CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Atalante 2004—An International Conference on Advances For Future Nuclear Fuel Cycles (AI No. 20.06002.01.081.326; Account No. 20.06002.01.081)

DATE/PLACE: June 21–25, 2004, Nimes, France

AUTHOR: Vijay Jain

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SUBJECT: Atalante 2004—An International Conference on Advances For Future Nuclear Fuel Cycles
(AI No. 20.06002.01.081.326; Account No. 20.06002.01.081)

DATE/PLACE: June 21–24, 2004, Nimes, France
June 25, 2004, CEA, Cadarache, France

AUTHOR: Vijay Jain, Manager, Corrosion Science and Process Engineering, Center for Nuclear Waste Regulatory Analyses (CNWRA)

BACKGROUND AND PURPOSE OF TRIP:

The purpose of the trip was to attend and present a paper at the Atalante 2004 International Conference on Advances for Future Nuclear Fuel Cycles. The Atalante conference is an international conference that is held every four years to explore advances for the future nuclear fuel cycles. A visit to Commissariat a l'Energie Atomique Research Center at Cadrache was included as a part of the conference.

SUMMARY OF PERTINENT POINTS:

Approximately 400 participants from 16 countries attended the conference. About 200 papers were presented in oral and poster sessions. The presentations and posters at the Atalante 2004 conference were focused on recycling processes, basic physico-chemistry of actinides and fission products, and waste management. I made an oral presentation of the paper titled "Performance of Surrogate High-Level Waste Glass in the Presence of Iron Corrosion Products." This paper discussed results of our recent investigations on the effects of corrosion products on the dissolution of a surrogate high-level waste glass. The presentation also illustrated the use of risk information in assessing the importance of high-level waste glass and spent nuclear fuel to waste isolation. A paper presented by Mr. Buzz Savage of the U.S. Department of Energy (DOE) titled "Impact of Partitioning and Transmutation on Repository Design" provided a rationale for DOE's advanced fuel cycle initiative, including generation IV fuel cycle, in the United States. The rationale for this program was based on the limiting capacity of the potential Yucca Mountain repository to accommodate future spent nuclear fuel. Excellent papers on spent nuclear fuel and high-level waste glass were presented at the conference.

The conference provided an excellent opportunity to keep current with the worldwide advancements in nuclear fuel cycle, and to interact with scientists from the European Community. The meeting helped staff to enhance awareness of issues facing the international community on the subject, and provided an opportunity to discuss our work with the international participants whose feedback on CNWRA/U.S. Nuclear Regulatory Commission

(NRC) work was valuable. Such interactions and acceptance by international experts enhances credibility of our work. Future participation in such conferences is recommended. There are no outstanding issues requiring action.

DISCUSSION:

The presentations and posters at the Atalante 2004 conference were focused on recycling processes, basic physico-chemistry of actinides and fission products, and waste management. There were 50 oral presentations and 150 posters. The first day of the conference was devoted to invited presentations. The invited session included ten papers. Several invited papers were presented in French and simultaneously translated in English. In the waste management area, there were 15 oral presentations and 35 posters. There were number of papers relevant to the high-level waste management. These papers can be broadly classified into three categories, namely, spent nuclear fuel, high-level waste glass, and ceramic waste forms for minor actinides. A summary of pertinent papers is provided below.

Spent Nuclear Fuel

J. P. Glatz (Institute of Transuranium Elements, Germany) discussed development of corrosion potential measurement, alternate current impedance analysis, and electrochemical noise measurement methods for measuring corrosion rate of spent nuclear fuel. In samples doped with 0.1 and 10 percent Pu-238, presenter showed that a higher Pu concentration results in a higher corrosion potential and a higher corrosion rate. This was attributed to the generation of reactive radicals and oxidizing species at the fuel/solution interface due to α radiolysis from Pu-238 decay. The study was conducted in reducing conditions. C. Poinssot (Commissariat a l'Energie Atomique) summarized the performance assessment model for the french spent nuclear fuel. The proposed model bounds radionuclide release and integrates expected uncertainties in processes and parameters. Presenter indicated that the He production in a 10,000 year period from a 47.5 GWd/MTU burnup MOX fuel is six times more than UO_2 spent nuclear fuel. This observation could necessitate assessment of He generation and its potential impact on the physical state of pellet and fuel rod. The instant release fraction of the radionuclide release was based on the existing literature while the matrix dissolution rate was based on α radiolysis occurring at the pellet/solution interface. Significant uncertainty remains, however, in the estimation of reactive surface area. The surface area could range between surface area of spent fuel at discharge and a case where every grain boundary is accessible to water. B. Muzeau (Commissariat a l'Energie Atomique) presented a paper describing the effect of α radiolysis on the alteration of spent nuclear fuel matrix. The impact of α radiolysis was studied by doping UO_2 with different levels of Pu-238/Pu-239 as well as spent fuel samples. The doped UO_2 pellets were exposed to air at 25 °C for different time periods. The dissolution tests were conducted in both aerated and deaerated conditions. Studies were conducted in both deionized water and carbonated solutions. The surface reactivity of UO_2 doped samples showed dependance on the flux of α source and to the exposed duration in air. In aerated conditions, observed changes in surface reactivity approached same value with several leaching cycles. In deaerated conditions, however, the dissolution was a function of flux of α source. Presenter indicated that it's important to assess the condition of fuel surface at the time

of water contact. C. Ferry (Commissariat a l'Energie Atomique) discussed the evolution of chemical and physical state prior to cladding failure, long-term mechanical properties of cladding after irradiation, and evolution of spent nuclear fuel in contact with air. While thermal diffusion of He was not a concern during dry storage, the formation of defects induced by α irradiation, especially in MOX fuel require further investigation. The presenter also highlighted the need for long term creep tests and oxidation data below 250 °C for high burnup spent nuclear fuel. T. Wiss (Institute of Transuranium Elements, Germany) in the poster showed that the fuel dissolution increases with the increase in α activity in reducing conditions. The UO_2 doped with 10 percent U-233 showed the highest dissolution rate. The fuel dissolution was higher in carbonated water compared to deionized water at 25 °C. When Fe(II) and H_2O_2 were present in equimolar amounts, UO_2 surface did not show any surface changes. A poster by L. Van Brutzel (Commissariat a l'Energie Atomique) showed structural effects of displacements cascades in UO_2 matrix using molecular dynamics. The results showed that their was no amorphization of the structure and that vacancies are created preferentially in the core of the cascade while interstitials were located at the surface.

The papers presented on spent nuclear fuel indicated that further research is needed to understand potential changes in the fuel microstructure prior to water contact and dissolution on contact for high burnup UO_2 and MOX spent nuclear fuel under disposal conditions.

High-Level Waste Glass

There were several interesting papers presented on high-level waste glass. In an invited talk, Dr. Grambow (Subatech, France) discussed needs and priorities for vitrified high-level waste. He summarized that nuclear waste glasses are best-studied materials and suggested that these glasses will resist complete corrosion for 1 to 100 million years with a large fraction of sparingly soluble actinides and long lived fission products retained in altered glass. Research is, however, needed to improve predictive credibility. I. Rebet (Commissariat a l'Energie Atomique) presented a performance assessment model for the disposal of french R7T7 high-level waste glass. The model is based on the initial and residual glass dissolution rates. The initial dissolution rate is several orders of magnitude higher compared to the residual dissolution rate. The glass dissolution process starts at initial rate and switches to residual rate when the sorption sites for silica released from the glass on the corrosion products and surrounding media is exhausted. Currently, the model is valid for a pH range between 6 and 10, and temperature range between 25 and 100 °C. The model uses an effective fracture ratio of 5, compared to the factor of 20 used by DOE in the abstraction of high-level waste glass. V. Jain (CNWRA) discussed the effects of corrosion products on the dissolution of a surrogate high-level waste glass. The results showed that the high-level waste glass could dissolve 200 times faster in acidic conditions compared to neutral or alkaline pH of 10. Furthermore the presentation showed, using risk information, that the contribution to the dose from high-level waste glass below 50 °C is less than 10 percent compared to the dose from the dissolution of the spent nuclear fuel at a pH of 8. At temperature higher than 50 °C, high-level waste glass becomes a significant contributor to the dose. It should be noted that only a fraction of waste packages considered as "initial failure" will come in contact with aqueous solution ay temperature higher than 50 °C. V. Luca (Australian Nuclear Science and Technology

Organization, Australia) examined the effect of canister corrosion products on the release of cesium from ceramic waste form and showed that cesium loaded bronze and hollandite waste forms could completely dissolve in 0.5 M $Fe(NO_3)_3$ in four days. A poster by I. Bardez (Commissariat a l'Energie Atomique) highlighted development of new nuclear waste glasses to incorporate highly active liquid waste arising from the reprocessing of the high burnup spent nuclear fuel. Glasses were prepared with Nd content between 16 and 30 percent. These glasses also contained more fluxing agents such as boron and sodium to keep the melting point below 1,300 °C. D. Peuget (Commissariat a l'Energie Atomique) showed effects of α-radiation on borosilicate glass. This study was initiated to support vitrification of highly active liquid waste from high burnup spent nuclear fuel. The R7T7 french high-level waste glass was doped with Cm-244 ranging between 0.04 and 1.5 percent to simulate a long-term effect of α radiation. Initial results indicate only a slight influence of α radiation on the mechanical properties and chemical durability. These tests are expected to be continued for a long-time. T. Mizuno (Japan Atomic Energy Research Institute, Japan) had a poster describing vitrification of spent nuclear fuel hulls to immobilize C-14. The Zircaloy-4 hulls were mixed with 20 percent Cu and melted at 1,200 °C. Melting in an inert environment retained all C-14 in the waste form. V. Magnien (Physique des Mineraux at des Magmas, France) used X-ray Absorption Near Edge Structure (XANES) spectroscopy to study the iron redox kinetics in silicate glasses, and showed that the XANES can measure concentrations of ferrous and ferric ions just above the glass transition temperature. Y. Minet (Commissariat a l'Energie Atomique) described usefulness of Monte-Carlo modeling to study basic dissolution mechanisms for predicting long-term behavior of nuclear waste glasses.

The papers and posters presented on high-level waste glass indicated a mature understanding of glass corrosion processes. However, improved models are needed to predict long-term behavior under repository conditions. Significant work is being conducted in Europe to develop high-level waste glass compositions for immobilizing actinide-rich liquid waste arising from the reprocessing of the high burnup spent nuclear fuel.

Ceramic Waste Forms for Minor Actinides

There were a several presentations and posters focused on ceramic wasteforms for minor actinides. The papers and posters included discussions on zirconolite, hollandite, monazite, apatite, britholite, thorium phosphate diphosphate (β-TPD), and brabantite based ceramic wasteforms. X. Deschanels (Commissariat a l'Energie Atomique) presented characterization results for zirconolite wasteform containing 10 percent Pu-239. Presenter showed that the leaching in aqueous solution was similar to simulated samples and the irradiation damage caused by decay resulted in moderate swelling. PuO2 was added to simulate long-term α dose in wasteforms. Fabrication method and characterization of fabricated zirconilite wasteform pellets was discussed by F. Jorion (Commissariat a l'Energie Atomique, France). The data presented by F. Jorion (Commissariat a l'Energie Atomique, France) showed that Monazite and Brabantite wasteforms containing 10 percent Pu-239 could not maintain the Pu in the desired valance state. Results on Hollandite based wasteform, was presented by V. Aubin (LCAES, France), who showed that the atomic displacements occur in presence of external electron irradiation. N. Clavier (IPN, France) showed that the thorium phosphate diphosphate (β-TPD)

and monazite composite wasteform is a promising candidate for immobilizing trivalent and tetravalent actinides.

Advanced Fuel Cycles

Significant progress continues worldwide on the development of fuels for advanced fuel cycles. There were number of papers from Europe, United States, Japan, and other countries that discussed the scientific research in the area of advance fuel cycles. An invited paper presented by Mr. Buzz Savage of DOE titled "Impact of Partitioning and Transmutation on Repository Design" provided a rationale for the DOEs advanced fuel cycle initiative, including generation IV fuel cycle, in the United States. The rationale for the program was based on the limiting capacity of the potential Yucca Mountain repository to accommodate future spent nuclear fuel. J. Laidler (Argonne National Laboratory), G. Vandegrift (Argonne National Laboratory), E. Collins (Oak Ridge National Laboratory), D. Mullins (Las Alamos National Laboratory) and J. Law (Idaho National Environmental Engineering Laboratory) provided overviews of their programs on transmutation, partitioning, and separations technologies as a part of the DOE Advanced Fuel Cycle Initiative. Actinide separation is an important step in a closed nuclear fuel cycle. A large effort is underway worldwide to develop liquid extraction, electrochemical, and pyro chemical based technologies to support extraction processes for minor actinides. Papers were also presented on the development of advanced fuel targets for future nuclear cycles.

Visit to Research Center of Cadarache

The visit to Commissariat a l'Energie Atomique Research Center of Cadarache included a brief overview of the facility, followed by a walking tour of two research laboratories involved in the development and characterization of advanced nuclear fuels. Cadarache Research Center was established in 1959 and currently employs 4000 people.

The Atalante 2004 conference provided excellent opportunities to keep current with the worldwide advancements in nuclear fuel cycle programs including waste management, interact with scientists, particularly from Europe where a broader international joint effort nuclear fuel cycle continues to expand. The meeting helped staff to enhance awareness of issues facing the international community on the subject, and provided an opportunity to discuss our work with the international participants whose feedback on CNWRA/NRC work was valuable. Such interactions and acceptance by international experts enhances credibility of our work. Future participation in such conferences is recommended.

Attachments

Conference Program and list of attendees. A conference proceeding containing papers presented during the conference was published by the organizers and is available from the author upon request.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

On June 20–25, 2004 staff from the CNWRA, an NRC Contractor, attended the Atalante 2004 International Conference on Advances For Future Nuclear Fuel Cycles. The CNWRA staff made an oral presentation titled "Performance of Surrogate High-Level Waste Glass in the Presence of Iron Corrosion Products." The presentation included results of recent investigations on the effects of corrosion products on the dissolution of a surrogate high-level waste glass. The presentation also illustrated the use of risk information in assessing the importance of high-level waste glass and spent nuclear fuel to waste isolation in a potential geologic repository.

"ON THE MARGINS:"

None.

SIGNATURES:

Vijay Jain, Manager
Corrosion Science & Process Engineering

7/16/04
Date

CONCURRENCE:

Budhi Sagar
Technical Director

7/20/04
Date

ATTACHMENT

PROGRAM

> Monday, June 21, 2004

8:00 Registration

Opening Session

Chairman: Jacques BOUCHARD (CEA, France)
Co-chairman: Roland SCHENKEL (European Commission)

9:15 Welcome address — *Loïck MARTIN-DEIDIER (Director, Valrhô nuclear center, CEA, France)*
9:20 Welcome address — *Representative of the Languedoc-Roussillon Region Council, France*
9:30 Opening conference — *Luis ECHAVARRI (General Director, OECD/Nuclear Energy Agency)*

Invited speakers

10:00 Research at Cogema: benefits and a future outlook of the nuclear fuel cycle
F. PONCELET (R&D Vice-President, Cogema, France), H. MASSON (DRD - Cogema, France)

10:35 The needs of basic chemistry studies for nuclear waste management issues
R. GUILLAUMONT (Professor, Academy of Science, France)

11:10 Building the European Research Area in nuclear fission. Pioneering steps in actinide science
H. FORSSTRÖM (Head of nuclear Fission and Radiation Protection unit, DG Research, European Commission)

12:00 Lunch

Chairman: Patrick LEDERMANN (CEA, France)
Co-chairman: Buzz SAVAGE (DOE, USA)

13:15 Basic physics & materials science in actinides: status & future needs
G. LANDER (Director, Institute for Transuranium Elements, European Commission)

13:50 Actinide separative chemistry
B. BOULLIS (Head of Radiochemistry and processes department, CEA, France)

14:25 Impact of partitioning and transmutation on repository design
B. SAVAGE (Advanced Fuel Cycle Initiative Program Director, DOE, USA)

15:00 Coffee break

15:30 Modeling: what can be expected? State of the art, needs and priorities for further works
JP. DAUDEY (Research Director, CNRS, France)

16:05 Status of the fuel transmutation programs in Japan and France. Lessons drawn from the results
Y. ARAI (JAERI, Japan), S. PILLON (Fuel research department, CEA, France)

16:40 Vitrified waste. State of the art, needs and priorities for research
B. GRAMBOW (Professor, SUBATECH, France)

17:15 Migration of radionuclides. Needs and priorities for performance assessment
J. HADERMANN (Laboratory for waste management, Paul Scherrer Institute, Suisse)

17:50 Coffee break

18:00 - 19:00

19:30 Cocktail offered by the Mayor of Nimes

> Tuesday, June 22, 2004

Session 1 — Recycling processes

8:00 - 10:00 Overview

Chairman: *Thierry DUJARDIN (OECD)*
Co-chairman: *Jean-Michel DELBECQ (EDF)*

8:00 The U.S. Advanced Fuel Cycle Initiative: Development of Separations Technologies
J. J. Laidler (ANL, USA) and J. C. Bresee (DOE, USA)

8:20 IAEA Coordinated Studies on Minimization of Process Losses in Pyro-chemical Partitioning Methods with view to Minimize Environmental Impact
H. P. Nawada and K. Fukuda (IAEA)

8:40 Prospects and Progress Status of the Advanced Fuel Cycle System in Japan
T. Namba, H. Funasaka, Y. Nagaoki and Y. Sagayama (JNC, Japan)

9:00 BTC the UK Focus for Nuclear Fission R&D in the post NDA era
T. G. Rice and J.C. Carpenter (BNFL, UK)

9:20 CEA R&D Support to Generation IV Nuclear Energy Systems
F. Carré, P. Anzieu, P. Billot, P. Brossard, G-L. Fiorini (CEA, France)

9:40 A technico-economic methodology applied to radioactive waste management options. Application to the case of France
A. Le Dars, C. Loaëc, J.P Grouiller, B. Porzio, R.M. Macias, C. Courtois (CEA, France)

10:00 Coffee break

10:30 - 12:10 Aqueous processes

Chairman: *Bernard BOULLIS (CEA)*
Co-chairman: *Shigeo NOMURA (JNC)*

10:30 Designing and demonstration of the UREX+ Process Using Spent Nuclear Fuel
G. F. Vandegrift, M. C. Regalbuto, S. Aase, H. Arafat, A. Bakel, D. Bowers, J. P. Byrnes, M. A. Clark, J. W. Emery, J. R. Falkenberg, A. V. Gelis, C. Pereira, L. Hafenrichter, Y. Tsai, K. J. Quigley, and M. H. Vander Pol (ANL, USA)

10:50 Process Development for Minor Actinides Separation
P. Baron, C. Rostaing, M. Lecomte, B. Boullis, D. Warin (CEA, France)

11:10 First DIAMEX partitioning using genuine High Active Concentrate
D. Serrano-Purroy, B. Christiansen, R. Malmbeck, J. -P. Glatz, P. Baron, C. Madic (ITU Karlsruhe, Germany and CEA, France)

11:30 Research on PARC process for future reprocessing
T. Asakura, S. Hotoku, Y. Ban, M. Matsumura, S.-Y. Kim, H. Mineo and Y. Morita (Tokai Research Institute, Japan)

11:50 Hydrometallurgical Minor Actinide Separation in Hollow Fibre Modules
A. Geist, M. Weigl, K. Gompper (INE Karlsruhe, Germany)

12:15 Lunch

13:30 - 15:30 Aqueous processes (continued)
Chairman: *Graham FAIRALL*
Co-chairman: *Marie-Françoise DEBREUILLE (COGEMA)*

13:30 Recent Advances in the Development of a Cobalt Dicarbollide Based Solvent Extraction Process for the Separation of Cs and Sr from Spent Fuel
J. D. Law, T.A. Todd, D. R. Peterman, and R. S. Herbst (INEEL, USA)

13:50 Characteristics of high-pressure mixtures of CO_2-TBP-$UO_2(NO_3)_2$-HNO_3-H_2O for actinide extraction from solid matrices with supercritical fluid
K. Sawada (Nagoya University, Japan), T. Koyama (JNC, Japan), T. Shimada, Y. Mori (Mitsubishi, Japan)

14:10 Plutonium and neptunium stripping in single cycle solvent extraction flowsheets: recent progress in flowsheet testing
J. E. Birkett, M. Carrott, O. D. Fox, C.J. Maher, R J. Taylor (BNFL, UK)

14:30 Evaluation of uranyl nitrate crystallization for spent nuclear fuel separations
G. Jarvinen Don Mullins, M. Mayne, D. Ford, K. Long, H. Reichert, P. Palmer, C. Drew Tait, D. Webster Keogh, P. Gordon (LANL, USA)

14:50 Lanthanides(III)/Actinides(III) Separation by Nanofiltration-Complexation
A. Sorin, S. Pellet-Rostaing, A.. Favre-Réguillon (Université Claude Bernard, France), G. Bernier and M. Lemaire (CEA, France)

15:10 Evaluation of Actinide Partitioning and Transmutation in Light-Water Reactors (LWRs)
E.D. Collins and J-P Renier (ORNL, USA)

15:30 Coffee break

16:00 - 17:40 Dry processes
Chairman: *Tadashi INOUE (CRIEPI)*
Co-chairman: *James J. LAIDLER (ANL)*

16:00 Nuclear fuel cycle programs of Argonne's Chemical Engineering Division
M.A. Williamson, M.C. Regalbuto, W.L. Ebert and D. Lewis (ANL, USA)

16:20 Electroseparation of An using Al cathodes in LiCl-KCl
J. Serp, R. Malmbeck, C. Scheppler, J-P. Glatz (ITU, Karlsruhe, Germany)

16:40 Pyrochemical Separation at CEA: Current Results and Future R&D Program
J. Lacquement, S. Bourg, H. Boussier, O. Conocar, A. Laplace, L. Donnet, J. Duhamet (CEA, France)

17:00 Actinide, lanthanide and fission product speciation and electrochemistry in high and low temperature ionic liquids
A I. Bhatt, H. Kinoshita, A L. Koster, I. May, C A. Sharrad (University of Manchester, UK), V A. Volkovich (Ural State Technical University, Russia), O. D. Fox, C. J. Jones, B. G. Lewin (BNFL, UK), J. M. Charnock (CLRC Daresbury Laboratory, UK) and C. Hennig (ESRF, France)

17:20 Current status of development in dry pyroelectrochemical technology of SNF reprocessing
A.V. Bychkov, O.V. Skiba, M.V. Kormilitsyn (RIIAR, Russia)

17:40 **Invited speaker:** From APM to ATALANTE. Technical highlights of the Marcoule transformation between 1994 and 2000
N. Camarcat (CEA, France)

18:15 - 19:15 Poster session (with authors)

> Wednesday, June 23, 2004

Session 1 (continued) Recycling processes

8:00 - 10:00 Targets and fuels

Chairman: *Rob VERSLUIS (DOE)*
Co-chairman: *Philippe MARTIN (CEA)*

8:00 CEA and AREVA HTR fuel particles manufacturing and characterization R&D Program
F. Charollais, M. Perez, S. Fonquernie, C. Ablitzer, A. Duhart, C. Perrais, O. Dugne (CEA), P. Guillermier, G. Harbonnier (AREVA, France)

8:20 The FUTURIX transmutation experiment in Phenix
D. Warin, F. Sudreau, S. Pillon, N. Drin, L. Donnet, E. Brunon (CEA, France)

8:40 Modernization of SIC facility for fabrication of MOX fuel, vibropac fuel pins and BN-600 FA with weapon grade plutonium
O.V. Skiba, A.A. Mayorshin, A.V. Bychkov, V.A. Kisly, Y.F. Ovsyannikov, D.A. Bobrov, S.I. Mamontov, P.I. Davydov, E.A. Samosenko, A.R. Shalak (RIIAR, Russia)

9:00 FUJI - a comparative irradiation test with pellet, sphere-pac, and vipac fuel
Ch. Hellwig (PSI, Switzerland), K. Bakker (NRG, Netherlands), T. Ozawa and Y. Kihara (JNC, Japan)

9:20 Americium incineration by recycling in target rods using coated particles
A.Renard, B.Lance (BELGONUCLEAIRE), H.Bairiot (FEX, Belgium)

9:40 Oxide and nitride TRU-fuels: lessons drawn from the CONFIRM and FUTURE projects of the 5th European framework programme
S. Pillon (CEA, France), J. Wallenius (KTH, Sweden)

10:00 Coffee break

Session 2 Actinides and fission products basic physico-chemistry

10:30 - 11:50 Theoretical chemistry

Chairman: *A. Yu. TZIVADZE (IPC)*
Co-chairman: *Mireille DEFRANCESCHI (CEA)*

10:30 Actinyl electronic structure investigation using a combined theoretical and experimental approach
S. Hilaire, D. Guillaumont, F. Gutierrez (CEA, France), F. Wastin, E. Colineau, T. Gouder, J. Rebizant (ITU, Germany), E. Simoni (IPN Paris XI, France) and D. Meyer (CEA, France)

10:50 Speciation of 241Am through 237Np Mössbauer and 241Am XPS spectroscopy
S. Fouchard (CEA), T. Gouder, E. Colineau, F. Wastin, J. Rebizant (ITU, Germany), E. Simoni (IPN Paris XI, France) and D. Meyer (CEA, France)

11:10 Ab initio modelling of the behaviour of helium in americium and plutonium oxides
M. Freyss, T. Petit (CEA, France)

11:30 Actinides in molecules : exotic properties probed by X-ray Absorption Spectroscopy
C. Den Auwer, Ph. Moisy (CEA, France), E. Simoni (IPN Paris XI, France), S. D. Conradson (LANL, USA)

12:00 Lunch

13:15 - 15:15 Basic physico-chemistry

Chairman: *Gérard LANDER (ITU)*
Co-chairman: *Pierre TURQ (Université P. et M. Curie)*

13:15 Phase, Microstructure and Thermo-Physical Properties of U-Pu-Np-Am-Zr Bearing Alloys as Nuclear Transmutation Fuels
J R. Kennedy, D D. Keiser, M J. Lambregts, S M. Frank (ANL, USA)

13:35 Lanthanide and actinide inorganic complexes in natural waters. TRLIFS and ESI-MS studies
T. Vercouter, P. Vitorge, C. Moulin (CEA, France)

13:55 Four types of supramolecular organization of extractant molecules used in ion separation processes
Testard F., Zemb, Th.(CEA, France)

14:15 Thermodynamics Properties of Plutonium in NaCl-KCl and CaCl2 at 1073K and in Liquid Gallium
D. Lambertin, S. Ched'homme, G. Bourgès, L. Pescayre (CEA, France), S. Sanchez and G. Picard (CNRS, ENSCP, France)

14:35 Behavior of An(IV) hexachloro complexes (An = Np and Pu) in room temperature ionic liquids
S.I. Nikitenko (IPC, Russia), Ph. Moisy, C. Berthon and I. Bisel (CEA, France)

14:55 Electrochemistry of actinides in molten fluorides media
C. Hamel (CEA, France), P. Chamelot (Université Paul Sabatier, France), A. Laplace, J. Lacquement (CEA, France) and P. Taxil (Université Paul Sabatier, France)

15:15 Coffee break

15:45 - 17:25 Basic physico-chemistry (continued) — **Chairman:** *Dave LEWIS (ANL)*, **Co-chairman:** *Maurice LEROY (CEA)*

15:45 Colloidal silver iodide characterization within the framework of nuclear spent fuel dissolution
O. Bernard-Mozziconacci, J.L. Marignier, J. Belloni (Université Paris-Sud, France), F. Devisme (CEA, France)

16:05 Heterogeneous redox reactions for dissolution, isolation and quantitative analysis of long-lived fission products in the solutions of nuclear fuel cycle.
A. Maslennikov, V. Peretroukhine (IPC, Russia), B. Fourest, F. David (IPN, France), M. Masson, P. Moisy. and M. Lecomte (CEA, France)

16:25 Electrochemical Properties of Zirconium, Plutonium and Lanthanides in Fluoride Melts
R. Zakirov, V. Ignatiev (Kurchatov Institute Russia), V. Subbotin, A. Toropov (Institute of Technical Physics, Russia)

16:45 Synthesis and crystal structure determination of some polymetallic oxalates of UIV, Na, LnIII (Ln = Ce and Nd)
B. Chapelet (ENSC, France), S. Grandjean (CEA, France), G. Nowogrocki, F. Abraham (ENSC, France)

17:05 Kinetics and thermodynamics of the dissolution of $Th_{1-x}MxO_2$ solid solutions (M = U, Pu)
S. Hubert, G. Heisbourg, N. Dacheux (IPN, France), Ph. Moisy (CEA, France), J. Purans (Universita' di trento, Italia)

18:00 - 23:30 Entertainment evening and conference dinner

> Thursday, June 24, 2004

Session 3 — Waste management

8:30 - 10:10 Spent fuel — **Chairman:** *Patrick LANDAIS (ANDRA)*, **Co-chairman:** *Jean-Paul GLATZ (ITU)*

8:30 Electrochemical and microgravimetric corrosion studies on spent fuel provide relevant source term data for a repository performance assessment
D.H. Wegen, P.D. W. Bottomley, J-P Glatz (ITU, Germany)

8:50 Anticipated Evolution of Spent Nuclear Fuel in a Geological Disposal and Assessment of a Radionuclides Source-Term
C. Poinssot, C. Ferry, P. Lovera, C. Jegou (CEA, France), J-M. Gras (EDF, France)

9:10 He migration in implanted UO2 sintered disks
T. Sauvage, H. Labrim, P. Desgardin, M.F. Barthe, G. Blondiaux, J.P. Piron (CERI, France), P. Garcia, G. Carlot, S. Guilbert (CEA, France)

9:30 Effect of water alpha radiolysis on the Spent nuclear fuel UO2 matrix alteration
C. Jégou, B. Muzeau, V. Broudic, F. Jorion, and J.M. Bart (CEA, France)

9:50 Anticipated evolution of Spent Nuclear Fuel in long term dry storage and associated radionuclides source-term
C. Ferry , C. Poinssot, J-P Piron, L. Desgranges, C. Cappelaere (CEA, France), J-M. Gras (EDF, France)

10:10 Coffee break

10:40 - 12:40 **Matrices**
Chairman: *Robert GUILLAUMONT (Science Academy)*
Co-chairman: *Etienne VERNAZ (CEA)*

11:00 Cesium Release from Tungstate Waste Form Materials in Simulated Canister Corrosion Product Containing Solutions
V. Luca, E. Drabarek, C. S. Griffith, H. Chronis, and J. Foy (ANSTO, Australia)

11:20 Pu doped zirconolite for minor actinides containement
X. Deschanels, T. Advocat, F. Jorion, S. Peuget (CEA, France)

11:40 Formulating a low-alkalinity cement for radioactive waste repositories
C. Cau Dit Coumes (CEA-France), S. Courtois (Université Aix-Marseille II-France), S. Leclercq (EDF-France), X. Bourbon (ANDRA-France)

12:00 Study of monazite and brabantite for conditioning plutonium: synthesis, sintering and characterisation
B. Glorieux, J. P. Coutures, M. Matecki1, J. M. Montel (CNRS, France), F. Jorion, C. Maillard, P. Costes, T. Advocat, L. Donnet (CEA, France)

12:20 Operational modeling of the long-term behavior of vitrified waste packages
I. Ribet, S. Gin, N. Godon, Y. Minet, P. Jollivet, P. Frugier, E. Vernaz, J-M. Cavedon, V. Petitjean (CEA, France)

12:45 Lunch

14:00 - 15:40 **Matrices** (continued)
Chairman: *Hans RIOTTE (AEN)*
Co-chairman: *Francis LARCHE (Montpellier II University)*

14:00 The stability under irradiation of hollandite ceramics, specific radioactive cesium-host wasteforms
V. Aubin, A. Dannoux, D. Caurant, D. Gourier, N. Baffier (ENSCP, France), T. Charpentier, S. Esnouf, T. Advocat, J.M. Costantini (CEA, France), F. Studer (CRISMAT/ISRMA)

14:20 Performance of surrogate high-level waste glass in the presence of iron corrosion products
V. Jain and Y.-M. Pan (Center for Nuclear Waste Regulatory Analyses, USA)

14:40 Containment of Actinides in zirconolite CaZrTi2O7 and alpha irradiation resistance
T. Advocat, F. Jorion, X. Deschanels, S. Peuget, H. Rabiller, C. Jégou (CEA, France), J. M. Montel (CNRS, France), J. Chaumont (CSNSM, France)

15:00 Thorium phosphate - diphosphate / monazite based ceramics for the immobilization of actinides
N. Clavier, N. Dacheux (IPN, France), R. Podor (Université Nancy, France), P. Le Coustumer (Université de Bordeaux, France)

15:20 Atmospheric corrosion of the container during long term storage
S. Perrin, F. Mazaudier (CEA, France)

Closing Session

Chairman: Jacques BOUCHARD (CEA)
Panelists: Mike GOFF (ANL), Kiyoto AIZAWA (JNC), A. Yu. TZIVADZE (IPC), Jean-Paul GLATZ (ITU), Marie-Françoise DEBREUILLE (CEA)

15:40 - 16:30 Panel discussion : perspective for the future

16:30 End of the ATALANTE 2004 Conference

INTERNATIONAL CONFERENCE

ATALANTE 2004
ADVANCES FOR FUTURE NUCLEAR FUEL CYCLES

Nîmes, June 21-24, 2004

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