

Yoshinori Katayama (Toshiba Corporation, Japan)

May 19 (Tue.)

1F Room 101A

9-1. Radionuclide Migration, and Detection

May 19 (Tue.), 08:30 - 10:30, 1F Room 101A

Chair: **Min Xiao** (China Nuclear Power Technology Research Institute, China)

Co-Chair: **Koji Tamura** (Japan Atomic Energy Agency, Japan)

9-2. Waste Generation, Treatment, and Isolation

May 19 (Tue.), 10:50 - 12:30, 1F Room 101A

Chair: **Dongsheng Li** (China Nuclear Power Technology Research Institute, China)

Co-Chair: **Kazuya Idemitsu** (Kyushu University, Japan)

Eisuke John Minehara (The Wakasa Wan Energy Research Center, Japan)

9-3. Reprocessing Waste

May 19 (Tue.), 13:30 - 15:30, 1F Room 101A

Chair: **Patricia Paviet** (Department of Energy, United States)

Co-Chair: **Noritake Sugitsue** (Japan Atomic Energy Agency, Japan)

Atsushi Mukunoki (JGC Corporation, Japan)

9-4. Waste disposal

May 19 (Tue.), 16:00 - 18:00, 1F Room 101A

Chair: **Yuichi Niibori** (Tohoku University, Japan)

Co-Chair: **Shingo Tanaka** (Hokkaido University, Japan)

1F Room 101B

12-3. Depletion method & Design calculation

May 19 (Tue.), 08:30 - 10:30, 1F Room 101B

Chair: **Mohamed A Elsawi** (Khalifa University of Science, Technology, and Research, United Arab Emirates)

Co-Chair: **Yuki Takemoto** (Mitsubishi Heavy Industries, Ltd., Japan)

12-4. Transient and Kinetic calculation

May 19 (Tue.), 10:50 - 12:30, 1F Room 101B

Chair: **Liqin Hu** (Chinese Academy of Sciences; USTC, China)

Co-Chair: **Yohei Kamiyama** (Mitsubishi Heavy Industries, Ltd., Japan)

12-5. Reactor analysis method

May 19 (Tue.), 13:30 - 15:30, 1F Room 101B

Chair: **Shigeaki Aoki** (Mitsubishi Nuclear Fuel Co., Ltd., Japan)

Co-Chair: **Hiroshi Matsumiya** (Toshiba Corporation, Japan)

17-1. Gas Cooled Systems

May 19 (Tue.), 16:00 - 18:00, 1F Room 101B

Chair: **Hajime Koikegami** (IHI Corporation, Japan)

Co-Chair: **Robert Stakenborghs** (ILD, Inc, United States)

3-1. Severe accidents

May 19 (Tue.), 10:50 - 12:30, 1F Room 102A

Chair: **Janusz Edward Kowalski** (Canadian Nuclear Safety Commission, Canada)

Co-Chair: **Naoto Kasahara** (The University of Tokyo, Japan)

3-2. Simulation of thermo-hydraulic components

May 19 (Tue.), 13:30 - 15:30, 1F Room 102A

Chair: **Asif H Arastu** (Unisont Engineering, Inc., United States)

Co-Chair: **Lin Tian** (Shanghai nuclear engineering research and design institute, China)

3-3. Structural mechanics

May 19 (Tue.), 16:00 - 18:00, 1F Room 102A

Chair: **Brian Fant** (Bechtel Corporation , United States)

Co-Chair: **Satoshi Okajima** (Japan Atomic Energy Agency, Japan)

1F Room 102B

16-1. Fukushima accident and emergency issues

May 19 (Tue.), 16:00 - 18:00, 1F Room 102B

Chair: **Hyun Sun Park** (Pohang University of Science and Technology, Korea)

Co-Chair: **Yu Maruyama** (Japan Atomic Energy Agency, Japan)

5-3. GIF Session I-1

May 19 (Tue.), 08:30 - 10:30, 1F Room 103

Chair: **John Kelly** (United States Department of Energy, United States)

5-4. GIF Session I-2

May 19 (Tue.), 10:50 - 12:30, 1F Room 103

Chair: **Jean-claude Bouchter** (Commissariat à l'Energie Atomique et aux Energies Alternatives, France)

5-5. GIF Session II-1

May 19 (Tue.), 13:30 - 15:30, 1F Room 103

Chair: **Dohee Hahn** (Korea Atomic Energy Research Institute, Korea)

5-6. GIF Session II-2

May 19 (Tue.), 16:00 - 17:15, 1F Room 103

Chair: **Dohee Hahn** (Korea Atomic Energy Research Institute, Korea)

7-2. Reactor safety measures and effectiveness assessment - I

May 19 (Tue.), 08:30 - 10:30, 1F Room 104

Chair: **Yoshihiko Ishii** (Hitachi, Ltd., Japan)

7-3. Hydrogen and Containment Safety Issues - I

May 19 (Tue.), 10:50 - 12:30, 1F Room 104

Chair: **Yoshihisa Nishi** (Central Research Institute of Electric Power Industry, Japan)

7-4. LMR Safety issues

May 19 (Tue.), 13:30 - 15:30, 1F Room 104

Chair: **Tomohiko Ikegawa** (Hitachi Ltd., Hitachi Research Laboratory, Japan)

7-5. Reactor safety measures and effectiveness assessment - II

May 19 (Tue.), 16:00 - 18:00, 1F Room 104

Chair: **Takeshi Yamada** (Hitachi-GE Nuclear Energy, Ltd., Japan)

1F Room 105

7-8. Deterministic Safety Analysis and related experiments - I

May 19 (Tue.), 08:30 - 10:30, 1F Room 105

Chair: **Tomohiko Ikegawa** (Hitachi Ltd., Hitachi Research Laboratory, Japan)

ICONE23-1049 (Cancelled)

7-9. Experimental Studies in Nuclear Safety -I

May 19 (Tue.), 10:50 - 12:30, 1F Room 105

Chair: **Takeshi Yamada** (Hitachi-GE Nuclear Energy, Ltd., Japan)

7-10. Deterministic Safety Analysis and related experiments - II

May 19 (Tue.), 13:30 - 15:30, 1F Room 105

Chair: **Masahiro Furuya** (Central Research Institute of Electric Power Industry, Japan)

7-11. Deterministic Safety Analysis and related experiments - III

May 19 (Tue.), 16:00 - 18:00, 1F Room 105

Chair: **Yoshihiko Ishii** (Hitachi, Ltd., Japan)

21-1. Special Technical Track Fukushima Session I

May 19 (Tue.), 08:30 - 10:30, 2F Convention Hall A

Chair: **Hiroshi Kurikami** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Jun Saegusa** (Japan Atomic Energy Agency, Japan)

21-2. Special Technical Track Fukushima Session II

May 19 (Tue.), 10:50 - 12:30, 2F Convention Hall A

Chair: **Jun Saegusa** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Hiroshi Kurikami** (Japan Atomic Energy Agency, Japan)

21-3. Special Technical Track Fukushima Session III

May 19 (Tue.), 13:30 - 15:30, 2F Convention Hall A

Chair: **Jun Saegusa** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Hiroshi Kurikami** (Japan Atomic Energy Agency, Japan)

2F Convention Hall B-1

18-2. Thermalhydraulics 2

May 19 (Tue.), 08:30 - 10:30, 2F Convention Hall B-1

Chair: **Cheng Peng** (Shanghai Jiao Tong University, China)

Co-Chair: **Eugene Saltanov** (University of Ontario Institute of Technology, Canada)

18-3. Thermalhydraulics 3

May 19 (Tue.), 10:50 - 12:30, 2F Convention Hall B-1

Chair: **Juan Carlos Jouvin** (University of Ontario Institute of Technology, Canada)

Co-Chair: **Kazuhiro Kaiho** (The University of Electro-Communications, Japan)

18-4. Thermalhydraulics 4

May 19 (Tue.), 13:30 - 15:30, 2F Convention Hall B-1

Chair: **Naoki Miyano** (The University of Electro-Communications, Japan)

Co-Chair: **Wei Bao** (Nuclear Power Institute of China, China)

18-10. Measurement Methods

May 19 (Tue.), 08:30 - 10:30, 2F Convention Hall B-2

Chair: **Sebastian Schmidt** (Institute of Process Technology, Process Automation and Measuring Technology, Germany)

Co-Chair: **Naoki Shiibara** (National Defense Academy, Japan)

18-11. Advanced Reactors 1

May 19 (Tue.), 10:50 - 12:30, 2F Convention Hall B-2

Chair: **Hassan Mohamed** (University of Cambridge, United Kingdom)

Co-Chair: **David Kowalczyk** (University of Ontario Institute of Technology, Canada)

18-12. Advanced Reactors 2

May 19 (Tue.), 13:30 - 15:30, 2F Convention Hall B-2

Chair: **Miral Chauhan** (University of Ontario Institute of Technology, Canada)

Co-Chair: **Takahito Ogura** (Hokkaido University, Japan)

2F Room 201A

1-1. Support for Maintenance

May 19 (Tue.), 10:50 - 12:30, 2F Room 201A

Chair: **Koji Yamada** (Chubu Electric Power Co., Inc.,, Japan)

Co-Chair: **William A. Byers** (Westinghouse, United States)

1-2. Plant Performance

May 19 (Tue.), 13:30 - 15:30, 2F Room 201A

Chair: **William A. Byers** (Westinghouse, United States)

Co-Chair: **Shigetoshi Ono** (Tokyo Electric Power Company, Japan)

Thibaud Mercier (EDF R&D, France)

1-3. Testing and Research I

May 19 (Tue.), 16:00 - 18:00, 2F Room 201A

Chair: **William A. Byers** (Westinghouse, United States)

Co-Chair: **Koji Yamada** (Chubu Electric Power Co., Inc.,, Japan)

11-3. General CFD Applications

May 19 (Tue.), 08:30 - 10:30, 2F Room 201B

Chair: **Hiroyuki Ohshima** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Akira T Tokuhiro** (Purdue University, United States)

11-4. Turbulence, Heat and Mass Transfer

May 19 (Tue.), 10:50 - 12:30, 2F Room 201B

Chair: **Yacine Addad** (Khalifa University, United Arab Emirates)

Co-Chair: **Sofiane Benhamadouche** (Electricite De France R & D, France)

11-5. Multi-Scale, Multi-Physics Thermal-Hydraulics

May 19 (Tue.), 13:30 - 15:30, 2F Room 201B

Chair: **Michio Murase** (Institue of Nuclear Safety System, Inc., Japan)

11-6. Thermal Mixing, Stratification

May 19 (Tue.), 16:00 - 18:00, 2F Room 201B

Chair: **Akira Nakamura** (Institute of Nuclear Safety System, Inc., Japan)

Co-Chair: **Yann Bartosiewicz** (Université catholique de Louvain, Belgium)

15-3. Plasma and Nuclear Analysis

May 19 (Tue.), 08:30 - 10:30, 2F Room 202

Chair: **Kenji Tobita** (jaea, Japan)

Co-Chair: **Feng Kaiming** (Southwest Institute of Physic, China)

8-1. Development of Codes, Standards and Guidelines

May 19 (Tue.), 10:50 - 12:30, 2F Room 202

Chair: **Shenjie Gu** (Shanghai Nuclear Engineering Research and Design Institute , China)

Co-Chair: **Ralph Hill** (Westinghouse Electric Company LLC, United States)

8-2. Safety Related Topics

May 19 (Tue.), 13:30 - 15:30, 2F Room 202

Chair: **Kazuyuki Tsukimori** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Clayton Taylor Smith** (Fluor Nuclear Power, United States)

8-3. Licensing, Quality and Regulatory Related Topics

May 19 (Tue.), 16:00 - 18:00, 2F Room 202

Chair: **Howard Ho Chung** (Korea Advanced Institute of Science & Technology, Korea)

Co-Chair: **Kazuyuki Tsukimori** (Japan Atomic Energy Agency, Japan)

14-1. Advanced Sensors ,Measurement and Monitoring Techniques

May 19 (Tue.), 08:30 - 10:30, 2F Room 203

Chair: **Hirohisa Satomi** (Hitachi,Ltd.,Infrastructure Systems Company, Japan)

Co-Chair: **Daisuke Tan** (Hitachi, Ltd., Japan)

14-2. Application of Technology to Enhance Design, Test and Maintenance I

May 19 (Tue.), 10:50 - 12:30, 2F Room 203

Chair: **Goran Simeunovic** (Czech Technical University, Czech Republic)

Co-Chair: **Mauro Cappelli** (Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Italy)

14-3. Application of Technology to Enhance Design, Test and Maintenance II

May 19 (Tue.), 13:30 - 15:30, 2F Room 203

Chair: **Goran Simeunovic** (Czech Technical University, Czech Republic)

Co-Chair: **Mauro Cappelli** (Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Italy)

14-4. Development of Instrumentation Systems for Severe Accidents

May 19 (Tue.), 16:00 - 18:00, 2F Room 203

Chair: **Yasutake Fujishima** (Hitachi-GE Nuclear Energy, Ltd., Japan)

Co-Chair: **Atsushi Fushimi** (Hitachi, Ltd., Japan)

10-3. Single-Phase Flow & Turbulence

May 19 (Tue.), 08:30 - 10:30, 3F Room 301A

Chair: **Yassin Hassan** (Texas A&M University, United States)

Co-Chair: **Yasushi Yamamoto** (Toshiba Corporation, Japan)

10-4. Single & Multi-Phase Flow CFD

May 19 (Tue.), 10:50 - 12:30, 3F Room 301A

Chair: **Yasushi Yamamoto** (Toshiba Corporation, Japan)

Co-Chair: **Yassin Hassan** (Texas A&M University, United States)

10-5. Multi-Phase Flow I

May 19 (Tue.), 13:30 - 15:30, 3F Room 301A

Chair: **Akira Ohnuki** (Mitsubishi Heavy Industries, Ltd., Japan)

Co-Chair: **Xuewu Cao** (Shanghai Jiaotong University, China)

10-6. Multi-Phase Flow II

May 19 (Tue.), 16:00 - 18:00, 3F Room 301A

Chair: **Michio Murase** (Institue of Nuclear Safety System, Inc., Japan)

Co-Chair: **Licheng Sun** (Sichuan University, China)

10-13. LOCA & Transient Analyses II

May 19 (Tue.), 08:30 - 10:30, 3F Room 301B

Chair: **Shuichiro Miwa** (Hokkaido University, Japan)

Co-Chair: **Mohammad Pourgol-Mohammad** (Quality Consultings Inc. , United States)

10-14. Bubbly Flow Dynamics

May 19 (Tue.), 10:50 - 12:30, 3F Room 301B

Chair: **Mohammad Pourgol-Mohammad** (Quality Consultings Inc. , United States)

Co-Chair: **Shuichiro Miwa** (Hokkaido University, Japan)

10-15. Severe Accidents I

May 19 (Tue.), 13:30 - 15:30, 3F Room 301B

Chair: **Hiroyuki Yoshida** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Guanghui Su** (Xi'an Jiaotong University, China)

10-16. Severe Accidents II

May 19 (Tue.), 16:00 - 18:00, 3F Room 301B

Chair: **Guanghui Su** (Xi'an Jiaotong University, China)

Co-Chair: **Hiroyuki Yoshida** (Japan Atomic Energy Agency, Japan)

Panel-3. Beyond Design Basis

May 19 (Tue.), 08:30 - 10:30, 3F Room 302

Chair: **Jun Sugimoto** (Kyoto University, Japan)

Co-Chair: **Farhang Ostadan** (Bechtel Corporation, United States)

Jinquan Yan (Shanghai Nuclear Engineering Research & Design Institute, China)

Speakers: **Koji Okamoto** (The University of Tokyo)

Yu Maruyama (Japan Atomic Energy Agency)

Farhang Ostadan (Bechtel Corporation)

Victor Hugo Sanchez-Espinoza (Karlrsruhe Institute of Technology)

Jinquan Yan (Shanghai Nuclear Engineering Research and Design Institute)

Panel-4. Risk-informed Decision-Making

May 19 (Tue.), 13:30 - 15:30, 3F Room 302

Chair: **Akira Omoto** (Nuclear Risk Research Center, Central Research Institute of Electric Power Industry, Japan)

Co-Chair: **Clayton Taylor Smith** (Fluor Nuclear Power, United States)

Jianbing Guo (China General Nuclear Power Group, China)

Speakers: **Satoshi Kurata** (Nuclear Safety Division, Japan Nuclear Safety Institute)

Shinichi Kawamura (Nuclear Asset Management Department, Tokyo Electric Power Company)

Robert Oelrich (Westinghouse Electric Company)

Jianbing Guo (China General Nuclear Power Group)

6-1. Advanced Light Water Reactors 1

May 19 (Tue.), 16:00 - 18:00, 3F Room 302

Chair: **Kazuhiro Kamei** (Toshiba Corporation, Japan)

Co-Chair: **Jovica Riznic** (Canadian Nuclear Safety Commission, Canada)

Panel-6. Plant Life Management of LWR

May 19 (Tue.), 08:30 - 10:30, 3F Room 303

Chair: **Naoto Sekimura** (The University of Tokyo, Japan)

Co-Chair: **Zhengcao Li** (Tsinghua Universty, China)

Speakers: **Koji Yamada** (Chubu Electric Power Company)

Naoki Soneda (Central Research Institute of Electric Power Industry)

Curtis Smith (US Department of Energy)

Regis Nhili (Material Ageing Institute, Electricite de France)

Zhengcao Li (Tsinghua Universty)

Deping Kong (China National Nuclear Corporation)

Panel-2. Nuclear Regulatory Standards in International Co-Operation

May 19 (Tue.), 10:50 - 12:30, 3F Room 303

Chair: **Yutaka Abe** (University of Tsukuba, Japan)

Co-Chair: **Jovica Riznic** (Canadian Nuclear Safety Commission, Canada)

Speakers: **Toyoshi Fuketa** (Nuclear Regulation Authority of Japan)

Kensuke Yoshihara (Kansai Electric Power Company)

Igor Pioro (University of Ontario Institute of Technology)

Panel-8. Advanced Reactors & Design Development

May 19 (Tue.), 13:30 - 15:30, 3F Room 303

Chair: **Jeff Bradfute** (Westinghouse Electric Company, United States)

Co-Chair: **Kazuaki Matsui** (Institute of Applied Energy, Japan)

Guanghui Su (Xi'an Jiaotong University, China)

Speakers: **Richard F. Wright** (Westinghouse Electric Company)

Jean-Claude Bouchter (French Alternative Energies and Atomic Energy Commission)

Koji Nishida (Hitachi-GE Nuclear Energy, Ltd.)

Guanghui Su (Xi'an Jiaotong University)

Shripad Revankar (Purdue University)

Panel-10. 25-years Anniversary Session of Power & Energy System Division of JSME and International Conference on Nuclear Engineering

May 19 (Tue.), 16:00 - 18:00, 3F Room 303

Chair: **Tetsuaki Takeda** (University of Yamanashi, Japan)

Speakers: **Michio Ishikawa** (Former Chief Advisor, Japan Nuclear Technology Institute)

Hideki Nariai (Emeritus Professor, University of Tsukuba)

Saburo Toda (Emeritus Professor, Tohoku University)

Masanori Aritomi (Distinguished Professor, Tokyo Institute of Technology)

2-3. Material Challenges for GEN IV Fast Reactors and HTGR - II

May 19 (Tue.), 08:30 - 10:30, 3F Room 304

Chair: **Emmanuel Horowitz** (EDF, France)

Co-Chair: **Carsten Schroer** (Karlsruhe Institute of Technology (KIT), Germany)

Yoshinori Katayama (Toshiba Corporation, Japan)

2-4. Irradiation Damage and Stress Corrosion Cracking

May 19 (Tue.), 10:50 - 12:30, 3F Room 304

Chair: **Radek Skoda** (Czech Technical University in Prague, Czech Republic)

Co-Chair: **Ikuo Ioka** (Japan Atomic Energy Agency, Japan)

2-5. Corrosion in LWR Environment and Tritium Breeding and Hydrogen Isotope Separation

May 19 (Tue.), 13:30 - 15:30, 3F Room 304

Chair: **Jovica Riznic** (Canadian Nuclear Safety Commission, Canada)

Co-Chair: **Xiaomin Wang** (Nuclear Power Institute of China, China)

Masahiko Osaka (Japan Atomic Energy Agency, Japan)

2-6. Corrosion in Nitric Acid, FP Environment

May 19 (Tue.), 16:00 - 18:00, 3F Room 304

Chair: **Tatjana Jevremovic** (University of Utah, United States)

Co-Chair: **Zhangjian Zhou** (University of Science and Technology Beijing, China)

Ikuo Ioka (Japan Atomic Energy Agency, Japan)

May 20 (Wed.)

9-5. Waste Management - Regulation, Inventory estimation, and Classification

May 20 (Wed.), 08:30 - 10:30, 1F Room 101A

Chair: **Yukihiro Iguchi** (University of Fukui, Japan)

Co-Chair: **Tadao Tanaka** (Japan Atomic Energy Agency, Japan)

9-6. Decommissioning - Dismantling and Decontamination

May 20 (Wed.), 10:50 - 12:30, 1F Room 101A

Chair: **Seungkook Park** (Korea Atomic Energy Research Institute, Korea)

Co-Chair: **Ken-ichi Tanaka** (The Institute of Applied Energy, Japan)

9-7. Decommissioning - Engineering and Management Systems

May 20 (Wed.), 13:30 - 15:10, 1F Room 101A

Chair: **Brian M Ikeda** (University of Ontario Institute of Technology, Canada)

Co-Chair: **Koichi Kitamura** (Japan Atomic Energy Agency, Japan)

1F Room 101B

17-2. Water Cooled Systems

May 20 (Wed.), 08:30 - 10:30, 1F Room 101B

Chair: **Mie Azuma** (Westinghouse Electric, United States)

Co-Chair: **Guoqiang Wang** (Westinghouse Electric, United States)

17-3. Liquid Metal Systems

May 20 (Wed.), 10:50 - 12:30, 1F Room 101B

Chair: **Kazuhito Asano** (Toshiba Corporation, Japan)

17-4. Space Applications

May 20 (Wed.), 13:30 - 15:10, 1F Room 101B

Chair: **Jovica Riznic** (Canadian Nuclear Safety Commission, Canada)

3-4. Simulation of structures

May 20 (Wed.), 08:30 - 10:30, 1F Room 102A

Chair: **Jianfeng Yang** (Westinghouse Electric Company, United States)

Co-Chair: **Chuanrong Jin** (ITOCHU Techno-Solutions Corporation, Japan)

3-5. Components and design

May 20 (Wed.), 10:50 - 12:30, 1F Room 102A

Chair: **Jovica Riznic** (Canadian Nuclear Safety Commission, Canada)

Co-Chair: **Qing Mao** (CGNPC China Nuclear Power Engineering Co.,Ltd, China)

3-6. Mathematical approaches and other topics

May 20 (Wed.), 13:30 - 15:10, 1F Room 102A

Chair: **Leon Cizelj** (Jozef Stefan Institute, Slovenia)

Co-Chair: **Chikashi Suzuki** (Japan Atomic Energy Agency, Japan)

3-7. Seismic analyses

May 20 (Wed.), 15:40 - 17:20, 1F Room 102A

Chair: **Akemi Nishida** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Tomoyoshi Watakabe** (Japan Atomic Energy Agency, Japan)

1F Room 102B

16-2. Severe accident management and analysis

May 20 (Wed.), 08:30 - 10:30, 1F Room 102B

Chair: **Koji Okamoto** (The University of Tokyo, Japan)

Co-Chair: **Guobao Shi** (Shanghai Nuclear Engineering Research and Design Institute , China)

16-3. In and ex-vessel melt behavior

May 20 (Wed.), 10:50 - 12:30, 1F Room 102B

Chair: **Yu Maruyama** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Guobao Shi** (Shanghai Nuclear Engineering Research and Design Institute , China)

16-4. Structural integrity

May 20 (Wed.), 13:30 - 15:10, 1F Room 102B

Chair: **Farhang Ostadan** (Bechtel Corporation, United States)

Co-Chair: **Kiyofumi Moriyama** (Pohang University of Science and Technology, Korea)

5-7. SFR

May 20 (Wed.), 08:30 - 10:30, 1F Room 103

Chair: **Philippe Dufour** (Commissariat à l'énergie atomique et aux énergies alternatives, France)

Co-Chair: **Hiroshi Endo** (Central Research Institute of Electric Power Industry, Japan)

5-8. SFR & LFR

May 20 (Wed.), 10:50 - 12:30, 1F Room 103

Co-Chair: **Shigenobu Kubo** (Japan Atomic Energy Agency, Japan)

5-9. MSR & LFR

May 20 (Wed.), 13:30 - 15:10, 1F Room 103

Chair: **Shinya Miyahara** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Jerome Serp** (CEA, France)

5-10. Advanced WR

May 20 (Wed.), 15:40 - 17:20, 1F Room 103

Chair: **Yanping Huang** (Nuclear Power Institute of China, China)

Co-Chair: **Yoshiyuki Inagaki** (Japan Atomic Energy Agency, Japan)

7-6. Hydrogen and Containment Safety Issues - II

May 20 (Wed.), 08:30 - 10:30, 1F Room 104

Chair: **Satoshi Nishimura** (Central Research Institute of Electric Power Industry, Japan)

16-5. Hydrogen and spent fuel pool

May 20 (Wed.), 10:50 - 12:30, 1F Room 104

Chair: **Jinquan Yan** (Shanghai Nuclear Engineering Research & Design Institute, China)

Co-Chair: **Kiyofumi Moriyama** (Pohang University of Science and Technology, Korea)

16-6. Risk, external events and others

May 20 (Wed.), 13:30 - 15:10, 1F Room 104

Chair: **Jun Sugimoto** (Kyoto University, Japan)

Co-Chair: **Jinquan Yan** (Shanghai Nuclear Engineering Research & Design Institute, China)

16-7. Fission product behavior

May 20 (Wed.), 15:40 - 17:20, 1F Room 104

Chair: **Jun Sugimoto** (Kyoto University, Japan)

Co-Chair: **Farhang Ostadan** (Bechtel Corporation, United States)

1F Room 105

7-12. Safety and Risk Assessment Tools and Methods

May 20 (Wed.), 08:30 - 10:30, 1F Room 105

Chair: **Kohei Hisamochi** (Hitachi-GE Nuclear Energy, Ltd., Japan)

7-13. Nuclear safety fundamental technology

May 20 (Wed.), 10:50 - 12:30, 1F Room 105

Chair: **Yoshihiko Ishii** (Hitachi, Ltd., Japan)

7-14. Experimental Studies in Nuclear Safety -II

May 20 (Wed.), 13:30 - 15:10, 1F Room 105

Chair: **Taizo Kanai** (Central research instititute of electric power industry, Japan)

18-5. Thermalhydraulics 5

May 20 (Wed.), 08:30 - 10:30, 2F Convention Hall B-1

Chair: **Min Han Htet** (Kobe University, Japan)

Co-Chair: **Khalil Sidawi** (University of Ontario Institue of Technology, Canada)

18-6. Nuclear Safety and Accident Analysis 1

May 20 (Wed.), 10:50 - 12:30, 2F Convention Hall B-1

Chair: **Vladyslav Soloviov** (National Technical University of Ukraine "Kyiv Polytechnic Institute", Ukraine)

Co-Chair: **Takaaki Goi** (University of Tsukuba, Japan)

18-7. Nuclear Safety and Accident Analysis 2

May 20 (Wed.), 13:30 - 15:10, 2F Convention Hall B-1

Chair: **Lorenzo Stefanini** (University of Pisa, Italy)

Co-Chair: **Jiageng Su** (Tsinghua University, China)

18-8. Nuclear Safety and Accident Analysis 3

May 20 (Wed.), 15:40 - 17:20, 2F Convention Hall B-1

Chair: **Yuta Okuyama** (Hokkaido University, Japan)

Co-Chair: **Weiqian Zhuo** (North China Electric Power University, China)

2F Convention Hall B-2

18-13. Nuclear Materials and Components

May 20 (Wed.), 08:30 - 10:30, 2F Convention Hall B-2

Chair: **Barbora Benešová** (Czech Technical University in Prague, Czech Republic, Czech Republic)

Co-Chair: **Kosuke Mori** (University of Fukui, Japan)

18-14. Nuclear Fuel and Reactor Physics 1

May 20 (Wed.), 10:50 - 12:30, 2F Convention Hall B-2

Chair: **Bruno Miglierini** (Research Centre Rez, Czech Republic)

Co-Chair: **Jason Song** (Royal Military College of Canada, Canada)

18-15. Nuclear Fuel and Reactor Physics 2

May 20 (Wed.), 13:30 - 15:10, 2F Convention Hall B-2

Chair: **Martin Lovecky** (University of West Bohemia, Czech Republic)

Co-Chair: **Timothy A.V. Teatro** (University of Ontario Institute of Technology, Canada)

1-4. Support for Operations

May 20 (Wed.), 08:30 - 10:30, 2F Room 201A

Chair: **Xinrong Liu** (CNNC China Nuclear Power Engineering Co., Ltd, China)

Co-Chair: **Satoshi Kurata** (Japan Nuclear Safety Institute, Japan)

1-5. Power Plant Piping

May 20 (Wed.), 10:50 - 12:30, 2F Room 201A

Chair: **Yukinori Hirose** (Toshiba Corporation, Japan)

Co-Chair: **Xinrong Liu** (CNNC China Nuclear Power Engineering Co., Ltd, China)

ICONE23-1056 (Cancelled)

ICONE23-1281 (Cancelled)

1-6. Sever Accident Management I

May 20 (Wed.), 13:30 - 15:10, 2F Room 201A

Chair: **Satoshi Kurata** (Japan Nuclear Safety Institute, Japan)

Co-Chair: **Yukinori Hirose** (Toshiba Corporation, Japan)

1-7. Sever Accident Management II

May 20 (Wed.), 15:40 - 17:20, 2F Room 201A

Chair: **Xinrong Liu** (CNNC China Nuclear Power Engineering Co., Ltd, China)

Co-Chair: **Robert Stakenborghs** (ILD, Inc, United States)

11-7. Free Surface/Interface Behaviors

May 20 (Wed.), 08:30 - 10:30, 2F Room 201B

Chair: **Yann Bartosiewicz** (Université catholique de Louvain, Belgium)

Co-Chair: **Yuzuru Eguchi** (Central Research Institute of Electric Power Industry, Japan)

11-8. Codes, Models, Numerical Methods, V&V (I)

May 20 (Wed.), 10:50 - 12:30, 2F Room 201B

Chair: **Masaaki Tanaka** (Japan Atomic Energy Agency, Japan)

11-9. Codes, Models, Numerical Methods, V&V (II)

May 20 (Wed.), 13:30 - 15:10, 2F Room 201B

Chair: **Kei Ito** (Japan Atomic Energy Agency, Japan)

1-8. Testing and Research II

May 20 (Wed.), 08:30 - 10:30, 2F Room 202

Chair: **Robert Stakenborghs** (ILD, Inc, United States)

Co-Chair: **Mitsuyuki Sagisaka** (Nuclear Fuel Industries, ltd., Japan)

1-9. Welding related Technology I

May 20 (Wed.), 13:30 - 15:10, 2F Room 202

Chair: **Robert Stakenborghs** (ILD, Inc, United States)

Co-Chair: **Koji Yamada** (Chubu Electric Power Co., Inc.,, Japan)

1-10. Welding related Technology II

May 20 (Wed.), 15:40 - 17:20, 2F Room 202

Chair: **Koji Yamada** (Chubu Electric Power Co., Inc.,, Japan)

Co-Chair: **Ryoji Mizuno** (Japan Power Engineering and Inspection Corporation, Japan)

14-5. Software Dependability and Analysis

May 20 (Wed.), 08:30 - 10:30, 2F Room 203

Chair: **Martin Kropik** (Czech Technical University, Czech Republic)

Co-Chair: **Goran Simeunovic** (Czech Technical University, Czech Republic)

ICONE23-2061 (Cancelled)

14-6. Digital System Reliability and Analysis

May 20 (Wed.), 10:50 - 12:30, 2F Room 203

Chair: **Yasutake Fujishima** (Hitachi-GE Nuclear Energy, Ltd., Japan)

Co-Chair: **Mauro Cappelli** (Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Italy)

14-7. Advanced C&Il Systems Design and Management

May 20 (Wed.), 13:30 - 15:10, 2F Room 203

Chair: **Mauro Cappelli** (Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Italy)

Co-Chair: **Shenjie Gu** (Shanghai Nuclear Engineering Research and Design Institute , China)

10-7. Supercritical Fluids & Gas-Cooled Reactors

May 20 (Wed.), 08:30 - 10:30, 3F Room 301A

Chair: **Wei Peng** (Tsinghua University, China)

Co-Chair: **Yanping Huang** (Nuclear Power Institute of China, China)

10-8. Liquid Metal Thermal-Hydraulics

May 20 (Wed.), 10:50 - 12:30, 3F Room 301A

Chair: **Hidemasa Yamano** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Wadim Jaeger** (Karlsruhe Institute of Technology, Germany)

10-9. Containment Thermal-Hydraulics

May 20 (Wed.), 13:30 - 15:10, 3F Room 301A

Chair: **Kazuyuki Takase** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Peipei Chen** (SNPTC, China)

10-10. Steam Generator & Heat Exchanger

May 20 (Wed.), 15:40 - 17:20, 3F Room 301A

Chair: **Peipei Chen** (SNPTC, China)

Co-Chair: **Kazuyuki Takase** (Japan Atomic Energy Agency, Japan)

10-17. Droplet Behavior

May 20 (Wed.), 08:30 - 10:30, 3F Room 301B

Chair: **Shoji Mori** (Yokohama National University, Japan)

Co-Chair: **Di Zhang** (Tsinghua University, China)

10-18. Critical Heat Flux

May 20 (Wed.), 10:50 - 12:30, 3F Room 301B

Chair: **Guoqiang Wang** (Westinghouse Electric, United States)

Co-Chair: **Shoji Mori** (Yokohama National University, Japan)

10-19. Flow Instability & Oscillation

May 20 (Wed.), 13:30 - 15:10, 3F Room 301B

Chair: **Takeshi Takeda** (Japan Atomic Energy Agency, Japan)

Co-Chair: **Bao-wen Yang** (Xian Jiaotong University, China)

6-2. Advanced Light Water Reactors 2

May 20 (Wed.), 08:30 - 10:30, 3F Room 302

Chair: **Kazuyoshi Aoki** (Toshiba Corporation, Japan)

Co-Chair: **Jovica Riznic** (Canadian Nuclear Safety Commission, Canada)

6-3. Advanced Light Water Reactors 3

May 20 (Wed.), 10:50 - 12:30, 3F Room 302

Chair: **Jovica Riznic** (Canadian Nuclear Safety Commission, Canada)

Co-Chair: **Kazuhiro Kamei** (Toshiba Corporation, Japan)

13-1. Nuclear Education, Public Acceptance and Related Issues I

May 20 (Wed.), 13:30 - 15:10, 3F Room 302

Chair: **Hiroshige Kikura** (Tokyo Institute of Technology, Japan)

Co-Chair: **Emilio Baglietto** (Massachusetts Inst of Tech, United States)

13-2. Nuclear Education, Public Acceptance and Related Issues II

May 20 (Wed.), 15:40 - 17:20, 3F Room 302

Chair: **Emilio Baglietto** (Massachusetts Inst of Tech, United States)

Co-Chair: **Hiroshige Kikura** (Tokyo Institute of Technology, Japan)

Panel-7. Education and Human Resources Development

May 20 (Wed.), 08:30 - 10:30, 3F Room 303

Chair: **Masaki Saito** (Tokyo Institute of Technology, Japan)

Co-Chair: **Yassin Hassan** (Texas A&M University, United States)

Shripad Revankar (Purdue University, United States)

Suyuan Yu (Tsinghua University, China)

Speakers: **Tomotsugu Sawai** (Japan Atomic Energy Agency)

Yassin Hassan (Texas A&M University)

Leon Cizelj (University of Ljubljana, ENEN Association)

Liangming Pan (Chongqing University)

Panel-9. Getting the Public to Accept Nuclear Power

May 20 (Wed.), 10:50 - 12:30, 3F Room 303

Chair: **Jay Kunze** (Idaho state University, United States)

Co-Chair: **Hidekazu Yoshikawa** (Kyoto University, Japan)

Guanghui Su (Xi'an Jiaotong University, China)

Speakers: **Steve Kidd** (East Cliff Consulting)

Vaughn Gilbert (Westinghouse Electric Company)

Leon Cizelj (Jožef Stefan Institute)

Reiko Fujita (Atomic Energy Society of Japan)

Guanghui Su (Xi'an Jiaotong University)

2-7. Fuel Cladding Behavior in Accidents and Corrosion Product Release

May 20 (Wed.), 08:30 - 10:30, 3F Room 304

Chair: **Robert L Oelrich** (Westinghouse, United States)

Co-Chair: **Ikuo Ioka** (Japan Atomic Energy Agency, Japan)

2-8. Fuel Design and Inspection

May 20 (Wed.), 10:50 - 12:30, 3F Room 304

Chair: **Yoshihiro Isobe** (Nuclear Fuel Industries, Ltd., Japan)

Co-Chair: **Suwardi Suwardi** (National Nuclear Energy Agency, Indonesia)

2-9. Fuel Safety and Performance

May 20 (Wed.), 13:30 - 15:10, 3F Room 304

Chair: **Lembit Sihver** (Chalmers University of Technology , Sweden)

Co-Chair: **Radek Skoda** (Czech Technical University in Prague, Czech Republic)

Yoshihiro Isobe (Nuclear Fuel Industries, Ltd., Japan)

2-10. Actinide and MOX Fuel Development

May 20 (Wed.), 15:40 - 17:20, 3F Room 304

Chair: **Paul Chan** (Royal Military College of Canada , Canada)

Co-Chair: **Wenzhong Zhou** (City University of Hong Kong, China)

Yoshihiro Isobe (Nuclear Fuel Industries, Ltd., Japan)