

出國報告(出國類別：開會)

## 高放射性廢棄物核種遷移研討會

服務機關：台灣電力公司  
核能後端營運處

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派赴國家：日本

出國期間：108年9月14日~108年9月21日

報告日期：108年10月31日

(本頁為空白頁)

## 行政院及所屬各機關出國報告提要

出國報告名稱：高放射性廢棄物核種遷移研討會

頁數 37 含附件：是否

出國計畫主辦機關/聯絡人/電話

台灣電力公司/陳德隆/02-23667685

出國人員姓名/服務機關/單位/職稱/電話

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出國類別：1 考察2 進修3 研究4 實習5 開會6 其他：

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關鍵詞：放射性廢棄物、最終處置、核種遷移

內容摘要：

高放射性廢棄物核種遷移研討會(Migration 研討會)從 1987 年開始舉辦，每兩年舉行一次，Migration 2019 研討會為第 17 屆，108 年 9 月 15 至 20 日於日本京都召開。Migration 研討會提供一個國際論壇進行科學資訊的交流，並討論銻系元素與分裂產物於天然含水層遷移行為的化學控制過程。

用過核子燃料最終處置攸關長時間尺度與人類生活圈的隔離，其安全分析評估之技術及手法非常重要，如何利用工程障壁、天然障壁等方法達到圍阻與遲滯放射性核種的功能，最終使其在不影響環境與人類生活的情況下衰變為環境的背景值。Migration 2019 研討會主要討論放射性核種與其分裂產物在天然地下水環境中的遷移行為，核種遷移實驗與數值模型建模為此會議的主要主題。於技術議題時，各國專家簡報近期於放射性核種遷移領域之研究成果，報告內容除理論分析模式之發展，更包含實驗室試驗與現地實驗，可提供與會人員最新技術及研究數據，後續進行相關討論，以聚焦研究方向。

藉由參加 Migration 2019 研討會，增加與各國專家交流機會，可瞭解目前國際上核種遷移研究發展現況與未來趨勢，並汲取各國專家之技術與經驗，建立國內相關技術，有助於國內用過核子燃料最終處置計畫之推動。

本文電子檔已傳至出國報告資訊網 (<http://report.nat.gov.tw/reportwork>)

## 摘要

" 高放射性廢棄物核種遷移研討會 (OKI TCWQP 研討會) 從 1983 年開始舉辦，每兩年舉行一次，OKI TCWQP 研討會為第 39 屆，於 2021 年 12 月 37 至 42 日於日本京都召開。OKI TCWQP 研討會提供一個國際論壇進行科學資訊的交流，並討論銻系元素與分裂產物於天然含水層遷移行為的化學控制過程。"

" 用過核子燃料最終處置攸關長時間尺度與人類生活圈的隔離，其安全分析評估之技術及手法非常重要，如何利用工程障壁、天然障壁等方法達到圍阻與遲滯放射性核種的功能，最終使其在不影響環境與人類生活的情況下衰變為環境的背景值。OKI TCWQP 研討會主要討論放射性核種與其分裂產物在天然地下水環境中的遷移行為，核種遷移實驗與數值模型建模為此會議的主要主題。於技術議題時，各國專家簡報近期於放射性核種遷移領域之研究成果，報告內容除理論分析模式之發展，更包含實驗室試驗與現地實驗，可提供與會人員最新技術及研究數據，後續進行相關討論，以聚焦研究方向。而本次研討會分為技術議題簡報與海報展示，其中台電公司偕同中興工程顧問社與台灣大學共同投稿 3 篇核種遷移相關成果參加海報展示，並與國際專家進行討論。"

" 藉由參加 OKI TCWQP 研討會，增加與各國專家交流機會，可瞭解目前國際上核種遷移研究發展現況與未來趨勢，並汲取各國專家之技術與經驗，建立國內相關技術，有助於國內用過核子燃料最終處置計畫之推動。"

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## 壹、目的"

" 台電公司依法執行用過核子燃料最終處置計畫，已於 328 年底提出「我國用過核子燃料最終處置技術可行性評估報告\*UHP F 4239 報告+」，亦經國際專家與主管機關審查同意，確認國內具備地質處置技術能力，主管機關要求台電公司持續精進高放處置技術，其中核種傳輸為處置安全評估分析之關鍵因子，亦屬於高放處置計畫之核心技術項目，相關技術資訊可作為高放處置安全評估及國內核種傳輸技術精進之規劃方向，參與相關研討會瞭解國際發展現況與未來趨勢有其必要性。"

" O ki tcvkqp 研討會\*kpvtgpcvkqpcnEqphgtgpeg'qp'vj g'Ej go kxt {"cpf 'O ki tcvkqp" Dgj cxkqt"qh'Cevkpkf gu'cpf 'Hkuukqp'Rtqf wew'lp'vj g'I gqur j gtg+從 3; : 9 年開始舉辦，每兩年舉行一次，主要針對鈾系元素與分裂產物於地質圈的化學與傳輸行為進行討論，提供國際專家交流平台，討論議題涵蓋用過核子燃料I高放射性廢棄物最終處置系統的核種傳輸研究，包含理論基礎、傳輸模式發展、實驗室試驗與現地實驗等。O ki tcvkqp'423; 研討會為第 39 屆，32: 年；月 37 至 42 日於日本京都召開，日本高放射性廢棄物處置專責機構/原子力發電環境整備機構\*P wergct'Y cug'O cpci go gpv'Qti cpk cvkqp"qh'Lcr cp."P WO Q+為協辦方，並有世界各國專責機構與研究單位參加，對未來相關技術與發展方向實有寶貴之幫助。"

" 藉由參加 O ki tcvkqp423; 研討會之機會，與來自世界各國的研究人員進行意見交流，並透過參加會議之發表人簡報及海報展示等方式，掌握國際上高放射性廢棄物核種傳輸技術發展現況、未來的發展趨勢等，有助於國內用過核子燃料最終處置計畫之推動。"

" "

## 貳、過程

自 32 年；月 36 日出發，；月 43 日返國，共計：天，參加於日本京都舉辦之 Oki tcvkqp"423; 研討會，本次行程及工作內容如表"3 所示。會議舉辦地點為 M{qv"Wpkxgtuk{ "Mj cf c"J cm。"

"

表"3：訪問行程及工作內容"

日期	地點與行程	工作內容
；月 36 日*六+	臺北" →大阪" →京都"	去程"
；月 37 日*日+ 至" ；月 42 日*五+	京都"	參加 Oki tcvkqp"423; 研討會"
；月 43 日*六+	京都" →大阪" →臺北"	回程"

## 參、工作內容"

### 一、會議大綱

" ; 月 37 日 37 時至 39 時為 O ki tcvkqp"423; 研討會註冊報到時間, 台電公司潘維耀副處長、尤偉駿主管與陳臆涵專員前往位於京都大學宇治校區內的 Mj cf c"J cm 一樓大廳辦理報到\*如圖 3 及圖 4+, 並領取 O ki tcvkqp"423; 研討會相關資料。"

O ki tcvkqp 研討會提供一個國際論壇進行科學資訊的交流, 並討論銅系元素與分裂產物於天然含水層遷移行為的化學控制過程。本次會議討論議題包含核種溶解度、核種吸附實驗、地化模式應用、耦合傳輸模擬、安全評估應用等, 此外, 也有結合裂隙水流與核種傳輸之評估模擬, 從研討會獲得的資訊可作為長半衰期核種於地質圈遷移機制之基礎, 對於放射性廢棄物最終處置長期安全評估非常重要。研討會主題分為 7 大主題, 內容涵蓋下列議題: "

#### C0 銅系元素的產生與水化學作用"

- 30 溶解度與溶解作用"
- 40 固體溶液與二次相形成"
- 50 無機與有機物錯合作用"
- 60 氧化還原反應與輻射分解作用"
- 70 固相與水相界面反應"
- 80 膠體形成"
- 90 實驗方法"
- :0 計算化學"

#### D0 放射性核種的遷移行為"

- 30 動態系統中的吸附脫附現象"
- 40 擴散和其他遷移過程"
- 50 膠體遷移"
- 60 生物和有機材料之影響"

70 現場與大規模實驗"

80 天然類比"

E0 地球化學與傳輸模式"

30 數據選擇與評估"

40 化學與傳輸之耦合"

50 模型的發展與應用"

60 模型驗證"

70 安全評估與處置概念"

F0 應用案例研究"

G0 特別單元"

日本針對高放射性廢棄物處置和福島第一核電站舊址修復的研究  
活動"

"



圖"3：日本京都大學宇治校區"

"



圖"4 : Oki tcvkp"423; 研討會會場"

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"

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## 二、開幕式暨專題演講

；月37日當天下午前往Oki tcvkqp"423; 研討會會場進行註冊，並參加開幕式\*如圖5+，本次研討會由日本京都大學及德國卡爾斯魯爾理工學院\*netnutwj g'kpukwng"qh'gej pqmqi {.MKV+主辦，為放射性廢棄物處置技術的重要會議，除日本之外亦有許多放射性廢棄物處置之先進國家參加，其單位包含了各國的專責機構與研究單位。Oki tcvkqp研討會從3; : 9年在德國舉辦的第一屆開始，每兩年定期舉辦一次，本次為第39屆會議。"

" 本次會議由日本PWOQ於開幕式分享日本放射性廢棄物深地層處置\*F ggr 'I gqmqi kecnTgr qukqt {.FI T+之經驗。日本在4222年8月完成特定放射性廢棄物最終處置法\*Ur gekkgf 'T cf kqcevkxg'Y cug'HlpcnF kur qucnCev+立法，同年32月設立日本原子力發電環境整備機構\*PWOQ+。PWOQ負責高放射性廢棄物之處置場選址、處置技術驗證、執照申請、處置場建造、運轉與封閉等工作。「特定放射性廢棄物最終處置法」已確立最終處置方式為地表下至少522"公尺深度之深地質處置，且需經5階段之調查與選址作業，以調查範圍大到小分為第一階段的文獻回顧，第二階段的初步場址調查，第三階段的詳細場址調查\*如圖6+。PWOQ於4224年公開各城市的調查文獻，惟獲得批准者可進行調查，日本在溝通方面做了許多縝密的思慮，有許多公開說明會、巡迴展示車，並從小教育看待處置的正確觀念\*如圖7+。目前日本尚未確定深地層處置之地點，故採取通用型研究，PWOQ的通用型安全論證報告\*Uchgv{ "Ecug+評估多種工程障壁系統與天然障壁的處置概念，可長時間提供隔離和圍阻的安全功能。"

為進行深地層處置的廢棄物罐以及地面和地下設施設計，PWOQ蒐集許多適當的方法論和資料，設計上應滿足國際原子能總署\*kpvtpcvkqpcn'cvqo ke"Gpgti {"Ci gpe{."KCGC+建議的安全標準。PWOQ使

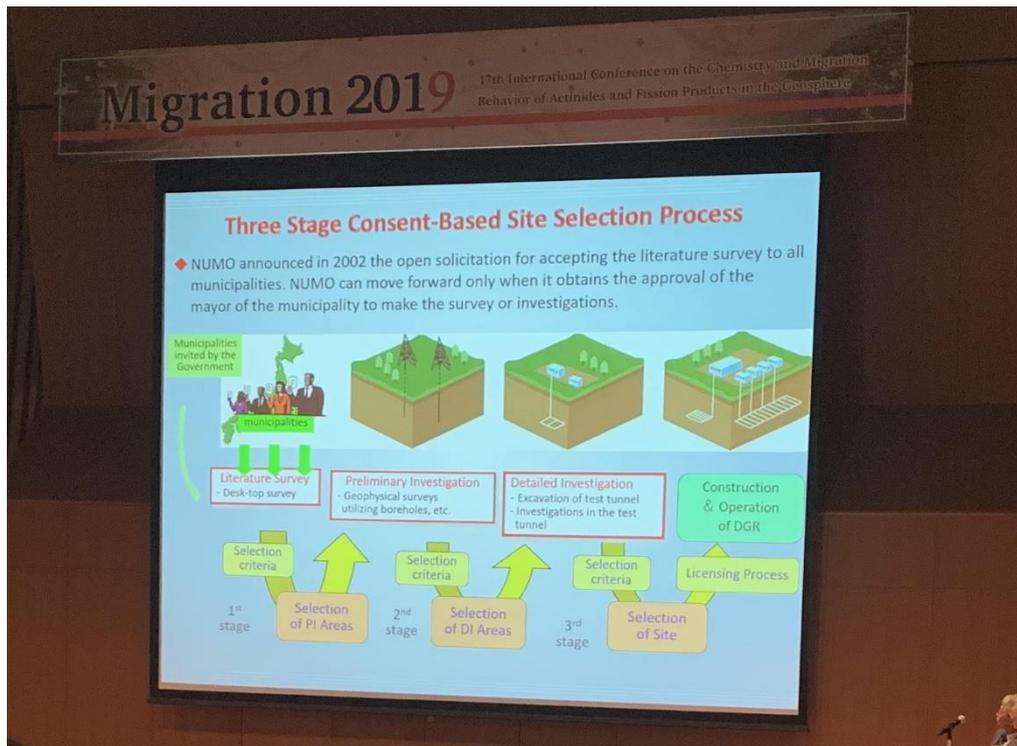
用整個處置場的系統建模來執行安全評估，系統建模可對不同工程障壁和天然障壁組合做出不同的評估結果與貢獻，目前在高放射性廢棄物處置中，依工程障壁系統可分為水平處置與垂直處置兩類，而超鈾廢棄物處置\*Vtcpuwtcplē"Y cuvg"Tr quksqt {+的工程障壁系統，也是在包封容器外填滿膨潤土作為緩衝材料\*如圖8+。在天然地質環境與遠場地下水流評估方面，係透過離散裂隙網路\*F luetgvg'Htcewtg'P gy qtm'F HP +概念模式進行應用，F HP 概念模式指將現地的裂隙調查、水文地質調查與地質特性調查的資料應用於數值模式，並整合成可分析之概念模型，可將數值模型與場址實地現況關聯性提高，藉此加強數值模擬的可信度，為安全論證之重點工作之一\*如圖9+。"

日本國內目前主要研發設施由日本原子力開發研究機構\*1cr cp" Cxqo le"Gpgti {"Ci gpe{"LCGC+所營運\*如圖: +，一座位於北海道的幌延\*J qtqqdg+地下實驗室，深度達572公尺，岩性為沉積岩，其地下水質鹽度較高，另一座位於東濃\*Vqpq+的地球科學研究中心，此處地下岩層為結晶岩，水質為淡水，另外還有位於東海\*Vqmck+的核燃料處理研究中心。日本的地質環境與我國類似，鑿借與汲取日本之經驗對我國高放處置技術發展與研發規劃有相當大之幫助。"

"



圖"5：開幕式會場"

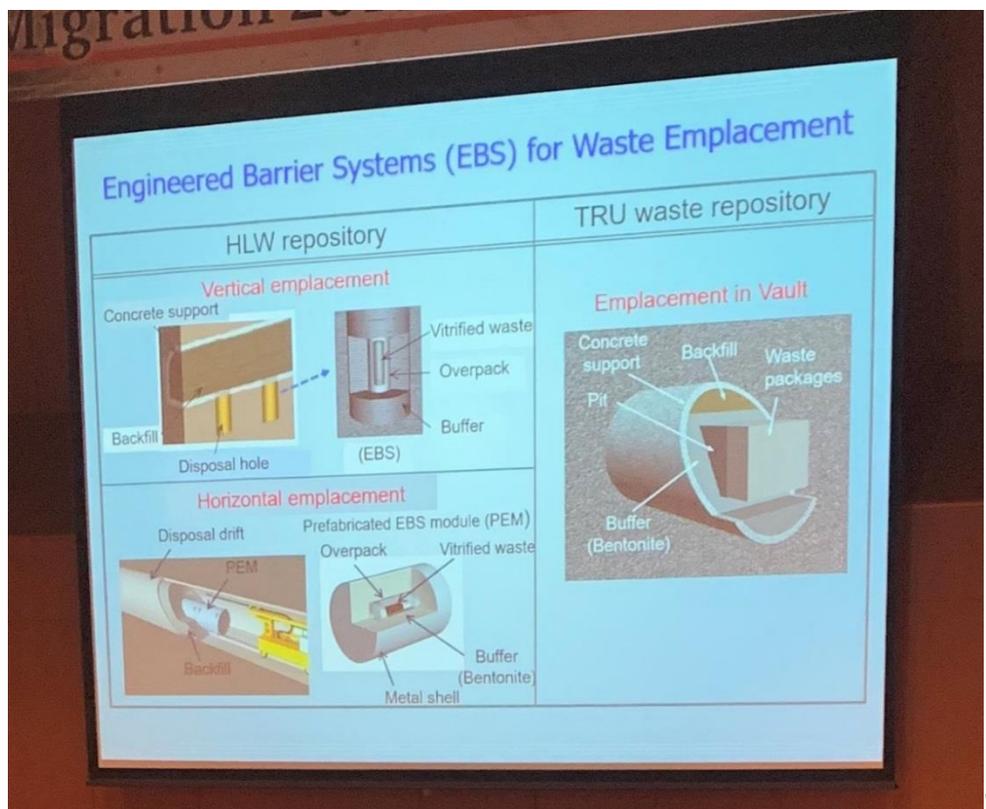


圖"6：日本 PWOQ 三階段選址程序"

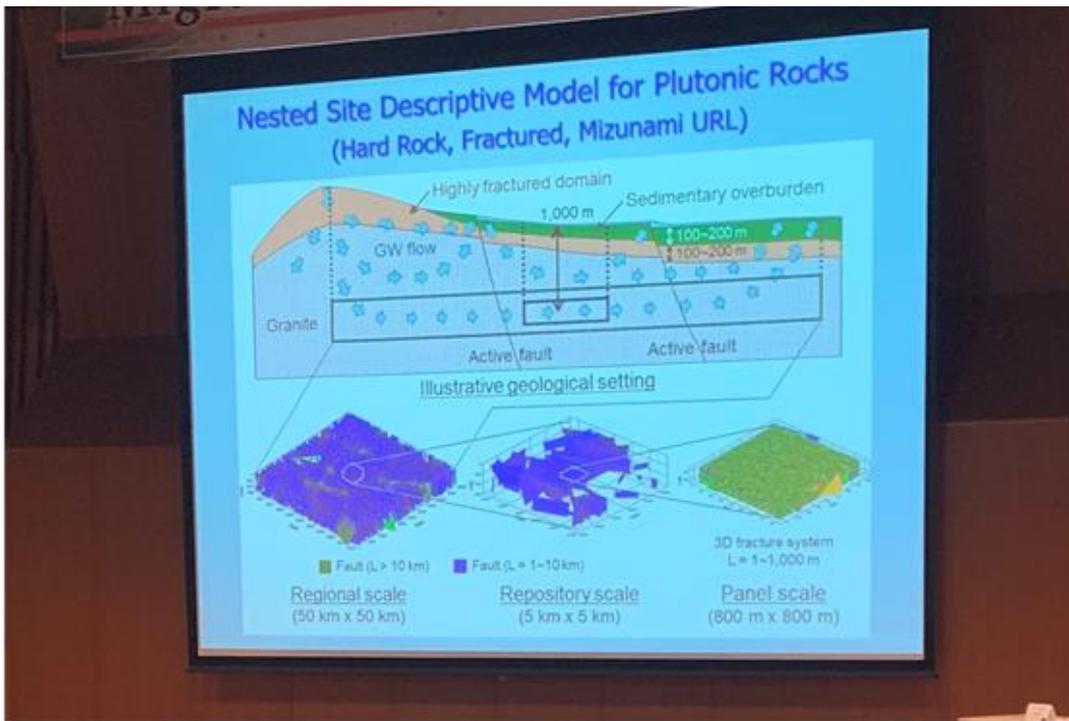


圖"7：民眾溝通相關說明"

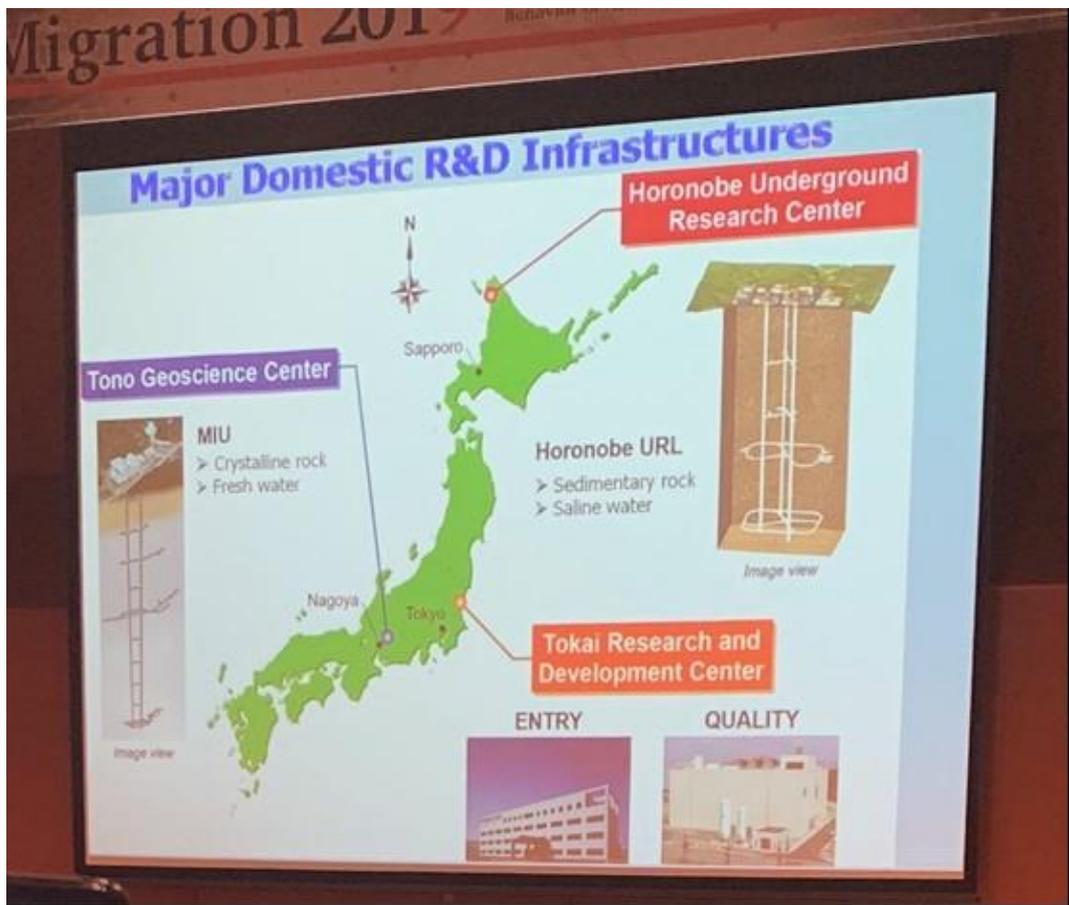
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圖"8：不同工程障壁系統示意圖"



圖"9：場址評估模型建置示意圖"



圖"：：日本主要研發設施"

### 三、技術議題

安全評估的基礎概念為當放置在地下深處的廢棄物體或包封容器受損，放射性核種將會釋出並流經工程障壁系統，再流至處置母岩與地下水中。核種遷移主要媒介為地下水，而在傳輸的過程中會碰到許多地質材料，可能會與地下水和地質材料發生化學反應，使遷移過程中增加許多變數，其傳輸機制考量核種衰變、釋出率、溶解度、平流、延散、擴散、吸附等，影響空間中核種濃度之分布機制。依各國地下水質、工程障壁系統材料或採用的母岩特性不同，其分析結果可能各國皆有差異。目前對核種特性研究較豐富的放射性廢棄物最終處置專責機構與研究單位有日本 ICGC、德國 MKV、德國 J g m j q n \ / g p t w o " F t g u f g p / T q u g p f q t h " \* J \ F T +、美國 N q u ' C r o q u ' P c v k q p c n ' N c d q t c v q t { " \* N C P N +、西班牙 C o r j q u " 43 等，本次研討會發表內容相當多關於核種溶解度、吸附、表面錯合、膠體形成等實驗結果。"

目前在吸附實驗及參數研究上，以將吸附實驗後逆推得到的參數轉換為表面錯合反應參數為主要方向，如轉換為表面錯合參數可與地化模式進行結合，因一般吸附實驗逆推吸附參數  $K_d$  值，只具有某情況下的代表性，加入代表性水質參數後可評估出更具代表性之吸附值，核種傳輸數值模擬上也有別於傳統的三維水流模擬與一維裂隙傳輸，此次也有研究單位展示三維離散裂隙網路  $DSP$  水流模型升尺度至等效連續多孔介質  $GS$  模型  $Eqp$  模型  $Rqt$  模型  $Ogf$  模型。GERO 後運行三維核種傳輸之結果。"

蒙脫石  $o$   $qpvo$   $qtkmpkg$  在地下水於低離子濃度時容易形成膠體，因膠體會吸附放射性核種可作為載體  $Ectt$ ，具有加速核種傳輸的潛能，尤其對於溶解度較低的放射性核種，可吸附於膠體表面而隨地下水傳輸，成為另一項傳輸機制。而膠體釋出會伴隨著蒙脫石的流失，蒙脫

石的流失量為維持處置場安全功能的重要指標，因此瞭解膠體對核種吸脫附及遷移行為的影響，為安全評估之重要工作。"

"

C0 模擬  $^{137}\text{Cs}$  與伊萊石、蒙脫石中的吸附行為，在 43°C、82°C 和 120°C 的情況下"

法國用過核子燃料最終處置如選擇深層泥岩做為處置母岩，其安全評估的準確度需要進行可靠的污染物遷移預測。預測污染物的遷移行為需要考慮環境中複雜的物理化學條件，特別是礦物表面的吸附反應，目前已經可以預測幾種放射性核種在泥岩上的等溫吸附曲線，並使用表面錯合與離子交換模型。吸附運用在放射性廢棄物安全評估中的遠場及近場中，其中還包含了擴散、平流、延散等條件。此研究主要目的是將蒙脫石與伊萊石兩者對於  $^{137}\text{Cs}$  在 43°C、82°C 和 120°C 時的吸附能力評估，法國採用 Ecmxq/Qzhqtf kcp<sup>EQz</sup> 黏土岩作為處置母岩進行評估，高放射性廢棄物與黏土岩的介面溫度將會升高，因為用過核子燃料具有衰變熱，放置後 32 年或 37 年後溫度最高可以達到 120°C，隨著時間拉長溫度會逐進降低，放置 322 年後約降低至 82°C。在此研究中，分別在 43°C、82°C 和 120°C 的溫度下獲得了  $^{137}\text{Cs}$  在伊萊石與蒙脫石樣品上的等溫吸附曲線。並在實驗裝置進行了擴散試驗，也使用 92% 伊萊石與 52% 蒙脫石的混和吸附性礦物，與實驗數據觀察到良好的一致性。如圖 10-10 所示，結果顯示溫度升高對  $^{137}\text{Cs}$  的濃度影響較小，而且濃度等溫曲線上獲得的數值跟實驗數據相比略有高估，但在 82°C 和 120°C 結果相當好。"

"

D0 模擬放射性核種傳輸綜合方法與模式鏈討論與概述"

本議題主要介紹用過核子燃料深地層處置安全評估中放射性核種傳輸模型的最新趨勢，安全評估範圍包含近場、遠場及生物圈。結晶岩

中裂隙系統的複雜性與非均質性相當的高，而一般地下水流場通常使用孔隙介質，且模型常常簡化至均質材料，但因此種模型已經被過度簡化，將會降低模型的實用性，並導致結果保守且有偏差。目前芬蘭的高放處置專責機構 RQUKIC 公司和瑞典的高放處置專責機構 UMD 公司都使用核種傳輸軟體 Oki tcvkqp "Cpcn{uku" qh" Tcf kqpwenkf gu" kp" yj g" Hct" Hgrf " \*OCTHC+進行傳輸模型模擬分析\*如圖 32+。"

用過核子燃料安全評估模型的開發步驟過程

30 場址特徵性研究。"

40 放射性核種傳輸概念模型開發。"

50 選擇適當的假設並將其參數化。"

60 提供安全評估模型。"

"

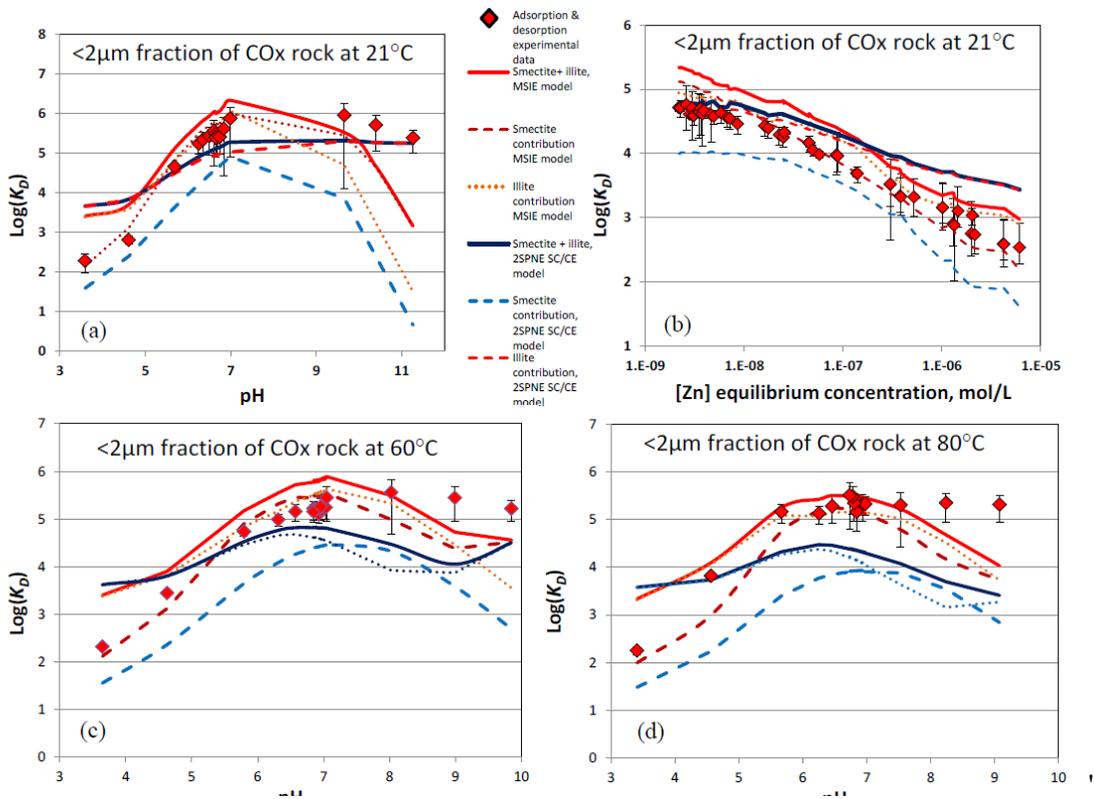
綜合地質圈評估工具 \*K CV+為西班牙 Co rj qu"43 公司、瑞典 UMD 公司、芬蘭 RQUKIC 公司正共同開發之評估工具，K CV 的核心為 OCTHC，此方法所使用的水流概念為離散裂隙網路與升尺度後的等效多孔介質，目前日本也採用此種方法進行評估\*如圖 33+ 西班牙 Co rj qu" 43 公司以地化模式起家，與高放射性廢棄物相關的業務包含近場熱/水/化模擬與模式耦合，目前 OCTHC 的維護及使用權也是此公司管理，此次也學習到此公司對裂隙水流場與傳輸耦合的相關概念，受益良多。"

"

E0 六所村低放射性廢棄物安全評估"

日本核燃料公司 \*Lcr cp" P wengct "Hwgn" Nko kgf . "IP HN+是由日本；家電  
力公司(中部 "Ej wdw 中國 "Ej wi qmw 北海道 "J qmckf q, 北陸 J qmwtkmw  
關西 "Mc puck, 九州 "M{ wuj w, 四國 "Uj knqmw, 東北 "Vqj qmw, 東京 "Vqm{ q)  
及日本原子力發電 \*Lcr cp" C vqo le "Rqy gt "Eqtr qtcvkqp. "LCRE+聯合成立，主

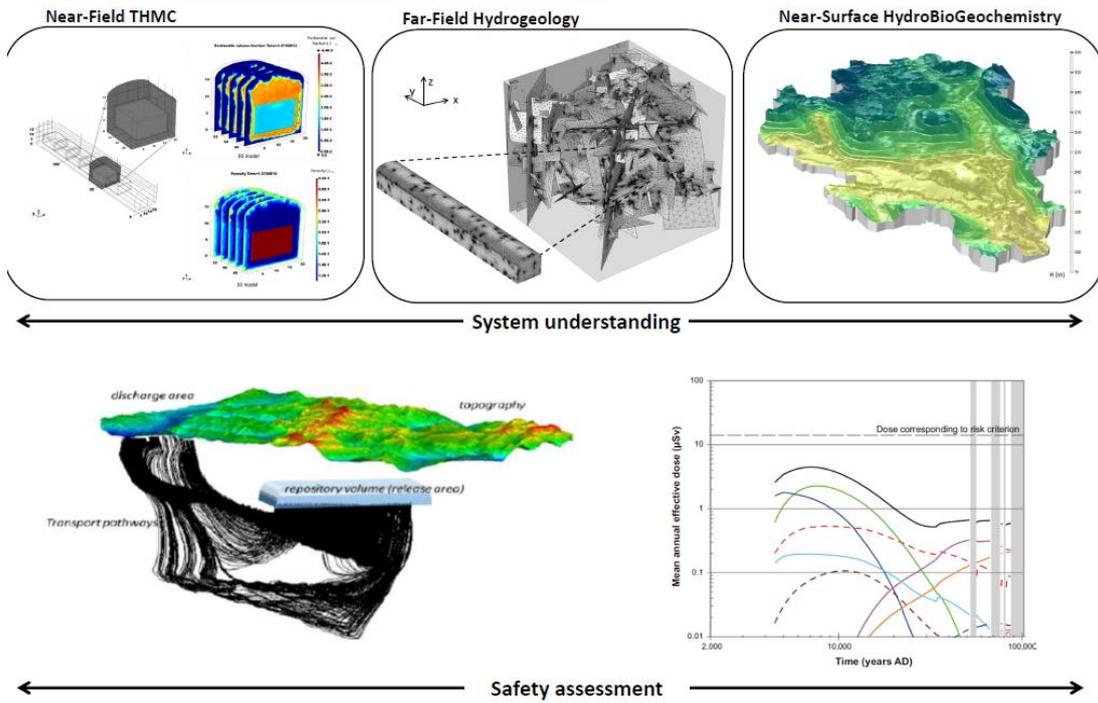
要業務為進行鈾濃縮、用過核子燃料再處理、OQZ"燃料製造、高放貯存及低放射性廢棄物最終處置等有關之作業，IPHN 在日本青森縣六所村建立核能相關設施，目前已啟用兩座低放射性廢棄物處置設施，預計增建的第三座低放處置設施容積更大，約為 64.222 立方公尺。圖 34 為六所村場址模型並假設地形的變化\*隆起與侵蝕+，為確定輻射劑量評估需考慮多種的變化情況，將各情節繪成輻射劑量評估模式鏈\*圖 35+進行評估分析。圖 36 為工程障壁與天然障壁介面示意圖，工程障壁與天然障壁間的交互作用會引起次生礦物的產生並影響天然障壁的滲透性，此分析使用了 RJ TGGSE/VTCPU 和 LP E/Uqtr vkqp"Fcvcug"\*LP E/UF D+。安全評估的結果顯示，輻射劑量峰值約在 3222 年時發生，主要放射性核種為 E/36\*如圖 37+。"



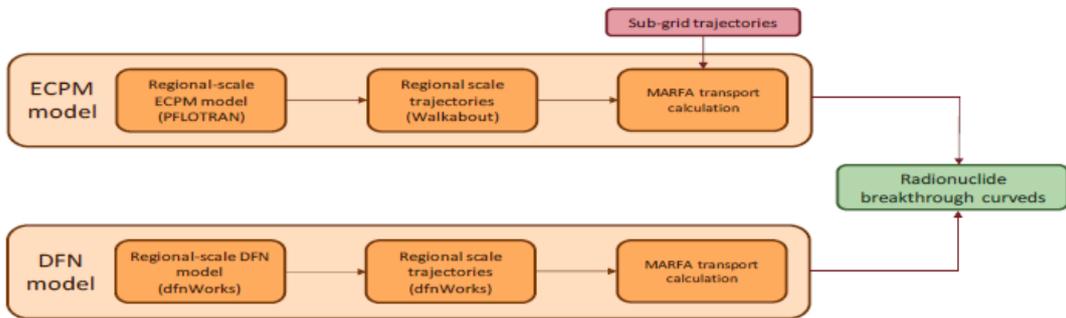
圖"; : 在不同溫度情況下，\ p\*K與伊萊石、蒙脫石中的吸附行為"

Model concepts

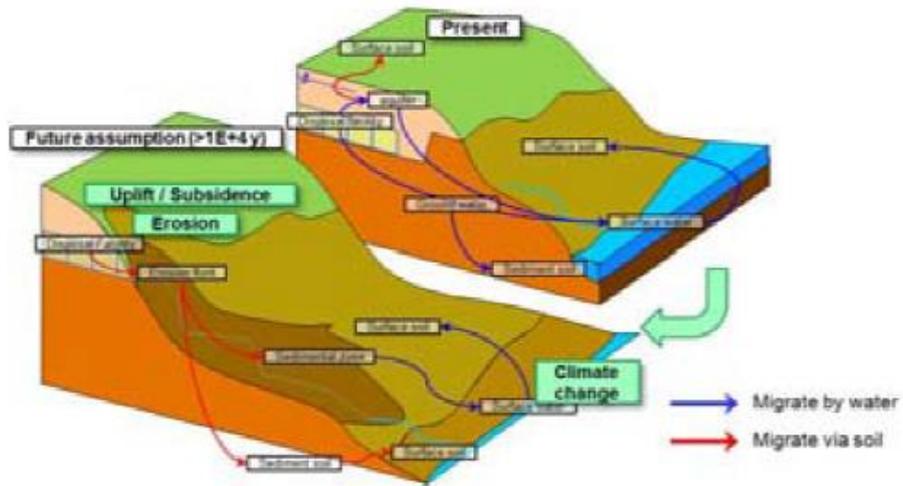
be used in the different parts of the chain are indicated in red.



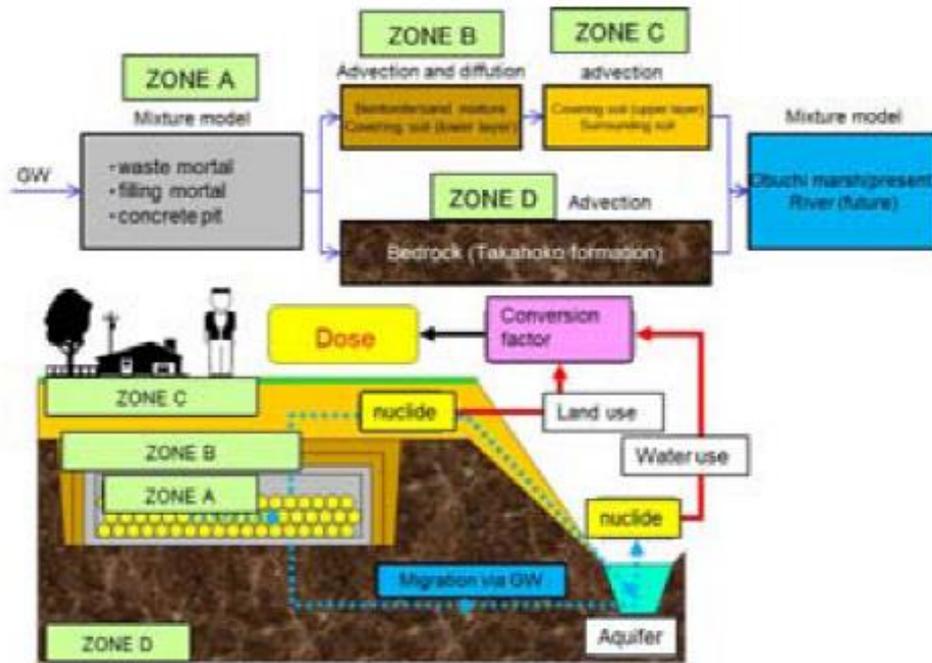
圖" 32：綜合安全評估模式概念"



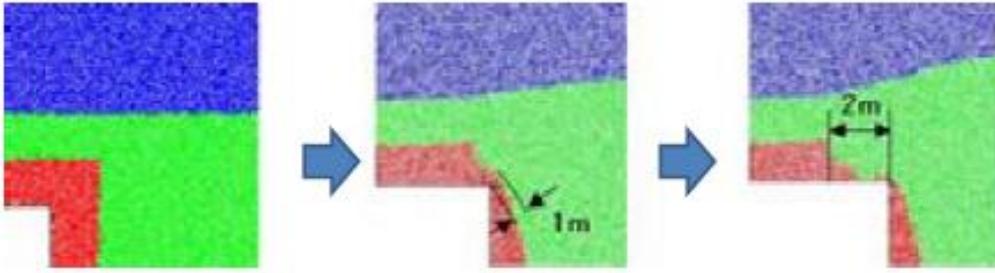
圖" 33：綜合地質圈評估工具"KCV"



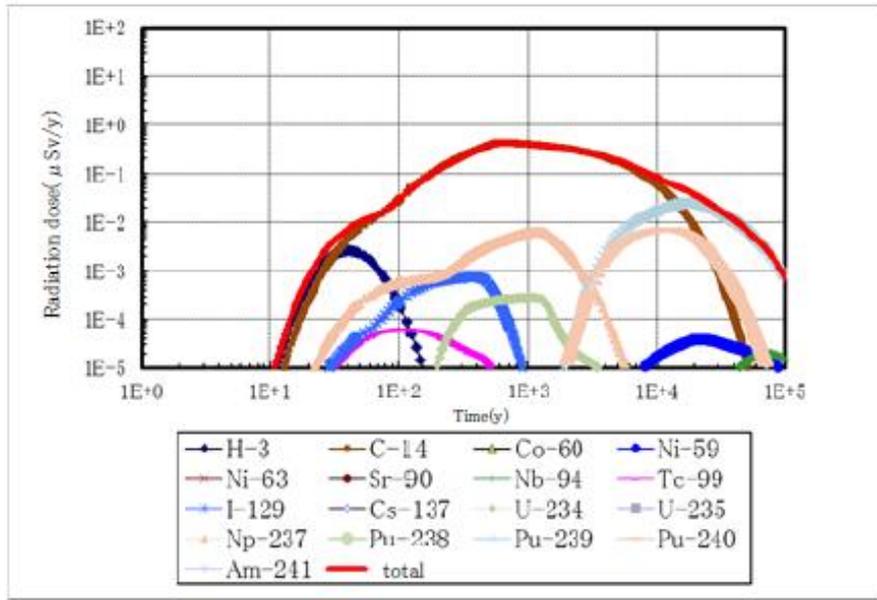
圖"34：六所村場址模型圖"



圖"35：六所村安全評估模式鏈"



圖"36：工程障壁與天然障壁介面示意圖"



圖"37：安全評估劑量圖"

#### 四、海報展示

" " ; 月 38 日及 ; 月 39 日晚上為會議投稿的海報展示,4 天共有約 452 篇海報展出, 本次研討會由台電公司李宗倫組長、李在平博士偕同台灣大學林文勝副研究員及中興工程顧問社梁書巖工程師共同發表了一篇應用論文, 論文題目為<「 VGO RGT CVWTG'F WEGF 'DWHGT'RQTQUK[ " EJ CPI G'HQT"P WENF G'VTCP URQTV"WUR I "VCKY CP "TGHGTGPEG" ECUG」, 於 ; 月 38 日晚上進行海報發表\*如圖 38+, 將我國在核種遷移研究成果與國際社會分享, 詳細海報內容如圖 39。"

本篇海報重點為<

" " 高放射性廢棄物的衰變熱導致膨潤土脫水, 造成工程障壁中緩衝材料孔隙率的變化, 進而影響到安全評估中核種傳輸結果, 本研究採用膨潤土層間水化狀態之孔隙率修正方程式, 計算由放射性廢棄物衰變熱引起膨潤土排出層間水, 排出層間水後, 會導致緩衝材料的體積收縮, 本模擬結果對處置場長期演化之研究相當有幫助。"

" " 蒙脫石屬於膨脹性膨潤石類黏土, 為膨潤土緩衝材料中主要礦物 (87y v%至 ;2y v%)。鈉型膨潤石具有優異的膨脹性和較低的滲透性, 因此被認為是緩衝材料。如果膨潤石層間區域吸附水分, 稱為層間水。膨潤石中間層包括三個不連續的基本間距, 在地下水文地質環境大約 32"  $\alpha$  \*32<sup>632</sup>o +、348" (一層水分子) 和 379" (兩層水分子)。層間水的化學和熱力學性質不同於孔隙水。層間水可以被認為是與礦物結合形成水合礦物的水。當脫水發生時, 層間水從水合的膨潤石中釋放出來形成 J 4Q 和無水的 4:3 層狀矽酸鹽對應物。這種行為類似於固體溶液可逆晶格內反應。"

" " 本研究採用層間水的動力學脫水、膨潤石轉化伊利石的動力學模型和層間水化狀態孔隙率修正來計算, 因放射性廢棄物衰變熱溫度而引起

的膨潤石粘土礦物脫水效應。溫度峰值約出現在第 32 年，大約一萬年後，由於放射性廢棄物釋出熱量已經分散，並且溫度已經降低至接近地熱背景值。在 57ÅE 和 ;2ÅE 時，脫水時間相對較快，分別為 5.883 秒(4Y/3Y) 和 46.9; ; 秒 (3Y/2Y)。受到溫度變化之水化狀態有效孔隙率分別為 20543 (3ç9; 6 年) 和 20899 (9; 6çÔ年)，結果在核種傳輸上不論是有吸附與無吸附之核種，皆有相當程度受到孔隙率變化之影響。"

"

" " 於海報展示期間有許多外國專責機構或研究單位人員，對本研究相當感興趣並詢問相關技術細節\*如圖 3: +，並分享該國之發展經驗，以及建議未來之方向，最後台電公司與中興工程顧問社參加研討會人員一起於發表海報前合影\*如圖 3; +。 "

**PC2-2**

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**SINOTECH**  
CONSULTANTS INC.

# TEMPERATURE INDUCED BUFFER POROSITY CHANGE FOR RADIOACTIVE NUCLEAR TRANSPORT USING TAIWAN REFERENCE CASE

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國立臺灣大學  
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台灣電力公司  
TAIWAN POWER COMPANY

**Abstract**

The concept of geological disposal for high-level radioactive waste (HLW) is based on a multibarrier system comprising the natural geological barrier that repository host rock provides and its surroundings, as well as an engineered barrier system (EBS) that includes waste form, waste canisters, buffer materials, and backfill. The multibarrier system is expected to perform its desired functions to isolate waste from the biosphere and achieve HLW disposal. Because of the interaction processes of radionuclide decay heat with hydraulic and water-mineral reactions in the radioactive waste repository, the bentonite buffer degradation resulting from the external temperature and pressure warrants investigation. However, seldom addressed in Taiwan is the influence of thermo-hydro-chemical (T-H-C) processes on buffer material degradation in the EBS of HLW disposal repositories as related to smectite clay dehydration. Therefore, we adopted the chemical kinetic model of smectite dehydration to calculate the amount of water expelled from smectite clay minerals caused by higher temperatures of waste decay heat. We discovered that smectite clay could cause volume shrinkage because of a loss of interlayer water, which can lead to bentonite buffer compression. The results of this study may be used in advanced research on the evolution of bentonite degradation for both performance assessments and safety analyses of final HLW disposal in Taiwan.

**Kinetic dehydration of interlayer water**

Smectite interlayer includes three discontinuous basal spacings of approximately 10 Å, 12.6 Å (one layer of water molecules), and 15.7 Å (two layers of water molecules) in a subsurface hydrogeological environment.

Dehydration stage	T(°C)	Basal spacings	n · H <sub>2</sub> O
2W	T > 35°C	15.7 Å	4.51
2W-1W	30°C < T < 35°C	12.6 Å	2.03
1W-0W	T > 90°C	10 Å	0

**Thermal Model**

The initial canister power was 1315 W. COMSOL Multiphysics software was used to simulate the temperature evolution in the EBS.

**Smectite shrinkage and swelling caused by the hydration state of the interlayer**

Brown and Ransom and Fitts and Brown proposed a porosity ( $\phi$ ) modified equation for porosity based on the hydration state of smectite. The modified porosity equation of hydrous smectite is expressed as

$$\phi_s = \frac{\rho_s \left( 1 + \frac{90 \cdot \Delta c}{M_s \rho_s} \right)}{\rho_s \left( 1 + \frac{90 \cdot \Delta c}{M_s \rho_s} \right)}$$

Dehydration stage	T(°C)	Porosity modified
2W	T > 35°C	0.177
2W-1W	30°C < T < 35°C	0.321

**RESULT**

The hydrous state porosity as a function of temperature evolution is equal to 0.321 (1-794 years), and 0.177 (794-∞ years).

The <sup>1129</sup>I and <sup>Pu283</sup> are selected to observe how the porosity evolution influence nuclear species with retardation and no retardation. The porosity of 0.435 is used as constant in general case. According to our transient porosity calculation, the near-field transport result is shown transient porosity case may has higher concentration after a period of time.

圖"38：台電公司、台灣大學、中興工程顧問社共同發表之海報"

# TEMPERATURE INDUCED BUFFER POROSITY CHANGE FOR RADIOACTIVE NUCLEAR TRANSPORT USING TAIWAN REFERENCE CASE

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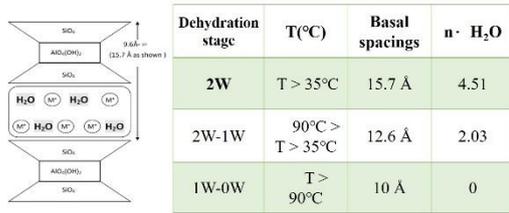
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Smectite interlayer includes three discontinuous basal spacings of approximately 10 Å, 12.6 Å (one layer of water molecules), and 15.7 Å (two layers of water molecules) in a subsurface hydrogeological environment.



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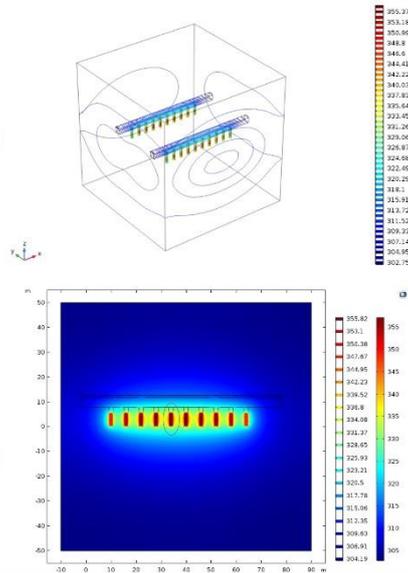
$$\phi_a = \frac{\rho_b \left( \frac{\Phi \rho_w}{M_s \rho_b} - \frac{A\alpha}{1-\alpha} \right)}{\rho_w \left( 1 + \frac{\Phi \rho_w}{M_s \rho_b} \right)}$$

Where  $\Phi$  is porosity,  $T$  is total volume of soil (cm<sup>3</sup>),  $T_p$  is total volume of soil (cm<sup>3</sup>),  $A$  is mass of water retained through heating per unit mass of soil (g),  $\alpha$  is mass of dry soil after desiccation through heating per unit mass of soil (g),  $\rho_w$  is mass of water retained in dry soil (g),  $\rho_b$  is mass of dry soil (g), and  $\rho_s$  is bulk density (g/cm<sup>3</sup>).

Dehydration stage	T(°C)	Porosity modified
2W	T > 35°C	0.177
2W-1W	90°C > T > 35°C	0.321

### Thermal Model

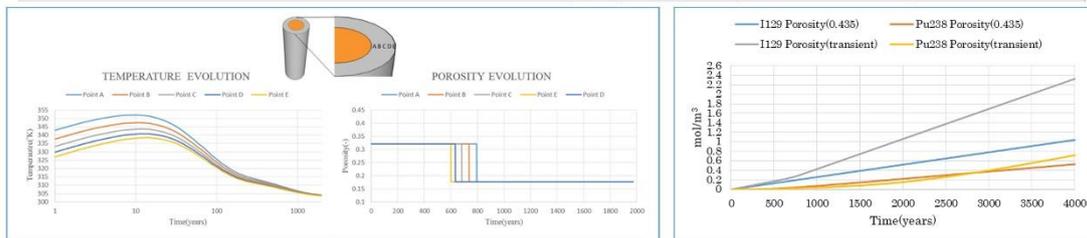
The initial canister power was 1315 W. COMSOL Multiphysics software was used to simulate the temperature evolution in the EBS.



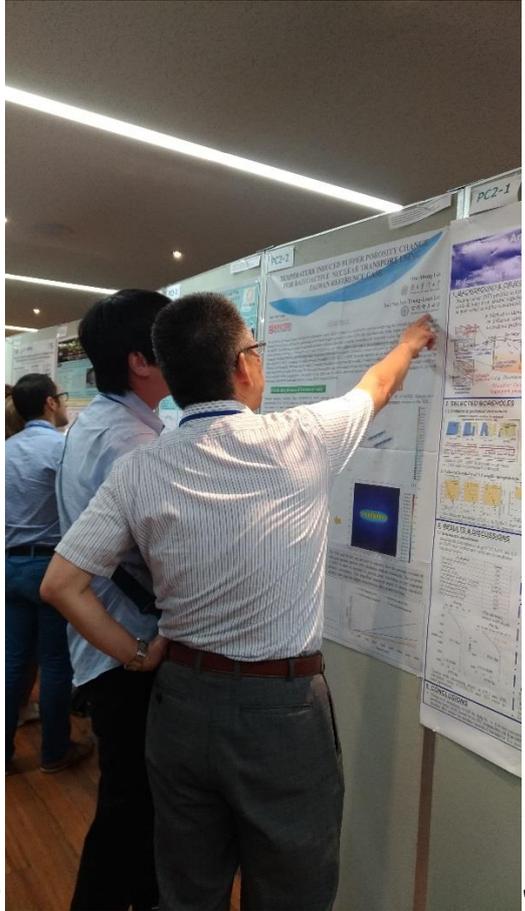
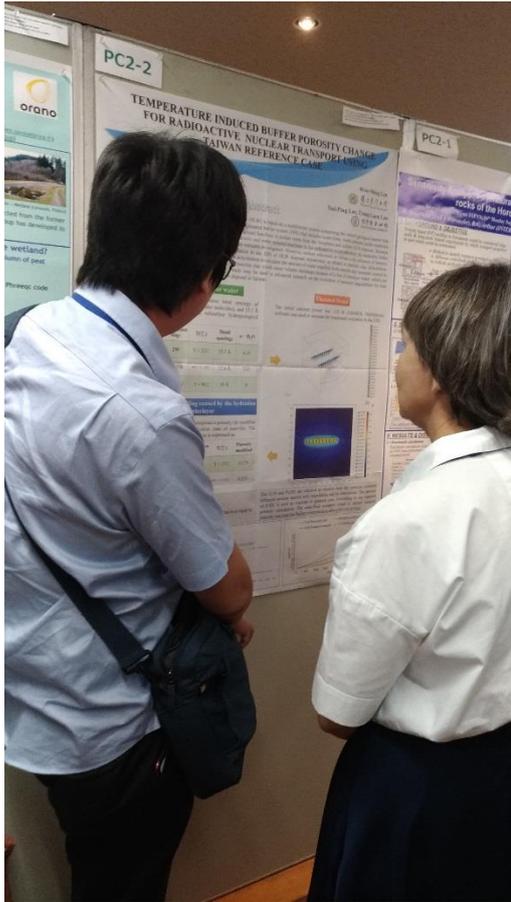
## RESULT

The hydrous state porosity as a function of temperature evolution is equal to 0.321 (1–794 years), and 0.177 (794–∞ years).

The I129 and Pu283 are selected to observe how the porosity evolution influence nuclear species with retardation and no retardation. The porosity of 0.435 is used as constant in general case. According to our transient porosity calculation. The near-field transport result is shown transient porosity case may has higher concentration after a period of time.

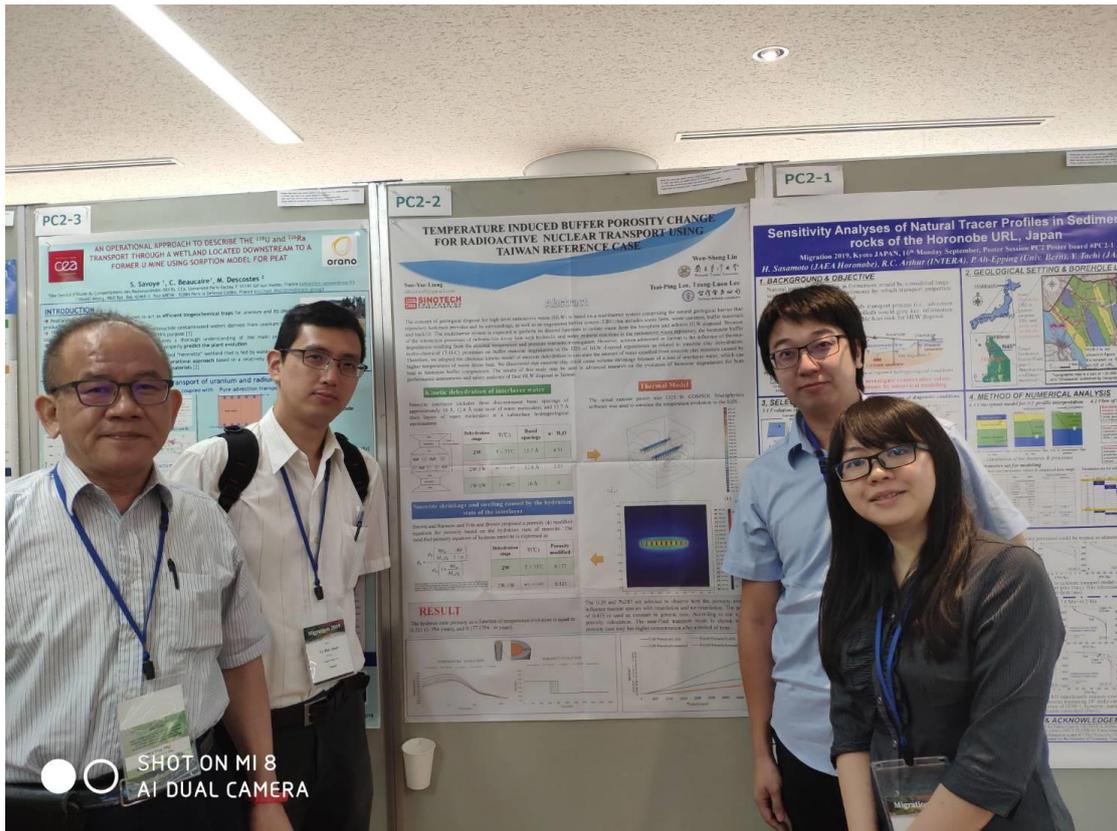


圖" 39：發表海報之詳細內容"



圖"3: : 中興工程顧問社工程師與國際專家進行海報內容討論"

"



圖"3; : 參加研討會人員於發表海報前之合影"

#### 肆、心得"

" Oki tcvkqp 研討會從 3;:9 年在德國慕尼黑舉辦的第一屆開始，每兩年在不同國家城市召開，本次 O ki tcvkqp"423; 研討會為第 39 屆，經過長期的科學交流與跨國的合作計畫，大量的資源被用於放射性核種遷移相關研究，本次研討會主要分為 7 大主題共 42 個子議題，專業領域相當廣泛，包含：地球化學、水文地質、放射性核種、放射化學、安全評估等。亦有許多不同國家之專責機構與研究單位參與，見聞各國之發展現況及技術成果，著實獲益良多。"

" 核種遷移除模擬外需要熟知相當多的重要參數，如各核種與當地地下水的溶解度，核種對於工程障壁及天然障壁的吸附行為了解，都需要大型且專業實驗室的協助，各國機構為了得到各項核種重要參數，皆建立完整之實驗設施，目前對於核種基礎參數研究最多的國家為德國、日本與美國，上述三國除了進行眾多核種相關試驗，亦建立了相當多的核種數據資料庫，非常適合借鏡其實驗方法與研究方向。目前因模式耦合的複雜度與擬真性愈來愈高，電腦的運算能力也相對地需要提升，過去常因受到電腦計算能力的限制而使用較於簡化的模型，造成與現實狀況有更大的差異，目前先進國家計算耦合流場或是熱/水/化之近場運算，皆使用超級電腦建立更符合現實條件下的模擬結果，以達到具有代表性之分析結果。"

" 藉由本次研討會，可以了解世界各核能先進國家研究單位均積極透過參加國際研討會或加入國際合作計畫，將模擬跟實驗成果與社群成員互惠分享，並反饋到自身的研究，確認模擬程式的可靠度與精進實驗設計，其研究成果均具有相當重要的參考價值。"

"

"

## 伍、建議"

\*一+ Oki Tokap 研討會為每兩年舉辦一次，將於 2023 年持續舉辦，我國目前在核種遷移方面之實驗及參數研究較為不足，建議可持續派員參加本研討會，透過與國際專家之經驗學習與交流，並取得最新國際資訊，了解核種遷移發展現況與未來趨勢，做為往後研究方向之參考，有助於國內用過核子燃料最終處置計畫之推動。"

\*二+ 參考日本目前高放處置現況，日本 PWOQ 在溝通、社群網站之設計、民眾溝通宣傳上下了非常多之功夫，且日本目前也無明確之場址，所以發展通用性的安全論證，本次會議也展示考慮工程障壁系統與安全論證所需的現地與裂隙地下水流相互驗證之研究成果，可供我國未來研究發展之參考。"

\*三+ 世界各核能先進國家皆成立高放射性廢棄物最終處置專責機構，如日本 PWOQ、瑞典 UMD、芬蘭 RUKK、法國 CPFTC 及德國 DI G 等，負責規劃及執行高放射性廢棄物最終處置，本次研討會亦有許多專責機構或其轄下之研究機構參加，建議可多參與相關處置技術之國際研討會，與各國專責機構專家進行交流討論，聽取各國執行最終處置計畫過程中的經驗建議與技術研發規劃，並善用國外發展技術及研發成果與國際接軌，作為國內處置計畫推動重要之一環。"

\*四+ 高放射性廢棄物最終處置為一長遠計畫，從前期之地質調查、處置場工程設計、安全評估分析、處置場建造、營運管理、監測、封閉等工作，皆需投入大量人力與物力，並涵蓋各種不同領域之專家共同執行，亦須進行妥善規劃與整合。為確保未來處置技術人力資源，建議參考國外研究發展經驗，藉由「吸引力」、「教育力」與「留住人才」等方式，進行人才培育，充實用過核子燃料處理工作及高放射性廢棄物最終處置計畫之研發能量。"

Programme

SUNDAY (15. SEPTEMBER)

- 15:00 REGISTRATION
- 17:00 WELCOME  
*T. Sasaki, T. Ohnuki (Japan)*  
*H. Geckeis (Germany)*
- OPENING SESSION  
**E: GEOLOGICAL DISPOSAL IN JAPAN AND REMEDIATION OF THE FUKUSHIMA DAIICHI NPS SITE**  
*Chair: T. Sasaki and T. Ohnuki (Japan)*
- 17:10 ISSUES JAPAN FACES WITHIN THE PROMOTION OF DEEP GEOLOGICAL DISPOSAL OF RADIOACTIVE WASTE E-1  
*S. Kondo (INVITED) (NUMO, Japan)*
- 18:10 DECOMMISSIONING OF THE FUKUSHIMA-DAIICHI NPP AND ITS IMPLICATIONS FOR THE WASTE MANAGEMENT OF NUCLEAR LEGACY SITE E-2  
*H. Yamana (INVITED) (Nuclear Damage Compensation and Decommissioning Facilitation Corporation, Japan)*
- 19:10 RECEPTION

MONDAY

SESSION 2 B4: EFFECTS OF BIOLOGICAL AND ORGANIC MATERIALS

- Chair: K. Morris (UK) and T. Stumpf (Germany)*
- 11:15 ROLE OF MICROBIAL PROCESSES IN THE ENVIRONMENTAL FATE OF URANIUM B4-1  
*R. Bernier-Latmani, L. Loreggian, M. Molinas, A. Brown, Z. Pan (INVITED) (Switzerland)*
- 12:00 *IN VIVO* SPECIATION AND ACCUMULATION MECHANISMS OF URANIUM IN *PARACENTROTUS LIVIDUS* SEA URCHIN AND *LAMINARIA DIGITATA* SEAWEED B4-2  
*M. R. Boccia, B. Reeves, R. Bianco, P. L. Solari, L. Mangialajo, C. Leblanc, D. K. Shuh, M. Monfort, C. Moulin, C. Den Auwer (France, Italy, USA)*
- 12:25 PLUTONIUM-MICROBIAL INTERACTIONS IN THE ENVIRONMENT B4-3  
*D. T. Reed, R. Kimber, J. S. Swanson, J. Lloyd (USA, UK)*
- 12:50 MICROSCOPIC AND SPECTROSCOPIC INVESTIGATIONS OF THE INTERACTIONS OF A HALOBACTERIUM-ISOLATE WITH URANIUM B4-4  
*S. Hilgmann, M. Bader, M. Bachtram, R. Stuedner, M. Schmidt, T. Stumpf, A. Cherkouk (Germany)*
- 13:15 BREAK

SESSION 3 C1: DATA SELECTION AND EVALUATION

- Chair: S. Brassinnes (Belgium) and L. Duro (Spain)*
- 14:30 VALIDATION OF EXPERIMENTAL RADIONUCLIDE ADSORPTION DATA ON ARGILLACEOUS ROCKS BY MECHANISTIC MODELS C1-1  
*B. Bavenzi, M. Marques Fernandes (Switzerland)*

MONDAY

MONDAY (16. SEPTEMBER)

- 9:05 CONFERENCE ANNOUNCEMENTS
- SESSION 1 A5: SOLID-LIQUID INTERFACE REACTIONS  
*Chair: M. Marques Fernandes (Switzerland) and B. Powell (USA)*
- 9:15 METAL ION SORPTION ON ALUMINUM OXYHYDROXIDES UNDER CONDITIONS OF HIGH LEVEL WASTE TANKS – A SUM FREQUENCY GENERATION – VIBRATIONAL SPECTROSCOPY STUDY A5-1  
*Z. Wang, X. Zhang, W. Cui, H. Zhang, Y. Chen, E. Walter, A. Tuladhar, M. Sassi, C. Pearce, H. Wang, S. Clark, K. Rosso (USA, China)*
- 9:40 CARBONATE MEDIATED SORPTION OF Eu(III) / Cm(III) ONTO CLAY MINERALS. BATCH SORPTION, LASER SPECTROSCOPY AND MODELLING A5-2  
*F. Rieder, M. Trumm, A. Skarvacak-Frech, T. Rabung, H. Geckeis (Germany)*
- 10:05 EFFECT OF REDOX TRANSFORMATIONS AND AQUEOUS COMPLEXATION IN THE TERNARY Pu(III)-EDTA-Fe MINERAL SYSTEM A5-3  
*N. Moore, E. Yalcintas, D. T. Reed, A.E. Hixon (USA)*
- 10:30 SORPTION OF TRIVALENT F-ELEMENTS BY MATERIALS OF BIOLOGICAL ORIGIN: NMR AND LUMINESCENCE SPECTROSCOPIC STUDIES A5-4  
*K. Kammerlander, L. Kohler, N. Huttinen, T. Stumpf, E. Brunner (Germany)*
- 10:55 BREAK

MONDAY

- 14:55 NEA-TDB UPDATE BOOK ON U, Np, Pu, Am AND Tc: OVERVIEW, SYSTEMATIC TRENDS AND DATAGAPS OF RELEVANCE TO NUCLEAR WASTE DISPOSAL C1-2  
*Y. Gaona, I. Grenthe, A. Pyazunov, L. Rao, W. Runde, B. Grambow, R. Konings, A. L. Smith, E. Moore, K. Spahiu, J. Martinez, M.-E. Ragoussi (Germany, Sweden, Russia, USA, France, Netherlands)*
- 15:20 GEOCHEMICAL MODELLING OF RETENTION OF RADIONUCLIDES IN C-S-H C1-3  
*D. A. Kulik, G.-D. Miron, J. Tits, B. Lothenbach (Switzerland)*
- 15:45 BREAK
- SESSION 4 A2: SOLID SOLUTION AND SECONDARY PHASE FORMATION  
*Chair: D. Bockbach (Germany) and D. Kulik (Switzerland)*
- 16:05 EVOLUTION OF URANIUM SPECIATION DURING SULFIDATION OF IRON (OXYHYDR)OXIDES A2-1  
*L. T. Townsend, S. Shaw, N. E. R. Ofili, N. Kaitsoyannis, A. S. Walton, J. F. W. Mosselmans, T. Neill, R. Hibbard, K. Morris (UK)*
- 16:30 MOLYBDENUM SORPTION IN CEMENTITIOUS ENVIRONMENTS. THE ROLE OF AFm ON MIXED APv/AFm PHASES A2-2  
*M. López-García, J. Olmeda, M. Grivé, L. Duro, P. Henocq (Spain, France)*
- 16:55 TRIVALENT LANTHANIDE AND ACTINIDE INCORPORATION INTO ZIRCONIUM(IV) OXIDE – SPECTROSCOPIC INVESTIGATIONS OF DEFECT FLUORITE STRUCTURES A2-3  
*M. Eibl, S. Shaw, C. Hennig, K. Morris, T. Stumpf, N. Huttinen (Germany, UK)*
- 17:20 END OF ORAL SESSIONS OF MONDAY

## SESSION 5 POSTER SESSION I (17:20 – 20:20)

## PA1 SOLUBILITY AND DISSOLUTION

- PA1-1 FUEL CORROSION INSIDE A FAILED NUCLEAR WASTE CONTAINER UNDER REPOSITORY CONDITIONS  
*T. T. Yang, D. W. Shoemith, J. J. Noël (Canada)*
- PA1-2 THE EFFECT OF CARBONATE ION ON THE DISSOLUTION RATE OF UO<sub>2</sub> PELLET  
*Y. Moroi, A. Kirishima, D. Akiyama, N. Sato, A. Kitamura, S. Kimuro (Japan)*
- PA1-3 EFFECT OF ARGILLITE ON THE OXIDATIVE DISSOLUTION OF UO<sub>2</sub> DOPED WITH A RADIOACTIVE ALPHA EMITTER IN SYNTHETIC CLAYEY GROUNDWATER  
*V. Keruegar, C. Jégou, L. De Wandt, V. Broudic, C. Marques, C. Martin, F. Tocino (France)*
- PA1-4 SOLUTION CHEMISTRY AND THERMODYNAMICS OF U(IV) AND U(VI): SOLUBILITY, HYDROLYSIS AND THE TERNARY Ca-U(VI)-CARBONATE SYSTEM  
*N. Cevrim-Papatoannou, J.-Y. Lee, X. Gaona, E. Yalcintaz, V. Montoya, D. Fellhauer, K. Dardenne, M. Almaier, H. Geckeis (Germany, Korea, USA)*

## PA2 SOLID SOLUTION AND SECONDARY PHASE FORMATION

- PA2-1 INVESTIGATION ON SECONDARY URANIUM SILICATE MINERALS FORMED IN THE KURT SITE  
*M. H. Baik, H.-R. Cho (Korea)*
- PA2-2 RETENTION OF IODINE BY THE Fe SECONDARY PHASES GREEN RUST AND MAGNETITE  
*T. Platte, R. Polj, N. Finck, S. Mangold, H. Geckeis (Germany)*
- PA2-3 COMPARISON OF THE STABILITY OF U(VI) AND Cm(III) DOPED CALCIUM (ALUMINUM) SILICATE HYDRATE (C-(A)-5-H) PHASES AT SALINE CONDITIONS  
*J.-M. Wolter, K. Schmeide, N. Huittinen, F. Bok, S. Weiss, Y. Brendler, T. Stumpf (Germany)*

- PA3-7 LANTHANIDE COMPLEXES OF HYBRID SCHIFF-BASE CALIX[4]ARENE LIGANDS: SYNTHESIS, STRUCTURES, PROPERTIES AND MAGNETIC BEHAVIOUR  
*P. Hahn, S. Ullmann, B. Kerzting (Germany)*
- PA3-8 STUDY OF Th(IV) COMPLEXATION WITH HYDROXAMIC ACID LIGANDS  
*V. Sladkov, J. Roques, F. Mangin, O. Fonquernie, S. Brandès, M. Meyer, J.-C. Chambron (France)*
- PA3-9 FORMATION OF Mg/Ca- $UO_2$ -CO<sub>2</sub> COMPLEXES AT VARIABLE TEMPERATURES (10 – 70 °C)  
*Y. Jo, A. Kirishima, H.-K. Kim, J.-I. Yun (Korea)*
- PA3-10 TEMPERATURE EFFECT ON PROTON AND Eu(III) BINDING TO HUMIC SUBSTANCES  
*Q. Jin, Z.Y. Chen, Z.J. Guo, W.S. Wu (China)*
- PA3-11 MULTI-TECHNIQUE STUDY OF THE INTERACTION OF Th(IV) WITH DEPEROXAMINE  
*M. He, M. Maloumbier, J. Roques, C. Le Naour (France)*
- PA3-12 PHOTOLUMINESCENT HETERODINUCLEAR CALIX[4]ARENE-COMPLEX  
*A. Mehnert, B. Kerzting (Germany)*

## PA4 REDOX REACTIONS AND RADIOLYSIS EFFECTS

- PA4-1 REDUCTIVE IMMOBILIZATION OF <sup>99</sup>Tc(VII) BY DIFFERENT CRYSTALLINE PHASES OF IRON SULFIDE (FeS<sub>2</sub>)  
*D. M. Rodriguez, N. Mayordomo, V. Brendler, K. Müller, D. Schild, T. Stumpf (Germany)*
- PA4-2 SPECTROELECTROCHEMICAL STUDIES OF THE Tc(VII) REDUCTION IN AQUEOUS ELECTROLYTE MEDIA  
*D. M. Rodriguez, N. Mayordomo, V. Brendler, K. Müller, T. Stumpf (Germany)*
- PA4-3 PERTECNETATE SORPTION ON SULPHIDE MINERALS  
*A. Makarov, A. Safonov, Y. Karasova, Y. Konevnik, I. Proshin, K. German, K. A. Boldyrev, E. Zakharova (Russia)*

- PA2-4 ELECTROKINETIC CONTROL OF THE GROWTH OF SECONDARY MINERALS IN COMPACTED MONTMORILLONITE  
*S. Tanaka (Japan)*

## PA3 COMPLEXATION WITH INORGANIC AND ORGANIC LIGANDS

- PA3-1 RELATIVE STABILITY OF ACTINIDE(IV) BISALEN COMPLEXES: EXPERIMENT AND THEORY  
*T. Radocke, S. Schöne, R. Kloditz, J. März, T. Stumpf, A. Ikeda-Ohno (Germany)*
- PA3-2 SPECTROSCOPIC AND COMPUTATIONAL STUDIES OF AMERICIUM-DICARBOXYLATE LIGAND COMPLEXES USING COMBINATION OF UV-VIS-LWCC, TRIFS AND DFT CALCULATION  
*H.-K. Kim, K. Jeong, H.-R. Cho, E.C. Jung, K. Kwak, W. Cha (Korea)*
- PA3-3 THERMODYNAMIC STUDIES OF THE COMPLEXATION OF LANTHANIDE/ACTINIDE WITH CEMENT SUPERPLASTICIZER BY ISOTHERMAL TITRATION CALORIMETRY  
*M. Acher, F. Taube, D.R. Frohlich, P.J. Panak, S. Taut, T. Stumpf (Germany)*
- PA3-4 IMPACT OF TEMPERATURE ON THE COMPLEXATION OF Eu(III) AND Cm(III) WITH AQUEOUS PHOSPHATES  
*N. Jordan, N. Huittinen, I. Jessat, F. Réal, V. Vallet, S. Starke, M. Demnitz, H. Lösch, V. Brendler (Germany, France)*
- PA3-5 INVESTIGATION OF URANYL ION SPECIATION AND SELF-ASSEMBLY IN THE PRESENCE OF 2-SALICYLIDENE GLUCOSAMINE  
*G. Schaper, M. Wenzel, L. Goetzke, F. Hemmersdorf, J. J. Weigand (Germany)*
- PA3-6 THERMODYNAMIC STUDY ON THE COMPLEXATION OF DEEP GROUNDWATER HUMIC ACID BY CALORIMETRY  
*S. Kimuro, M. Terashima, T. Tachi, Y. Kitataji, K. Miyakawa, D. Akiyama, N. Sato, A. Kirishima (Japan)*

- PA4-4 EFFECT OF SEVERAL INORGANIC ANIONS ON THE ELECTROCHEMICAL BEHAVIOR OF Ce(III/IV) IN NITRIC ACID MEDIA  
*Y. Liu, F. Wu, N. Wang, S. Hu (China)*

## PA5 SOLID-WATER INTERFACE REACTIONS

- PA5-1 EFFICIENT CAPTURE OF ACTINIDES FROM STRONG ACIDIC SOLUTION BY HAFNIUM PHOSPHONATE FRAMEWORKS AND CERAMIC DISPOSAL OF THE ACTINIDES-LOADED PRODUCTS  
*L. P. Xiong, K. Lv, M. Gu, C. T. Yang, F. C. Wu, S. Hu (China)*
- PA5-2 ADSORPTION OF U<sup>VI</sup> AND Eu<sup>III</sup> ON ILLITE: THE IMPORTANT ROLE OF ACCESSORY MINERALS  
*M. Marques Fernandez, A. C. Scheinost, N. Huittinen, B. Baeyens (Switzerland, Germany, France)*
- PA5-3 EFFICIENT AND SELECTIVE ADSORPTION OF <sup>99</sup>TcO<sub>4</sub> USING HEXADECYLPIRIDINIUM (HDPY) MODIFIED BENTONITE  
*K. L. Shi, J. Q. Yang, Y. Su, W. S. Wu (China)*
- PA5-4 SORPTION OF Tc(IV) ON ILLITE AND MX-80 BENTONITE UNDER HIGH IONIC STRENGTH CONDITIONS  
*J. Racette, A. Walker, T. Yang, S. Nagasaki (Canada)*
- PA5-5 SYNTHESIS OF ZEOLITE NaP FROM NATURAL ZEOLITE AND APPLICATION FOR RADIONUCLIDE REMOVAL  
*S. J. Hong, W. Um (Korea)*
- PA5-6 SORPTION OF Se(-II) ONTO ILLITE, BENTONITE, AND SHALE UNDER HIGH IONIC STRENGTH CONDITIONS  
*A. Walker, J. Racette, T. Yang, S. Nagasaki (Canada)*
- PA5-7 EFFECT OF SOLUTION CHEMISTRY ON THE SORPTION OF SELENITE IN GAOMIAOZI BENTONITE  
*Y. Li, J. G. He, Z. M. Lin, X. Y. Tang, M. K. Chang, C. L. Liu (China)*
- PA5-8 SORPTION BEHAVIOUR OF LEAD ONTO MONTMORILLONITE IN THE PRESENCE OF CARBONATE  
*Y. Sugitara, T. Ishidara, T. Suyama, M. Okazaki, T. Hamamoto, K. Ishida, Y. Tachi (Japan)*

- PA5-9 THE BEHAVIOR OF URANYL PEROXIDE NANOCCLUSERS AT THE MINERAL-WATER INTERFACE  
*A. E. Hixon, L. R. Sadargaski (USA)*
- PA5-10 REMOVAL OF RADIONUCLIDES IN WASTE SOLUTION USING CANCRINITE SORBENT  
*J. Kang, S. Park, W. Um (Korea)*
- PA5-11 SORPTION OF U(VI) ONTO NATURAL SOILS AND DIFFERENT MINERAL COMPOSITIONS: THE BATCH METHOD AND SPECTROSCOPY ANALYSIS  
*Y. Shi, J. He, X. Tang, W. Zhou, J. Wang, X. Li, C. L. Liu (China)*
- PA5-12 SORPTION OF Cs(I), Eu(III) AND Np(V) ON ENGINEERING CLAY BARRIERS  
*A. Semenova, P. Verma, V. Krupskaya, A. Romanchuk, S. Kalmykov (Russia, India)*
- PA5-13 CESIUM INTERACTION WITH MX-80 BENTONITE AND NANOCORE PGN MONTMORILLONITE  
*N. Pakkanen, E. Puhakka, P. Hølttä (Finland)*
- PA5-14 RADIOCAESIUM SORPTION IN GLAUCONITE SANDS OF THE NEOGENE REVEALING SURPRISINGLY STRONG SORPTION POTENTIALS  
*Y. Brunel, E. Smolders, L. Van Laer, S. Brassines (Belgium)*
- PA5-15 ADSORPTION OF Eu(III) ONTO MONTMORILLONITE BY BATCH TECHNIQUE  
*M. K. Chang, Y. Li, W. Q. Zhou, C. L. Liu (China)*
- PA5-16 SORPTION OF U(VI) ON MONTMORILLONITE IN THE PRESENCE OF EDTA: A COMBINED BATCH, XPS AND ATR-FTIR STUDY  
*W. Q. Zhou, J. G. He, X. Y. Yang, J. Y. Wang, C. L. Liu (China)*
- PA5-17 NOVEL POLYAZAMACROCYCLIC RECEPTOR IMPREGNATED MACROPOROUS POLYMERIC RESINS FOR HIGHLY EFFICIENT CAPTURE OF FISSION PALLADIUM FROM NITRIC ACID MEDIA: ADSORPTION BEHAVIOR AND COORDINATION MECHANISM STUDY  
*F. C. Wu, S. Hu, J. Chen (China)*

- PA7-3 ULTRA-SENSITIVE, SPECIFIC, RECYCLABLE DETECTION OF  $UO_2^{2+}$  IN REAL SYSTEMS THROUGH A DNAAZYME BASED ZnO-Ag HYBRIDS SERS BIOSENSOR  
*X. He, Y. Liu, X. Wang (China)*
- PA7-4 AUTORADIOGRAPHY TECHNIQUE TO LOCATE RADIONUCLIDES ON SOLID SURFACES OF MINERALS  
*S. Leblond, P. Fichet, P. Sardini, S. Billon (France)*
- PA7-5 NON-DESTRUCTIVE ISOTOPE ANALYSIS OF MICROMETER SIZED HOT PARTICLES FROM THE CHERNOBYL ENVIRONMENT BY RL-SNMS  
*M. Ratwa, H. Bosco, M. Weiss, N. Kneip, K. Wendt, C. Walther (Germany)*
- PA8 COMPUTATIONAL CHEMISTRY
- PA8-1 CONFORMATIONAL ANALYSIS OF LANTHANIDE-BOUND METHANOL DEHYDROGENASE  
*S. Tsuchida (Germany)*
- PA8-2 DENSITY FUNCTIONAL THEORY STUDY OF THE INCORPORATION OF RADIONUCLIDES IN HYDROXYCARBONATE AND HYDROXYCHLORIDE GREEN RUST  
*R. Polly, B. Schimmelppfennig, N. Vozarova, T. Platte, F. Heberling, N. Finck, H. Geckels (Germany)*
- PA8-3 DENSITY FUNCTIONAL THEORY INVESTIGATIONS ON THE FORMATION MECHANISM OF Pa(V) ION IN HYDROUS SOLUTIONS  
*J. Ma, C. Yang, J. Han, J. Yu, S. Hu, H. Yu, X. Long (China)*

- PA5-18 THE SYNERGISTIC ELIMINATION OF URANIUM (VI) SPECIES FROM AQUEOUS SOLUTION USING BI-FUNCTIONAL NANOCOMPOSITE OF CARBON SPHERE AND LAYERED DOUBLE HYDROXIDE  
*X. Wang (China)*
- PA5-19 ENHANCED URANIUM(VI) ADSORPTION ON MANGANESE-SUBSTITUTED GOETHITE  
*J. Y. Wang, W. Q. Zhou, Y. L. Shi, C. L. Liu (China)*
- PA5-20 INFLUENCE OF MALONIC ACID ON Eu(III) SORPTION BY  $\gamma$ -ALUMINA  
*M. A. Patel, A. Soumitra Kar, V. V. Raut, B. S. Tomar (India)*
- PA6 COLLOID FORMATION
- PA6-1 U(IV)-SILICATE COLLOIDS AND THE INTERACTION OF CORRODED URANIUM METAL WITH SILICATE  
*T. S. Neill, K. Morris, S. Shaw (UK)*
- PA6-2 GENERATION AND STABILITY OF BENTONITE COLLOIDS  
*P. Hølttä, N. Pakkanen, V. Suorsa (Finland)*
- PA6-3 EXAMINATION OF PLUTONIUM NANOPARTICLES WITH MANIFOLD SYNCHROTRON METHODS  
*E. Gerber, A. Romanchuk, C. Hennig, A. Trigub, A. Scheinost, A. Rossberg, G. Vaughan, L. Amidani, I. Pridchenko, S. Weiss, S. Kalmykov, E. Evashina (France, Germany, Russia)*
- PA7 EXPERIMENTAL METHODS
- PA7-1 APPLICATION OF THE TIME RESOLVED LASER SPECTROSCOPY (TRLIF AND TRLIC) FOR DETECTION OF ACTINIDES/LANTHANIDES IN SOLUTIONS  
*I. N. Isosimov (Russia)*
- PA7-2 THERMODYNAMICS OF ACTINYL ( $^{239}\text{Pu}^V$ ,  $^{241}\text{Pu}^V$ ,  $^{243}\text{Pu}^V$ ) CARBONATE SYSTEMS BY CAPILLARY ELECTROPHORESIS-ICP-MS FOR ENVIRONMENTAL APPLICATIONS  
*J. Aupiais, B. Siberchicot, R. Sire, J. C. Alexandre, N. Dacheux (France)*

## PB1 SORPTION/DESORPTION PHENOMENA IN DYNAMIC SYSTEMS

- PB1-1 FRACTIONATION OF ACTINIDES AND  $^{137}\text{Cs}$  IN CONTAMINATED SEDIMENTS AND MODEL SAMPLES USING SEQUENTIAL EXTRACTION  
*A. Rzhavskaya, A. Romanchuk, A. Semenova, I. Vlasova, S. Kalmykov (Russia)*
- PB1-2 ADSORPTION AND TRANSPORT OF U(VI) IN IRON OXIDE-COATED QUARTZ SAND COLUMN: AN EXPERIMENTAL STUDY  
*Y. F. Sun, Q. Jin, Z. Y. Chen, Z. J. Guo, W. S. Wu (China)*
- PB1-3 ENHANCED Sr MOBILITY IN GROUNDWATER BY SEAWATER INTRUSION  
*S. Chang, G. Wang, W. Um (Korea, USA)*
- PB1-4 REMOVAL OF ALKALINE EARTH METALS DURING THE FORMATION OF BIOMASS-MANGANESE OXIDE TOWARD ELIMINATION OF  $^{226}\text{Ra}$   
*T. Kato, Q. Yu, T. Ohnuki (Japan, China)*

## PB2 DIFFUSION AND OTHER MIGRATION PROCESSES

- PB2-1 REDUCED DIFFUSION AND ENHANCED RETENTION OF MULTIPLE RADIONUCLIDES FROM PORE STRUCTURE CHARACTERIZATION OF BARRIER MATERIALS  
*Q. H. Hu (USA)*
- PB2-2 APPLICATION OF HYDRUS-1D MODEL FOR ESTIMATE DIFFUSION COEFFICIENT OF PERTECHNETATE ( $^{99}\text{TcO}_4^-$ ) AND HTO IN COMPACTED MX-80 BENTONITE  
*I.-H. Lee, T.-L. Tsai, C.-F. Ni, Y.-H. Shih, L.-C. Chen, C.-P. Lee, S.-C. Tsai, B.-T. Wang (Taiwan)*
- PB2-3 PORE SPACE PROPERTY OF BOOM CLAY BEFORE AND AFTER ALKALINE PERTURBATION EXAMINED BY FM-AFM AND PSI MEASUREMENTS  
*H. Satoh, T. Araki, Y. Akagi, S. Brassines (Japan, Belgium)*

- PB2-4 IMPACT OF CEMENT LEACHATES ON THE HTO DIFFUSION IN COMPACTED BENTONITE  
*E. Hofmanová, T. Rosendorf, R. Červinka (Czech Republic)*
- PB2-5 ANION DIFFUSION IN BOOM CLAY, BELGIUM: DIFFUSION-AVAILABLE POROSITY AND ANISOTROPY  
*T. Akagi, S. Shimoda, S. Ueta, M. Ochi, S. Brassimnes (Japan, Switzerland, Belgium)*
- PB2-6 DIFFUSION OF <sup>137</sup>Ca THROUGH OPALINUS CLAY: A COMBINED DIFFUSION AND SORPTION STUDY  
*F. Brandt, L. Van Loon, M. Klimkenberg, J. Poonoosamy, M. Glaus, D. Bockach (Germany, Switzerland)*
- PB2-7 DIFFUSION AND RETENTION OF RADIONUCLIDES IN CORRODED STEEL REINFORCED CONCRETES  
*J. Sammaljärvi, V. Heszko, S. Betelu, S. Migitu, E. Muuri, M. Sittari-Kauppi, P. Henocq, S. Gaboreau (Finland, France)*
- PB3 COLLOID MIGRATION**
- PB3-1 ENVIRONMENTAL FATE OF BENTONITE COLLOIDS IN AQUIFER MEDIA: STABILITY AND TRANSPORT  
*D. Pan, W. Wu (China)*
- PB3-2 THE COAGULATION AND TRANSPORT BEHAVIOR OF ILLITE COLLOIDS UNDER ENVIRONMENTAL CONDITIONS  
*X. Y. Wei, D. Q. Pan, Z. Xu, Y. L. Sun, W. S. Wu (China)*
- PB3-3 BIOGENIC COLLOID TRANSPORT OF ACTINIDES IN DEEP ENVIRONMENTS  
*A. Safonov, K. Boldirev, A. Lobanova, R. Aidabaev, N. Popova, Y. Konevnik, A. Novikov, E. Zakharova (Russia)*

- PB4-9 AN EXPERIMENTAL STUDY OF MICROBIAL EFFECT ON SIMULANT FUEL DEBRIS  
*J. Liu, Y. Dotsuta, T. Kitagaki, N. Kozai, K. Yamaji, T. Ohnuki (Japan)*
- PB5 FIELD AND LARGE SCALE EXPERIMENTS**
- PB5-1 THE DETERMINATION OF <sup>137</sup>Ba DIFFUSION IN GRANODIORITE FROM AN IN-SITU DIFFUSION EXPERIMENT USING GAMMA SPECTROMETRY AND AUTORADIOGRAPHY; COMPARISON WITH LABORATORY DATA  
*E. Muuri, O. Tikkanen, A. Martin, A. Lindberg, M. Heule, M. Sittari-Kauppi (Finland, Switzerland)*
- PB5-2 EVALUATING THE MASS TRANSPORT CHARACTERISTICS FOR FAULT ZONE IN MUDSTONE AT THE HORONOBE UNDERGROUND RESEARCH LABORATORY  
*M. Takeda, E. Ishii, H. Ohno, Y. Tachi, T. Ito, K. Nemoto (Japan)*
- PB5-3 IN SITU DIFFUSION EXPERIMENT IN MUDSTONE AT THE HORONOBE URL: COMPARATIVE STUDY BETWEEN IN SITU AND LABORATORY TESTS  
*Y. Tachi, M. Takeda, H. Ohno, T. Ito, T. Sato, K. Nemoto (Japan)*
- PB5-4 VADOSE-ZONE ALTERATION OF URANIC PARTICLES IN FIELD LYSIMETER EXPERIMENTS  
*C. M. Fallon, W. R. Bower, K. Peruski, B. Powell, D. I. Kaplan, K. Morris, I. C. Lyon, D. Grolimund, P. Warnicke, J. F. W. Mosselmann, F. Livens, G. T. W. Law (UK, Finland, USA, Switzerland)*
- PC1 DATA SELECTION AND EVALUATION**
- PC1-1 THE NEW ELECTRONIC DATABASE OF THE NUCLEAR ENERGY AGENCY'S THERMOCHEMICAL DATABASE PROJECT  
*M. E. Rogozzi, J. S. Martinez, D. Costa, M. Bossant, E. F. Santillan (France, USA)*

**PB4 EFFECTS OF BIOLOGICAL AND ORGANIC MATERIALS**

- PB4-1 SPECIATION AND ANALYSIS OF SOIL TO PLANT TRANSFER OF PLUTONIUM AND AMERICIUM FOR DOSE ESTIMATION IN CROP CULTIVATION  
*S. Potgiesser, A. Gust, M. Mandel, B. Riebe, C. Walthar (Germany)*
- PB4-2 THE FATE OF Sr IN CULTURES OF THE CYANOBACTERIUM PSEUDANABAENA CATENATA  
*L. Foster, A. Cleary, H. Bagshaw, D. Sigee, J. K. Pittman, K. Morris, K. Zhang, K. F. Smith, J. R. Lloyd (UK)*
- PB4-3 COORDINATION OF LANTHANIDES AND ACTINIDES BY 4-PHOSPHORYLPYRAZOLONE RECEPTORS  
*M. Wenzel, K. Schnaars, F. Hemmersdorf, J. Marz, A. Rossberg, M. Acker, T. Stumpf, J. J. Weigand (Germany)*
- PB4-4 BIOGEOGENIC SULFIDE ANTIOXIDANT BUFFER IN NITRATE AND URANIUM POLLUTED AQUIFERS NEAR TO SLUDGE DEPOSITORY AFTER IN SITU BIOREMEDIATION  
*A. Safonov, N. Popova, P. Seledchik, K. A. Boldyrev, O. Gaskova, A. Boguslavskiy (Russia)*
- PB4-5 THE IMPACT OF REPEATED REDOX CYCLING EVENTS ON THE BIOGEOCHEMISTRY OF A SIMULATED LEGACY RADIOACTIVE WASTE TRENCH  
*A. S. Kinsela, M. Bligh, X. Vazquez-Campos, T. D. Waite, T. E. Payne, M. J. Comarmond, B. Rowling (Australia)*
- PB4-6 BINDING, UPTAKE AND TRANSPORT OF RADIONUCLIDES AND THEIR ANALOGUES BY THE FUNGUS SCHIZOPHYLLUM COMMUNE UNDER NATURAL CONDITIONS  
*A. Wollenberg, R. Hübner, A. Günther, L. Freitag, J. Raff, T. Stumpf (Germany)*
- PB4-7 CLAY MINERAL DISSOLUTION BY ACTIVITIES OF SIDEROPHORE PRODUCING BACTERIA  
*T. Kimura, F. Guido-Garcia, N. Kozai, S. Zhang, K. Yamaji, Q. Yu, B. Grambow (Japan, China, France)*
- PB4-8 <sup>137</sup>Cs UPTAKE BY LENTINULA EDODES (SHIITAKE) MUSHROOMS  
*F. Guido Garcia, F. Sakamoto, N. Kozai, B. Grambow, K. David (Japan, France)*

- PC1-2 THERMOCHEMIE – A THERMODYNAMIC DATABASE TO BE USED IN RADIOACTIVE WASTE MANAGEMENT  
*S. Brassimnes, R. Hibberd, B. Madé (Belgium, UK, France)*
- PC2 COUPLING CHEMISTRY AND TRANSPORT**
- PC2-1 SENSITIVITY ANALYSES OF NATURAL TRACER PROFILES IN SEDIMENTARY ROCKS OF THE HORONOBE URL, JAPAN  
*H. Sasamoto, R. C. Arthur, P. Alt-Epping, Y. Tachi (Japan, USA, Switzerland)*
- PC2-2 TEMPERATURE INDUCED BUFFER POROSITY CHANGE FOR NUCLIDE TRANSPORT USING TAIWAN REFERENCE CASE  
*S.-Y. Liang, W.-S. Lin, T.-P. Lee, T.-L. Lee (Taiwan)*
- PC2-3 AN OPERATIONAL APPROACH TO DESCRIBE THE <sup>238</sup>U AND <sup>230</sup>Ra TRANSPORT THROUGH A WETLAND LOCATED DOWNSTREAM TO A FORMER U MINE USING SORPTION MODEL FOR PEAT  
*S. Savoye, C. Beaucaire, M. Descostes (France)*
- PC3 DEVELOPMENT AND APPLICATION OF MODELS**
- PC3-1 REPOSITORY CHEMICAL CONDITIONS AND PLUTONIUM OXIDATION STATES IN THE POST-CLOSURE WASTE ISOLATION PILOT PLANT, CARLSBAD, NEW MEXICO, USA  
*E. F. U. Santillan, J. A. Schramke, R. T. Peake (USA)*
- PC3-2 MODELLING ANALYSIS ON IN SITU LONG TERM DIFFUSION (LTD-II) TEST AT THE GRIMSEL TEST SITE  
*Y. Fukatsu, T. Ito, Y. Tachi, K. Ishida, A. Martin (Japan, Switzerland)*
- PC3-3 MODEL CALCULATIONS FOR RADIONUCLIDE AND COLLOID TRANSPORT IN A GRANITIC SHEAR ZONE AT THE GRIMSEL TEST SITE (CFM PROJECT)  
*U. Noseck, Th. Schäfer, T. Reiche, I. Bloeschmidt (Germany, Switzerland)*
- PC3-4 COLLABORATIVE MODELLING OF AN IN-SITU THROUGH DIFFUSION EXPERIMENT PERFORMED IN FINLAND  
*B. Gylling, J. Soler, N. Marzic (USA, Spain, Sweden)*

MONDAY

- PC3-5 OPTIMISING NUCLEAR WASTE GLASS DISSOLUTION MODEL KINETIC PARAMETERS  
*J. Lillington, T. Gout, I. Farnan (UK)*
- PC3-6 MODELLING APPROACH TO SIMULATE MIGRATION BEHAVIOR IN SHALLOW UNDERGROUND  
*Y. Tanaka, T. Hijikata, S. Tokoyama, T. Koyama, S. Okamoto (Japan)*
- PC3-7 MODELLING GROUNDWATER TRANSPORT OF HELIUM IN FRACTURED CRYSTALLINE ROCKS  
*P. Trincharo, M. Sidborn, I. Puigdomènech, A. Iraola, G. Deiszmann, D. Bosbach (Spain, Sweden, Germany)*

PC5 SAFETY ASSESSMENT AND REPOSITORY CONCEPTS

- PC5-1 EFFECT OF FUEL CYCLE SELECTION ON THE DISPOSABILITY OF WASTES  
*K. Dungan, R. W. H. Gregg, K. Morris, F. Z. Taylor, G. Butler (UK)*
- PC5-2 ESTIMATION OF SORPTION REDUCTION BY ORGANIC LIGANDS IN ACTINIDE-CEMENT SYSTEMS  
*M. Ochs, F. Dolder, Y. Tachi (Switzerland, Japan)*
- PC5-3 SAFETY ASSESSMENT OF COLLOID FACILITATED TRANSPORT CASE ON THE SPENT NUCLEAR FUEL DISPOSAL IN TAIWAN  
*C. C. Chang, Y. H. Huang, J. Wu, S. J. Chang (Taiwan)*

PD APPLICATION TO CASE STUDIES

- PD-1 MOCK-UP TUNNEL CLOSURE TEST AND HYDRO-CHEMICAL COUPLING SIMULATION OF ENVIRONMENTAL CONDITION AS A BASIS OF SOLUTE-TRANSPORT ANALYSIS  
*Y. Ozaki, T. Iwatsuki, H. Onoe (Japan)*
- PD-2 POLLUTION SURVEY OF ARTIFICIAL RADIOISOTOPES IN AUSTRIA  
*C. Landstetter, K. M. Bartholomew, A. Achatz, W. Ringer (Austria)*

MONDAY

- PD-11 IMPORTANCE OF HALOGEN FOR SOIL DECONTAMINATION USING CESIUM-FREE MINERALIZATION: A ROLE OF CHLORINE ON PHASE TRANSFORMATION OF WEATHERED BIOTITE  
*I. Shimoyama, Y. Baba (Japan)*
- PD-12 STUDY ON WATER-REPELLENT TREATMENT METHOD FOR SUPPRESSING ELUTION OF RADIOACTIVE CESIUM FROM MUNICIPAL SOLID WASTE INCINERATION FLY ASH  
*T. Amano, D. Fukuda, Y. Koike, N. Ogawa (Japan)*
- PD-13 TRANSPORT AND TRANSFER BEHAVIOUR OF LONG-LIVED RADIONUCLIDES ALONG THE CAUSAL GROUNDWATER-SOIL-SURFACE-PLANT CHAIN TAKING INTO ACCOUNT LONG-TERM CLIMATIC CHANGES: THE TRANS-LARA PROJECT  
*A. Gust, M. Mandel, S. Pottgießer, B. Riebe, C. Walther (Germany)*
- PD-14 THE JOINT PROJECT TRANSSENS: TRANSDISCIPLINARY RESEARCH ON THE DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE IN GERMANY  
*C. Walther, K.-J. Röhlig (Germany)*
- PD-15 MEET-CINCH: A MODULAR EUROPEAN EDUCATION AND TRAINING CONCEPT IN NUCLEAR AND RADIOCHEMISTRY  
*C. Walther, J. John (Germany, Czech Republic)*
- PD-16 WIPP TRU REPOSITORY: UPDATE OF THE SAFETY CASE  
*D. T. Reed, F. E. Stanley, J. S. Swanson, E. Yalcintas, C. Hazelton (USA)*
- PD-17 FINAL RESULT FROM THE EC HORIZON2020 CEBAMA PROJECT  
*M. Almaier, V. Montoya, L. Duro, A. Valls, E. Holt, F. Claret, U. Mäder, B. Grambow, A. Idiart (Germany, Spain, Finland, France, Switzerland)*

MONDAY

- PD-3 RADIOCESIUM IN SEWAGE SLUDGE ASH  
*N. Kozai, S. Suzuki, F. Sakamoto, T. Ohnuki (Japan)*
- PD-4 REGIONAL-SCALE TEMPORAL EVOLUTION OF AIR DOSE RATES AFTER THE FUKUSHIMA DAIICHI NUCLEAR POWER PLANT ACCIDENT AND LONG-TERM MONITORING OPTIMIZATION  
*H. M. Wainwright, D. Sun, C. Oroza, A. Seki, S. Mikami, H. Takemiya, K. Saito (USA, Japan)*
- PD-5 BIOGEOCHEMICAL MODELING OF ACTINIDE AND TECHNETIUM MIGRATION IN SUBSURFACE WATER WITH HIGH NITRATE CONCENTRATION DURING BIOREMEDIATION  
*A. Safonov, R. Aidabaev, T. Konevnik, N. Popova, A. Lobanova, K. A. Boldyrev, T. Babich, E. Zakharova (Russia)*
- PD-6 INTEGRATION OF LABORATORY AND FIELD EXPERIMENTS TO INTERPRET ACTINIDE DISTRIBUTIONS AT A LEGACY TRENCH DISPOSAL SITE  
*T. E. Payne, A. S. Kinsela, J. J. Harrison, M. P. Johansen, D. Anderson, M. Bligh, M. J. Comarmond, S. Hankin, B. Rowling, A. Silitonga, S. Thiruvoth, C. Yordanega, X. Vazquez-Campos, T. D. Waite, K. Wilcher, H. K. Wong (Australia)*
- PD-7 TRITIUM SPECIATION IN ENVIRONMENTAL MATRICES BY ISOTOPIC EXCHANGE  
*A. Nivese, N. Baglan, G. Montavon, O. Péron (France)*
- PD-8 ABOVE- AND BELOWGROUND DISTRIBUTIONS OF RADIOCESIUM RELEASED FROM TEPCO'S FDNPP ACCIDENT IN THE MOUNTAINOUS FOREST OF FUKUSHIMA  
*T. Nizato, Y. Sasaki, S. Ito, K. Mitsuichi, T. Watanabe (Japan)*
- PD-9 DISTRIBUTION OF PLUTONIUM ISOTOPES AND AMERICIUM-241 IN UPLAND AGRICULTURAL SOILS THROUGHOUT JAPAN BEFORE THE FUKUSHIMA NUCLEAR ACCIDENT  
*J. Zheng, Z. T. Wang, Y. T. Ni, K. Tagami, S. Uchida (Japan, China)*
- PD-10 IMPACT OF VITRIFICATION TREATMENT ON LEACHING BEHAVIOUR OF FISSION PRODUCTS FROM MCCI DEBRIS  
*Y. Kodama, S. Sakamoto, D. Akiyama, A. Kirishima, T. Kobayashi, N. Sato, T. Sasaki (Japan)*

TUESDAY

TUESDAY (17. SEPTEMBER)

- 9:05 CONFERENCE ANNOUNCEMENTS
- SESSION 6 E: RESEARCH ACTIVITIES TOWARDS GEOLOGICAL DISPOSAL IN JAPAN AND REMEDIATION OF THE FUKUSHIMA DAIICHI NPS SITE
- Chair: *T. Ohnuki and T. Kobayashi (Japan)*
- 9:15 ESTIMATION OF FUEL DEBRIS PROPERTIES BY EXPERIMENTAL APPROACH FOR FUKUSHIMA DAIICHI NPS  
*T. Washiya, M. Takano, H. Hirano, K. Yano, T. Mitsugi (INVITED) (Japan)* E-3
- 10:00 MIGRATION OF RADIOCESIUM AND RADIOIODINE IN THE ENVIRONMENT EMITTED DURING FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT  
*Y. Takahashi, (INVITED) (Japan)* E-4
- 10:25 DEVELOPMENT OF THE SDM-BASED PRE-SITING SAFETY CASE IN JAPAN  
*T. Fujiyama, K. Fujisaki, H. Umeki (INVITED) (Japan)* E-5
- 10:50 TOWARDS GEOLOGICAL DISPOSAL IN JAPAN AND REMEDIATION OF THE FUKUSHIMA DAIICHI NPS SITE: RESEARCH STRATEGY IN THE GLOBAL CONTEXT  
*B. Grambow, R. C. Ewing, T. Ohnuki (INVITED) (Japan, France, USA)* E-6
- 11:15 BREAK

TUESDAY

## SESSION 7 D: CASE STUDIES

Chair: T. Payne (Australia) and C. Liu (China)

- 11:35 MECHANISMS OF RADIONUCLIDE IMMOBILIZATION: A HANFORD CASE STUDY D-1  
C. I. Pearce, E. A. Cordova, J. W. Morad, K. J. Cantrell, S. A. Saxlow, O. Qafoku, T. G. Levitskaia, S. M. Heald, J. E. Szeccsody, M. J. Rigali, R. C. Moore, V. L. Freedman (INVTED) (USA)
- 12:20 ANALYSIS OF FUTURE BEHAVIOR AND POSSIBLE COUNTERMEASURES FOR CONTAMINATED GROUNDWATER OF FUKUSHIMA-DAIICHI NUCLEAR POWER STATION D-2  
T. Kovama, Y. Tanaka, D. Tsumune, T. Hijikata, T. Hattori, M. Kamoshida, A. Hasunuma, K. Hida, M.M. Uematsu, T. Fukuda (Japan)
- 12:45 U MIGRATION PROCESSES IN U MINES WASTE ROCKS: IMPACT OF THE WEATHERING CONDITIONS ON THE MAIN U-BEARING PHASES D-3  
F. Lahrouch, A. Tayal, A. Kanzari, M. Hunaul, P. L. Solari, M. Descostes, M. Gérard (France, Germany)
- 13:10 BREAK

## SESSION 8 A8: COMPUTATIONAL CHEMISTRY

Chair: V. Vallet (France) and K. M. Rosso (USA)

- 14:30 INTERACTIONS BETWEEN F-ELEMENT NANOCRYSTALS AND SURFACE LIGANDS A8-1  
P. Yang, E. R. Batista, A. Karakon, G. Wang, W. Wang, S. Thevuthasan (USA, India, China)
- 14:55 ADDRESSING RADIOCESIUM CONTAMINATION IN FUKUSHIMA WASTE SOIL THROUGH THE LENS OF SYSTEMATIC NUMERICAL SIMULATIONS A8-2  
M. Ohnuma, S. Kerisit, I. C. Bourg, L. N. Lammers, T. Ikeda, M. Sassi, K. M. Rosso, M. Machida (Japan, USA)

TUESDAY

## SESSION 10 POSTER SESSION II (17:20 – 20:20)

## PA1 SOLUBILITY AND DISSOLUTION

- PA1-5 RADIONUCLIDE - ORGANIC INTERACTION: IMPACT ON THE SOLUBILITY OF M(III/IV) UNDER REPOSITORY-RELEVANT pH / E<sub>h</sub> CONDITIONS  
X. Gaona, A. Tasi, N. Adam, S. Duckworth, D. Fellhauer, M. Altmair, H. Geckets (Germany)
- PA1-6 CHEMICAL FORM OF STABLE CARBON RELEASED FROM GAS-ATOMIZED 316L STAINLESS-STEEL POWDER  
R. Nakabayashi, T. Fujita (Japan)
- PA1-7 NpO<sub>2</sub>(s) DISSOLUTION UNDER VADOSE ZONE CONDITIONS  
K. Peruski, D. I. Kaplan, B. A. Powell (USA)
- PA1-8 EFFECTS OF THE DOPANTS IN UO<sub>2</sub> MATRIX ON THE DISSOLUTION OF THE SPENT FUEL UNDER CEMENTITIOUS STORAGE CONDITIONS  
J. Cobos, N. Rodríguez-Villagra, S. Fernández (Spain)
- PA1-9 SOLUBILITY, SPECIATION AND SOLID PHASE FORMATION OF Pu(VI) IN ALKALINE CaCl<sub>2</sub> AND NaCl SOLUTIONS  
A. Kuzenkova, D. Fellhauer, D. Schild, X. Gaona, A. Romanchuk, J. Rothe, S. Kalmykov, M. Altmair (Russia, Germany)
- PA2 SOLID SOLUTION AND SECONDARY PHASE FORMATION
- PA2-5 CHANGES IN THE CHEMICAL, PHYSICAL AND MIGRATION PROPERTIES OF CEMENTITIOUS MATERIALS FOLLOWING INTERACTION WITH BENTONITE AND TEMPERATURE LOADING  
P. Večerník, R. Červinka, T. Rosendorf, R. Váňáček (Czech Republic)
- PA2-6 THE TRANSPORT, CHEMICAL AND PHYSICAL PROPERTIES OF BENTONITE-CEMENT MIXTURES AS A POTENTIAL ALTERNATIVE BUFFER MATERIAL  
P. Večerník, V. Kašpar, E. Hofmanová, Y. Havlová (Czech Republic)

TUESDAY

- 15:20 QUANTUM CHEMICAL MODELING OF U(VI) SORPTION ON CALCIUM SILICATE HYDRATE A8-3  
A. Kremleva, S. Krüger, N. Rösch (Germany)
- 15:45 BREAK

## SESSION 9 A7: EXPERIMENTAL METHODS

Chair: J.-I. Yun (Korea) and C. Walther (Germany)

- 16:05 EFFECT OF LASER-INDUCED REACTION ON THE SPECIES DISTRIBUTION OF U(VI) ADSORBED ONTO AN AMORPHOUS SILICA SURFACE A7-1  
E. C. Jung, Y. Jo, T.-H. Kim, H.-K. Kim, H.-R. Cho, W. Cha, M.H. Baik, J.-I. Yun (Korea)
- 16:30 DIGITAL AUTORADIOGRAPHY OF ALPHA AND BETA PARTICLES EMISSIONS IN GEOLOGICAL SAMPLES USING THE BEAQUANT™: AN OVERVIEW A7-2  
F. Sardini, S. Billon, A. Angileri, C. Beaudeau, D. Beaufort, J. Donnard, J.C. Parneix, N. Sittari-Kauppi, M. Descostes (France, Finland)
- 16:55 RESEARCH PROGRESS OF TRACE URANYL IONS DETECTION BY SURFACE-ENHANCED RAMAN SCATTERING (SERS) A7-3  
X. He, S. Wang, X. Wang (China)
- 17:20 END OF ORAL SESSIONS OF TUESDAY

TUESDAY

- PA2-7 TRAVELLING CaCO<sub>3</sub> PRECIPITATION REACTION FRONT IN COMPACTED BENTONITE UNDER ELECTRICAL POTENTIAL GRADIENT  
J. Rachmadetin, M. Mizuto, T. Kozaki, N. Watanabe (Japan, Indonesia)
- PA2-8 A NEW TECHNIQUE FOR REMOVING SELENITE AND SELENATE FROM AQUEOUS SOLUTION BY COPRECIPITATION WITH BARITE  
K. Tokunaga, T. Takahashi, N. Kozai (Japan)
- PA3 COMPLEXATION WITH INORGANIC AND ORGANIC LIGANDS
- PA3-13 COMPLEXATION OF Th(IV) AND U(VI) WITH N-(2-HYDROXYETHYL)IMINODIACETIC ACID IN AQUEOUS SOLUTION - A THERMODYNAMIC APPROACH BY EXPERIMENT AND THEORY  
S. Sharma, R. M. Rao Dumpala, N. Rawat (India)
- PA3-14 THE COMPLEXATION AND THERMODYNAMICS OF Cm(III) WITH F<sup>-</sup> AT T = 25 TO 200 °C STUDIED BY TIME RESOLVED LASER FLUORESCENCE SPECTROSCOPY  
C. Koke, A. Škerencak-Frech, P. J. Panak (Germany)
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*S. M. T. Hoang, D. K. Tran (Vietnam)*
- PD-25 ELUTION SUPPRESSION OF HAZARDOUS ELEMENTS FROM MUNICIPAL SOLID WASTE INCINERATION FLY ASH BY GEOPOLYMER SODIFICATION MIXED WITH SOIL COMBINING WATER-REPELLENT TREATMENT  
*T. Takahashi, T. Mizuno, M. Kasari, W. Matsuda, A. Ohbuchi, N. Ogawa, Y. Koike (Japan)*
- PD-26 TIME DEPENDENCE OF DISTRIBUTION OF RADIONUCLIDES IN SOIL NEAR THE FUKUSHIMA DAI-ICHI NUCLEAR POWER STATION  
*K. Fujiwara, T. Sasaki, D. Matoba, K. Iijima (Japan)*
- PD-27 MIGRATION BEHAVIOR OF RADIONUCLIDES DEPOSITED IN FOREST NEAR FDNPS: EVALUATION BY ADVECTION DISPERSION MODEL  
*K. Iijima, K. Fujiwara, D. Matoba, T. Sasaki (Japan)*
- PD-28 ESTIMATION OF THE AMOUNT OF I-129 IN THE ENVIRONMENT GENERATED DUE TO THE DECAY OF Te-129m DISCHARGED BY THE FUKUSHIMA NPP ACCIDENT  
*H. Sato, M. Miyoshi (Japan)*
- PD-29 AQUATIC RADIOCHEMISTRY AND SOLUBILITY STUDIES IN SUPPORT OF POTENTIAL EMERGENCY MEASURES FOR THE ASSE II SALT MINE, GERMANY  
*D. Fellhauer, M. Altmair, V. Metz, H. Geckets (Germany)*
- PD-30 LICENSE APPLICATION REVIEW OF RADIONUCLIDE RETARDATION PHENOMENA IN UPDATED SAFETY ASSESSMENT FOR EXTENSION OF EXISTING FACILITY FOR FINAL DISPOSAL OF LOW AND INTERMEDIATE LEVEL WASTE (SFR) IN SWEDEN  
*B. Strömberg (Sweden)*
- PD-31 SAFETY ASSESSMENT OF ROKKASHO LOW LEVEL RADIOACTIVE WASTE DISPOSAL FACILITIES  
*Y. Miyauchi, T. Hamanaka, N. Tamura, T. Kozawa, T. Sasaki (Japan)*
- PD-32 RADIOLOGICAL RISK OF NORMS DERIVED FROM USED FILTERS IN THE BOTTLED MINERAL WATER FACILITIES  
*W. Shin, S. Choung, J.-H. Han, B.-U. Chang (Korea)*

- PD-33 THE WORKPACKAGE FUTURE WITHIN THE EU JOINT PROGRAMME EURAD  
*D. Bosbach, V. Havlova, S. Churakov (Germany, Czech Republic, Switzerland)*
- PD-34 SEDIMENT CHARACTERIZATION AND SORPTION STUDIES TO ASSESS URANIUM FATE AND TRANSPORT AT A POTENTIAL SPENT FUEL REPOSITORY SITE IN THE NEGEV DESERT, ISRAEL  
*M. Dangelmayr, H. Boukhalfa, P. Reimus, R. Harris, D. Ware, F. A. Caporuscio, O. Klein BenDavid, N. Balaban, A. Dody, R. Rosenzweig, P. Reimus, G. Bussod (USA, Israel)*

## WEDNESDAY (18. SEPTEMBER)

## SESSION 11 C2: COUPLING CHEMISTRY AND TRANSPORT

Chair: *I. Puigdomènech (Sweden) and P. De Canière (Belgium)*

- 15:00 THE EFFECT OF IONIC STRENGTH ON DIFFUSION IN CLAY. MODELING SOLUTE TRANSPORT AND RETENTION IN THE DR-A EXPERIMENT AT MONT TERRI  
*J. M. Seler, C. I. Steefel, T. Gimmi, O. X. Leupin, V. Cloet (INVITED) (Spain, USA, Switzerland)*
- 15:45 MODELLING THE MOBILITY OF Zn(II) IN ARGILLACEOUS ROCKS AT 21°, 60° AND 80°C USING ADSORPTION MODELS FOR ILLITE AND SMECTITE  
*S. Savoye, S. Lefèvre, C. Lim (France)*
- 16:10 REACTIVE TRANSPORT MODELLING FOR SUPPORTING LONG-TERM MONITORING AFTER ENVIRONMENTAL REMEDIATION AT RADIOACTIVELY CONTAMINATED SITES  
*H. M. Wainwright, D. Ermakova, A. Libera, B. Faybishenko, B. Arora, M. Denham, F. de Barros, K. Lipnikov, D. Moulton, C. Eddy-Dilek (USA)*
- 16:35 THREE-DIMENSIONAL MODELLING OF THE LIQUID RADIOACTIVE WASTE INJECTION SITE «SEVERNYY» USING GEOPOLIS SOFTWARE  
*V. Suskin, I. Kapryin, A. Rastorguev, V. Kononov (Russia)*
- 17:00 NATURE IS DISCRETE, BUT CONTINUITY IS USEFUL: A REFLECTION ON THE MODELING METHODOLOGIES FOR RADIONUCLIDE TRANSPORT IN DEEP GEOLOGICAL REPOSITORIES IN CRYSTALLINE ROCKS  
*D. Sampietro, E. Abarca, A. Sáinz-García, P. Trinchero, A. Iraola, J. Molinero (Spain)*
- 17:25 BREAK

## SESSION 12 A1: SOLUBILITY AND DISSOLUTION

Chair: *B. Grambow (France) and D. Reed (USA)*

- 17:45 LEACHING OF HOMOGENEOUS MOX PELLETS ( $\text{U}_{97}\text{Pu}_{2}\text{O}_7$ ) IN CARBONATED WATER AND CLAYEY GROUNDWATER WITH METAL IRON  
*V. Kerleguer, C. Jégou, L. De Windt, V. Broudic, C. Martin, F. Tocino (France)*
- 18:10 THE IMPACT OF (SUB)MILLIMOLAR CONCENTRATIONS OF  $\text{Ca}^{2+}$  ON  $\text{Np(V)}$  SOLID PHASE FORMATION IN ALKALINE SOLUTIONS  
*D. Fellhauer, X. Gaona, M. Altmair, H. Geckets (Germany)*
- 18:35 EVIDENCES FOR COFFINITIZATION OF  $\text{UO}_{2-x}$  SINTERED PELLETS UNDER ANOXIC CONDITIONS  
*D. Alby, S. Szenhneer, A. Masbah, J. Lin, L. Duro, M. López-García, L. Zetterström-Evins, R. C. Ewing, N. Dacheux, J. Bruno (France, Spain, Sweden, USA)*
- 19:00 ALTERATION OF VITRIFIED INTERMEDIATE LEVEL NUCLEAR WASTES IN ALKALINE MEDIA: EFFECT OF CEMENTITIOUS MATERIALS, pH AND TEMPERATURE  
*T. Suzuki-Muresan, A. Abdelouas, C. Landesman, A. Ait-Chaoui, Y. El Mendili, S. Ribet, K. Perrigaud, D. Shitara, X. Bourbon, C. Martin (France, Japan)*
- 19:25 END OF ORAL SESSIONS OF WEDNESDAY

THURSDAY

## THURSDAY (19. SEPTEMBER)

9:05 CONFERENCE ANNOUNCEMENTS

## SESSION 13 A7: EXPERIMENTAL METHODS

Chair: D. Clark (USA) and W. Cha (Korea)

- 9:15 ADVANCED STRUCTURAL STUDIES OF ACTINIDE MATERIALS APPLYING HIGH RESOLUTION X-RAY ABSORPTION AND EMISSION SPECTROSCOPY  
*T. Vitova (INVITED) (Germany)* A7-4
- 10:00 FAST DEUTERATED WATER DIFFUSION MEASUREMENTS IN CEMENT PASTE, MORTAR AND CONCRETE USING A NMR TECHNIQUE  
*M. Fleury, T. Chevalier, G. Berthe, W. Dridi, M. Adadji (France)* A7-5
- 10:25 APPLICATION OF AMS TO ULTRA-LOW LEVELS OF ACTINIDES AND <sup>99</sup>Tc IN THE ENVIRONMENT  
*K. Hain, T. Faestermann, F. Gilca, M. Kern, G. Korschinek, M. Martschini, J. Pitters, F. Quinto, A. Sakaguchi, P. Steier, G. Wallner, J. Welch, M. Yamada, R. Golser (Austria, Germany, Japan)* A7-6
- 10:50 NONDESTRUCTIVE EXTRACTION AND SPECIATION ANALYSIS OF NUCLEAR FUEL PARTICLES FROM ENVIRONMENTAL SAMPLES  
*M. Weiss, H. Bosco, M. Raiwa, C. M. Fallon, W. R. Bower, P. Warnicke, G. T. W. Law, C. Walther (Germany, Finland, UK, Switzerland)* A7-7
- 11:15 BREAK

THURSDAY

- 15:20 WHY MIGRATION EXPERIMENTS WITH A PRESSURE GRADIENT DO NOT ALLOW TO DETERMINE THE ANION ACCESSIBLE POROSITY IN CLAYS  
*M. Aertens, N. Maes (Belgium)* B2-3
- 15:45 ANION EXCLUSION IN CRYSTALLINE ROCKS: THE INFLUENCE OF ROCK STRUCTURE AND PORE NETWORK  
*V. Havlova, M. Zuna, L. Brázda, T. Rosendorf, J. Sammaljärvi, V. Nenonen, M. Siitari-Kauppi, E. Sasao, L. Gvozdič (Czech Republic, Finland, Japan)* B2-4
- 16:10 DIFFUSION IN COMPACTED BENTONITE: DO WE HAVE PROCESS UNDERSTANDING?  
*E. Hofmanová, A. Pecková, R. Cervinka, A. Vokál (Czech Republic)* B2-5
- 16:35 BREAK

## SESSION 16 A3: COMPLEXATION WITH INORGANIC AND ORGANIC LIGANDS

Chair: P. Toulhoat (France) and N. Evans (UK)

- 16:55 THERMODYNAMIC STUDIES ON THE SOLUBILITY OF ACTINIDES IN THE PRESENCE OF ORGANIC ACIDS RELATED TO GEOLOGICAL DISPOSAL  
*T. Kobayashi, T. Teshima, P. Wang, T. Sasaki, A. Kitamura (Japan)* A3-1
- 17:20 URANIUM(VI) COMPLEXATION WITH AQUEOUS SILICATES IN THE ACIDIC TO ALKALINE pH-RANGE  
*H. Lösch, J. Tits, M. Marques Fernandes, B. Baeyens, I. Chitorascu, S. Krüger, T. Stumpf, N. Huittinen (Germany, Switzerland)* A3-2
- 17:45 COMPLEXATION OF PROTACTINIUM (V) WITH POLYAMINOCARBOXYLATES  
*M. Maloubier, C. Le Naour, J. Roques, B. Siberchicot, J. Aupiais, C. Den Auwer, P. Moisy, P. L. Solari (France)* A3-3

THURSDAY

## SESSION 14 A4: REDOX REACTIONS AND RADIOLYSIS EFFECTS

Chair: S. Clark (USA) and G. Law (Finland)

- 11:35 STRUCTURAL INVESTIGATIONS OF Np SORBED ON ILLITE BY M<sub>2</sub>-EDGE HR-XANES AND L<sub>2</sub>-EDGE EXAFS SPECTROSCOPY  
*B. Schacherl, C. Joseph, A. Beck, A. Schurr, F. Rieder, K. Dardenne, D. Fellhauer, E. Bohmert, T. Kupcik, J. Rothe, H. Geckeis, T. Vitova (Germany)* A4-1
- 12:00 ON REDUCTIVE PRECIPITATION OF MULTIVALENT ELEMENTS ON IRON MATERIALS UNDER ANAEROBIC CONDITIONS  
*T. Li, H. Yang, L. Wang, D. Cui (China, Sweden)* A4-2
- 12:25 URANIUM BEHAVIOR IN CALLOVO-OXFORDIAN CLAY ROCK FORMATION: FROM LABORATORY-DERIVED MODELS TO IN-SITU K<sub>d</sub> VALUES  
*G. Montanon, F. Maia, C. Batilly, S. Ribet, C. Lerouge, K. David, B. Madé, M. Lundy, Y. Hassan Loni, M. Grivé, B. Grambow (France, Spain)* A4-3
- 12:50 BREAK

## SESSION 15 B2: DIFFUSION AND OTHER MIGRATION PROCESSES

Chair: M. Siitari-Kauppi (Finland) and T. Missana (Spain)

- 14:10 DIFFUSIVE TRANSPORT OF STRONGLY SORBING RADIOELEMENTS IN ARGILLACEOUS MEDIA: OLD WINE IN NEW BOTTLES?  
*M. Glauz, L. Van Loon (INVITED) (Switzerland)* B2-1
- 14:55 MIGRATION OF CATIONIC, ANIONIC AND NEUTRAL RADIONUCLIDES IN CEMENT-BASED MATERIALS: THE ROLE OF THE CHARGED SURFACES VERSUS THE CHEMICAL DEGRADATION  
*P. Henocq, S. Gaboréau, T. Sanchez (France, Canada)* B2-2

THURSDAY

- 18:10 THE FORMATION OF NANOCRYSTALLINE ThO<sub>2</sub>: FROM PRECIPITATION IN AQUEOUS SOLUTIONS TO THE HIGH-TEMPERATURE TECHNIQUES  
*T. V. Plakhova, A. Yu. Romanchuk, A. E. Baranchikov, R. D. Svetogorov, V. A. Lebedev, A. L. Trigub, E. A. Gerber, K. O. Kvashnina, V. K. Ivanov, S. N. Kalmykov (Russia, France, Germany)* A3-4
- 18:35 END OF ORAL SESSIONS OF THURSDAY
- 18:40 MOVE TO BANQUET

## FRIDAY (20. SEPTEMBER)

9:05 CONFERENCE ANNOUNCEMENTS

## SESSION 17 A3: COMPLEXATION WITH INORGANIC AND ORGANIC LIGANDS

Chair: *S. Nagasaki (Canada) and X. Gaona (Germany)*

- 9:15 EXPERIMENTAL AND THEORETICAL STUDIES ON COMPLEXATION OF Eu(III), Th(IV) AND U(VI) WITH PYRAZINE CARBOXYLATES A3-5  
*R. M. Rao Dumpala, N. Rawat (India)*
- 9:40 COMPLEXATION OF U AND Th IN HYDROTHERMAL SOLUTIONS A3-6  
*A. Migdisov, H. Xu, H. Boukhalfa (USA)*
- 10:05 CONCLUSIONS FROM THE THERMAC PROJECT – A DEDICATED COLLABORATIVE PROJECT TO INVESTIGATE ACTINIDE CHEMISTRY AT ELEVATED TEMPERATURE CONDITIONS A3-7  
*M. Altmajer, F. Brandt, V. Brendler, I. Campos, N. Cevirim-Papaioannou, I. Chiorescu, E. Colás, F. Endrizzi, D. Fellhauer, X. Gaona, A. Gray, S. Hagemann, N. Huittinen, C. Koke, D.A. Kulik, S. Krüger, J.-Y. Lee, M. Maiwald, G.D. Miron, P.J. Panak, J. Poonoosamy, A. Skerencak-Frech, R. Steudmer, T. Thoenen (Germany, Spain, Switzerland)*
- 10:30 INTERACTION OF RADIONUCLIDES WITH CARBON NANOMATERIALS STUDIED BY BATCH, SPECTROSCOPY AND THEORETICAL CALCULATIONS A3-8  
*X. Wang (China)*
- 10:55 COMPLEXATION OF URANIUM(VI) WITH SUBSTITUTED AROMATIC ACIDS IN AQUEOUS SOLUTION A3-9  
*S. Choi, J.-I. Yun (Korea)*
- 11:20 BREAK

## SESSION 18 B5: FIELD AND LARGE SCALE EXPERIMENTS

Chair: *M. H. Baik (Korea) and V. Havlová (Czech Republic)*

- 11:40 COMPREHENSIVE STUDY OF THE MIGRATION PROPERTY IN REPRESENTATIVE ROCK OF JAPAN AT UNDERGROUND RESEARCH LABORATORIES B5-1  
*T. Iwatsuki, E. Ishii (IN/TTED) (Japan)*
- 12:05 AN OVERVIEW AND KEY RESULTS FROM THE LONG-TERM IN-SITU DIFFUSION PROJECT (LTD) AT THE GRIMSEL TEST SITE, SWITZERLAND B5-2  
*A. Mairin, Y. Fukatsu, Y. Tachi, K. Ishida, E. Muuri, M. Sitar-Kauppi, V. Havlova, A. Vokal, (Switzerland, Japan, Finland, Czech Republic)*
- 12:30 INFLUENCE OF REDOX REACTIONS AND ORGANIC LIGAND COMPLEXATION ON URANIUM, NEPTUNIUM, TECHNETIUM AND PLUTONIUM SUBSURFACE TRANSPORT: UPSCALING LABORATORY EXPERIMENTS TO UNDERSTAND FIELD LYSIMETER DATA B5-3  
*B. A. Powell, R. Dozier, N. Edavilam, K. Peruski, N. Conroy, T. A. DeVol, M. Dogan, B. Ferguson, J. Hundley, D. I. Kaplan, A. Kersting, A. Al Maman, M. Maloubier, N. Martinez, D. Montgomery, S. Moyssey, L. Murdoch, N. Tharayil, M. Zavarin (USA)*
- 12:55 THE CURRENT STATUS OF HLW DISPOSAL IN CHINA AND DIFFUSION AND SORPTION BEHAVIOR OF SELENIUM-75 IN BEISHAN GRANITE AND GMZ BENTONITE B5-4  
*C. Liu, J. G. He, X. Y. Yang, C. L. Wang (China)*
- 13:20 END OF THE CONFERENCE