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ORNL
FOREIGN TRIP REPORT

ORNL/FTR-2903

DATE: June 24, 1988

SUBJECT: Report of Foreign Travel of E. C. Beahm, Chemical Development Section, Chemical Technology Division

TO: Alexander Zucker

FROM: E. C. Beahm

PURPOSE: To present two papers and chair two sessions at the Second Workshop on the Chemistry of Iodine in Reactor Safety, sponsored by the Committee on the Safety of Nuclear Installations of the Organization for Economic Cooperation and Development, and to present an invited paper at the Third Chemical Congress of North America.

SITES VISITED:

06/01/88	Darlington Nuclear Generating Station	New Castle, Ontario, Canada
06/2-3/88	Second Workshop on the Chemistry of Iodine in Reactor Safety	Toronto, Canada
06/06/88	Ontario Hydro	Toronto, Canada
06/6-8/88	Third Chemical Congress of North America	Toronto, Canada

ABSTRACT: The traveler visited the construction site of the four CANDU reactors Darlington generating station and participated in a lively workshop on iodine chemistry in reactor safety by presenting technical papers and chairing sessions. In addition, an invited paper entitled "Chemistry and Mass Transport of Iodine in Containment" was given at the Nuclear Reactor Severe Accident Chemistry Symposium of the Third Chemical Congress of North America.

DISCLAIMER

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POST-ACCIDENT FISSION PRODUCT CHEMISTRY

Report of Foreign Travel of E. C. Beahm to Canada

Foreign Trip Report

E. C. Beahm

June 24, 1988

L. K. Chan, Technical Program Monitor
Accident Evaluation Branch
Division of Reactor System Safety

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REPORT OF FOREIGN TRAVEL OF E. C. BEAHM

1. INTRODUCTION

1.1 SECOND CSNI WORKSHOP ON IODINE CHEMISTRY IN REACTOR SAFETY

The second Committee on the Safety of Nuclear Installations (CSNI) Workshop on Iodine Chemistry in Reactor Safety was held in Toronto, Ontario, Canada, on June 2 and 3 and was attended by ~40 iodine experts from 10 Organization for Economic Cooperation and Development (OECD) countries. The workshop was an effective forum for exchanging information on the behavior of iodine under power-reactor accident conditions.

1.2 ACE MEETING AT ONTARIO HYDRO

A planning meeting was held at Ontario Hydro Headquarters in Toronto on June 6, 1988, to discuss the proposed Aerosol Containment Experiment (ACE) program and its research support. The meeting was attended by personnel from Oak Ridge National Laboratory (ORNL), the Electric Power Research Institute (EPRI), the U.S. Nuclear Regulatory Commission (NRC), Hanford Engineering Development Laboratory (HEDL), Ontario Hydro, and Whiteshell Nuclear Research Establishment.

1.3 NUCLEAR REACTOR SEVERE ACCIDENT CHEMISTRY SYMPOSIUM

The second Nuclear Reactor Severe Accident Chemistry Symposium was held June 6–10, 1988, in Toronto. At this symposium, papers were presented covering all aspects of chemical effects in nuclear reactor accidents.

2. CSNI WORKSHOP ON IODINE CHEMISTRY IN REACTOR SAFETY

The workshop helped to identify existing weaknesses and current limitations; undoubtedly, information shared at this workshop and the ensuing stimulating discussions will help to guide the course of future research to resolve the remaining uncertainties.

Two papers presented at the workshop were prepared at ORNL by the traveler: "Aqueous Iodine at Low Concentrations and High Temperatures," S. R. Daish, E. C. Beahm, and W. E. Shockley (presented by S. R. Daish, a British attaché at ORNL) and "Iodine Behavior in Containment," E. C. Beahm, C. F. Weber, T. S. Kress, S. R. Daish, and W. E. Shockley (presented by E. C. Beahm and C. F. Weber). In addition, the traveler chaired two sessions at the meeting: "Thermodynamic Measurements" and "Revolatilization Studies."

The following is a preliminary summary of conclusions/recommendations generated by workshop session chairmen immediately following the meeting discussions.

On the subject of kinetics and mechanisms of iodine reactions in aqueous solutions, it was agreed that:

1. Oxidation of I^- to the I_2 and HOI states is now sufficiently understood, but more experimental studies are required to elucidate the mechanism of formation of the higher oxidation states.

2. Mechanistic studies at iodine concentrations below about 10^{-6} to 10^{-7} mol·dm^{-3} may not be appropriate because of the potential influence of undefined water impurities.

3. An evaluated kinetic data base (rate constants and activation energies) is required for relevant thermal and radiolytic reactions. It is recommended that a specialist group be set up initially to examine the feasibility of formulating such a data base. In this respect, it should be noted that an iodine thermodynamic data base compilation is in progress under the Organization for Economic Cooperation and Development/Nuclear Energy Agency program for radioactive waste management.

4. Additional studies are required to examine the effects of organic and inorganic impurities on the thermal and radiolytic reactions of iodine. Also, more studies are required to assess the effect of surfaces. Studies of the physical and chemical behavior of iodine species in the aqueous or gaseous phases, in contact with surfaces, should be undertaken. With respect to the latter, it was noted that detailed mechanistic studies would be too slow in addressing current needs; thus, scoping studies of an empirical nature are recommended initially.

5. There is now conclusive evidence that radiation field strengths of the order expected to be present in reactor accidents would not have an effect on the gas-phase decomposition of cesium iodide. Also, modeling studies of radiation-induced reactions in the gas phase, in moist air containing traces of iodine and methane, demonstrate conclusively that no significant amounts of organic iodides should form. The latter studies also indicate that radiation-induced iodine/oxygen reactions may suppress airborne iodine.

With respect to thermodynamic measurements, it was agreed that there is a need for heat capacity data beyond 100°C, for aqueous I_2, I_3^-, and OI^-. Such data are needed to calculate partition coefficients of iodine in steam-generator tube-rupture accidents and evaporation to dryness of water pools under severe accidents. In addition, the possibility of volatilization of I^-, through steam dissolution, should be examined. Studies of evaporation to dryness should attempt to (1) identify the volatilized products, (2) evaluate the phase relations at high borate concentrations, (3) measure the borate concentrations in the condensate, and (4) study the interaction of evaporating borate films with metal oxide surfaces.

Significant progress was noted on the development and validation of models/codes to predict the behavior of iodine in reactor accidents. Chemical knowledge generated by the underlying research programs is now being used in combination with physics and engineering variables to develop more realistic models/codes. The chemistry-physics-engineering mix varies extensively among the various models/codes being developed. The chemical detail required in such models/codes was discussed. It was concluded that the ultimate test of such models/codes was their validation. Progress in this direction has been slow because of the unavailability of the required facilities for such validations, but a number of such facilities are becoming available in the future [Radiation Test Facility (RTF); ACE; and PHEBUS, a French reactor simulation test] for this purpose.

Finally, there was unanimity among the iodine experts to recommend to the CSNI that a Third CSNI Workshop on Iodine Chemistry in Reactor Safety be convened, in about two to three years, to assess future progress.

The program for the workshop is given in Appendix B.

3. ACE PROGRAM MEETING

The meeting opened with comments by Bob Ritzman of EPRI on the status of foreign partners in the ACE program. He stated that the Soviet Union would like to participate; however, other partners have reservations about sharing reactor safety technology with the Soviet Union. France was cited as being in opposition to participation by the Soviet Union. Three European countries — France, Federal Republic of Germany, and Switzerland — are uncertain about what should be done on iodine-aerosol large-scale tests. Peter Hosemann (Switzerland) reportedly has requested a delay in iodine ACE program work. Ritzman said that EPRI would proceed with this work despite his request.

After Bob Ritzman's remarks, Tom Kress of ORNL gave a short presentation of a proposal for ACE support work to be carried out in the Chemical Technology Division at ORNL. The work proposed consisted of:

Technical support

1. participation in defining, designing, and interpreting large-scale ACE tests;

2. providing general expertise in iodine chemistry;

3. technical review and recommendations on analytical measurement techniques;

4. participation in ACE meetings, ACE code coordination activities, and complementary laboratory experiments;

5. chemical kinetics associated with iodine interacting with hygroscopic aerosols; and

6. thermochemical and physical interactions of iodine containing aerosols in the presence of a hydrogen burn.

Following the presentation by Tom Kress, Andy Vikis of Whiteshell Nuclear Research Establishment in Canada gave a presentation of their proposal for support work, which consisted of:

1. tests in their Radioiodine Test Facility,

2. bench-scale surface chemistry of organic iodide formation from painted surfaces,

3. hydrogen burns,

4. analytical support for large-scale ACE tests, and

5. posttest analysis.

There is obviously some overlap in the proposals from ORNL and from Whiteshell. Ritzman stated that he would support both proposals and that there was a general call for cooperation and frequent telephone contact to keep each other informed of progress.

4. NUCLEAR REACTOR SEVERE ACCIDENT CHEMISTRY SYMPOSIUM

This symposium began with an overview of chemical phenomena in severe nuclear reactor accidents given by A. P. Malinauskas, ORNL; D. A. Powers, Sandia National Laboratories; and J. L. Margrave, Rice University. This was followed by a panel discussion of Nuclear Reactor Severe Accident Chemistry and Academic Research. More than 50 technical papers were then presented covering many aspects of chemistry as applied to severe nuclear reactor accidents. The traveler presented an invited paper entitled "Chemistry and Mass Transport of Iodine in Containment" by E. C. Beahm, C. F. Weber, T. S. Kress, W. E. Shockley, and S. R. Daish. This presentation was about the "TRENDS" computer code, developed at ORNL to described the behavior of iodine in containment during severe accidents. Discussion following this talk centered on the reduction of pH by nitric acid formed by irradiation of water-air. Experimental data on this were given in the presentation, and some symposium participants had not realized the importance in nitric acid formation in controlling pH and indirectly influencing the formation of volatile iodine species. Appendix C gives the program for this symposium.

5. SUMMARY EVALUATION

The OECD iodine workshop provided a good forum for presenting the results of iodine work done at ORNL, and also subcontract work by Science

Applications International Corporation, Idaho Falls, on the behavior of iodine at very low tracer concentrations. The summary conclusion from this workshop, which states that mechanistic studies at these low iodine concentrations may not be appropriate because of tracer effects, is very significant. It means that it is not possible to predict the behavior of iodine at tracer concentrations based on observations at high iodine concentrations. Anomalous behavior of iodine at very low concentrations has been observed by many investigators. The clear indication from this workshop and from earlier investigators is that the only effective way to evaluate iodine at tracer concentrations is to study it directly in the conditions and systems of interest.

All of the discussions at the iodine workshop, at Ontario Hydro, and at the Symposium on Chemistry in Severe Nuclear Reactor Accidents provided a unique opportunity to interact and exchange ideas with fission product chemists from around the world.

APPENDIX A

TRIP ITINERARY

May 31, 1988	Leave Oak Ridge, Tennessee
June 1, 1988	Tour Darlington Nuclear Generating Station, New Castle, Ontario, Canada
June 2–3, 1988	Second Workshop on the Chemistry of Iodine in Reactor Safety
June 4–5, 1988	Weekend
June 6, 1988	ACE meeting at Ontario Hydro
June 6–8, 1988	Third Chemical Congress of North America
June 9, 1988	Travel from Toronto, Ontario Canada, to Oak Ridge

APPENDIX B

SECOND CSNI WORKSHOP ON IODINE CHEMISTRY IN REACTOR SAFETY
Toronto, Canada
1988 June 2&3

PRELIMINARY PROGRAM

Wednesday, 1988 June 1

13:00 Depart from Holiday Inn for two-hour tour of Darlington NGS

14:00 Tour of Darlington

16:00 Depart Darlington NGS for Holiday Inn

Thursday, 1988 June 2

09:00 Introductions and Welcome

I. KINETICS AND MECHANISMS
Chairman: P.E. Potter and K. Ishigure

9:30 KINETICS OF IODINE HYDROLYSIS IN UNBUFFERED SOLUTIONS, Donald A. Palmer and Leslie J. Lyons, Oak Ridge National Laboratory, U.S.A.

10:00 RADIOLYTIC AND SURFACE REACTIONS OF DILUTE IODINE SOLUTIONS, W.G. Burns, M.C. Kent, W.R. Marsh, P.E. Potter and H.E. Simmons, Chemistry Division, Harwell Laboratory, U.K.

10:30 Coffee Break

10:45 "FACTORS AFFECTING RADIOLYSIS OF DILUTE IODINE SOLUTIONS", K. Ishigure and H. Shiraishi, Department of Nuclear Engineering, University of Tokyo, JAPAN.

11:15 THE RADIATION-INDUCED FORMATION OF IODOALKANES AND THE RADIOLYSIS OF IODOMETHANE, J. Paquette and B.L. Ford, Research Chemistry Branch, Atomic Energy Of Canada, CANADA

11:45 AQUEOUS IODINE AT LOW CONCENTRATIONS AND HIGH TEMPERATURES, S.R. Daish, E.C. Beahm and W.E. Shockley, Chemical Technology Division, Oak Ridge National Laboratory, U.S.A.

12:15 AN EXPERIMENTAL STUDY OF RADIOIODINE VOLATILITY, G.J. Evan and R.E. Jervis, University of Toronto, CANADA.

12:45 Lunch Break

14:00 **THE INFLUENCE OF RADIATION ON THE STABILITY OF CSI IN FLOWING STEAM,** D.J. Wren, R.K. Rondeau and M. Pellow, Atomic Energy Of Canada, CANADA

14:30 **DISCUSSIONS AND SUMMARY OF SESSION I**

15:00 *Coffee Break*

II. THERMODYNAMIC MEASUREMENTS
Chairman: E.C. Beahm

15:30 **ON THE EXISTENCE OF IODIDE BORATE COMPLEXES IN SATURATED STEAM,** D.J. Turner, Technology Planning and Research Division, Central Electricity Generating Board, U.K.

16:00 **IODINE DISPROPORTIONATION EQUILIBRIA UP TO 300°C,** P.P.S. Saluja, Research Chemistry Branch, Atomic Energy Of Canada, CANADA.

III. REVOLATILIZATION STUDIES
Chairman: E.C. Beahm

16:30 **IODINE VOLATILITY FROM EVAPORATING PRIMARY COOLANT FILMS IN STEAM ATMOSPHERES,** B.J. Handy, R&D Chemistry Department, National Nuclear Corporation Limited, U.K.

17:00 **REVOLATILIZATION OF FISSION PRODUCTS, ESPECIALLY IODINE, FROM WATER PHASES EVAPORATING TO DRYNESS,** M. Furrer and T. Bühler Gloor, Paul Scherre Institute, SWITZERLAND

17:30 **DISCUSSIONS AND SUMMARY OF SESSIONS II & III**

18:00 *End of Day One*

RECEPTION AND DINNER (Time and Place to be Announced)

Friday, 1988 June 3

IV. MODEL/CODE DEVELOPMENT
Chairman: K.H. Neeb

09:00 COMPUTER MODELLING OF THE RADIATION CHEMISTRY OF AQUEOUS IODIDE SOLUTIONS IN LABORATORY CONDITIONS AND IN A PWR LOCA USING THE FACSIMILE COMPUTER PROGRAM, W.G. Burns and H.E. Sims, Chemistry Division, Harwell Laboratory, U.K.

09:30 MODELLING THE BEHAVIOR OF IODINE, J. Paquette, Research Chemistry Branch, Atomic Energy Of Canada, CANADA.

10:00 RADIOLYSIS OF IODINE IN MOIST AIR: A COMPUTER STUDY, N.H. Sagert, Research Chemistry Branch, Atomic Energy Of Canada, CANADA.

10:30 *Coffee Break*

11:00 IODINE BEHAVIOR IN CONTAINMENT, E.C. Beahm, C.F. Weber, T.S. Kress, S.R. Daish and W.E. Shockley, Chemical Technology Division, Oak Ridge National Laboratory, U.S.A.

11:30 DISCUSSION AND SUMMARY OF SESSION IV

12:00 *Lunch Break*

V. LARGE-SCALE TESTS
Chairman: M. Furrer

13:30 MEASUREMENTS OF RADIOIODIDINE SPECIES IN SAMPLES OF PRESSURIZED WATER REACTOR COOLANT, Paul G. Viollequé, Utility Services Operation, Science Applications International Corporation, U.S.A.

14:00 A DESCRIPTION OF THE RADIOIODINE TEST FACILITY (RTF) AND RESULTS OF INITIAL RTF FULL-SYSTEM TESTS, W.C.H. Kupferschmidt, R. Portman and G.G. Sanipelli, Research Chemistry Branch, Atomic Energy Of Canada, CANADA.

14:30 TO BE ANNOUNCED

15:00 DISCUSSION AND SUMMARY OF SESSION V

15:30 *End of Workshop*

15:45 WORKSHOP SUMMARY/RECOMMENDATIONS TO CSNI, Session Chairmen

APPENDIX C

Nuclear Reactor Severe Accident Chemistry Symposium I -- Tuesday AM

S. J. Niemczyk (Gull Associates), Session Chair

9:00 Opening Remarks

9:15 Chemical Considerations in Severe Accident Analysis -- A. P. Malinauskas

9:45 Chemical Phenomena Under Severe Accident Conditions -- D. A. Powers

10:15 Break

10:45 Workshop on Chemcial Processes and Products in Severe Accident Accidents -- J. L. Margrave

11:10 Nuclear Reactor Severe Accident Chemistry and Academic Research: A Panel Discussion -- S. J. Niemczyk, J. L. Margrave, D. R. Olander, and D. A. Powers

Nuclear Reactor Severe Accident Chemistry Symposium II - Tuesday PM

A. L. Nichols (United Kingdom Atomic Energy Authority, Atomic Energy Establishment - Winfrith), Session Chair

1:30 An Overview of Separate Effects Tests and Their Contributions to Severe Accident Chemistry -- A. Taig

2:00 Mass Spectrometry Studies of Fission Product Behavior I -- I. Johnson and C. E. Johnson

2:20 Mass Spectrometry Studies of Fission Product Behavior II. Gas Species -- P. E. Blackburn and C. E. Johnson

2:40 The System CsOH-H_2O -- L. G. Johansson and S. Kasikowski

3:00 Break

3:20 The Chemistry of Tellurium for the Analysis of Severe Accidents in Water Cooled Nuclear Reactors -- P. E. Potter

3:40 Possibility of Formation of Organic Telluride Under Reactor Accident Condition--An Experimental Approach -- H. Shiraishi and K. Ishigure

4:00 The Interaction and Resuspension of Fission Products in Severe Reactor Accidents -- A. M. Beard, B. R. Bowsher, S. Dickinson, A. L. Nichols

4:20 Chemical Reactions in LWR Reactor Vessels During Core Melt Accidents Analyzed with the CELSOL Computer Code -- L. Schepper and U. S. Jensen

4:40 Dissolution of Uranium Dioxide by Molten Dioxide -- K. T. Kim and D. R. Olander

5:00 Fission Product Migration in UO_2 Fuel -- F. Osaisai, S. G. Prussin, and D. R. Olander

Nuclear Reactor Severe Accident Chemistry Symposium III - Tuesday Evening

D. J. Osetek (Idaho National Engineering Laboratory--INEL), Session Chair

7:30 The Influence of Chemistry on Severe Accident Phenomena in Integral Tests -- R. R. Hobbins, D. J. Osetek and D. L. Hagrman

8:00 Chemistry Models in the Victoria Code -- A. J. Grimley III

8:20 Computer Code Validation by High Temperature Chemistry -- C. A. Alexander and J. S. Ogden

8:40 Fission Product Behavior During the In-Pile Severe Fuel Damage Test SFD 1-4 -- K. Vinjamuri, D. J. Osetek and D. H. Meikrantz

9:00 Fuel Behavior Questions Raised by TMI-2 -- R. R. Hobbins and S. Langer

9:20 Gamma Ray Emission Tomography Examinations of TMI-2 Fuel Debris -- D. W. Akers, H. Makowitz, J. K. Hartwell and R. R. Hobbins

9:40 Verification of the ORIGEN2 Code Analysis for the TMI-2 Reactor Code -- D. W. Akers and B. G. Schnitzler

10:00 Different Options in Purification of Polluted Water Volumes -- A. Kostyrko

Nuclear Reactor Severe Accident Chemistry Symposium IV - Wednesday AM

F. Garisto (Atomic Energy of Canada Limited, Whiteshell Nuclear Research Establishment--AECL-WNRE), Session Chair

8:30 Vibrational Fundamentals and Thermodynamic Functions of Molecular Boric Acid: A Re-Evaluation of the CsI + H_3BO_3 Reaction -- S. Dickinson, J. S. Ogden, N. A. Young

8:50 The Influence of Radiation on the Stability of CsI in Flowing Steam -- D. J. Wren, R. K. Rondeau and M. Pellow

9:10 Radiolytic Effect on the Chemical State of Iodine in Aqueous Solution -- H. Shiraishi, T. Kimiya, M. Ohmae and K. Ishigure

9:30 Iodine Speciation and Volatility in Relation to Accidental Releases from Nuclear Reactor Accidents -- G. J. Evans and R. E. Jervis

9:50 Break

10:10 Influence of Metal'ic Silver and Oxygen on the Radiolysis of Cesium Iodide Solutions -- M. Furrer and T. Gloor

10:30 The Radiation-Induced Formation of Organic Iodides -- J. Paquette and B. L. Ford

10:50 Panel Discussion: Status and Understanding of RCS Chemistry, Including an Assessment of Outstanding Issues. -- P. C. Potter, R. R. Hobbins, A. R. Taig and D. J. Wren

Nuclear Reactor Severe Accident Chemistry Symposium V - Wednesday PM

D. J. Wren (Atomic Energy of Canada Limited, Whiteshell Nuclear Research Establishment--AECL-WNRE), Session Chair

1:30 Chemistry and Mass Transport of Iodine in Containment -- E. C. Beahm, C. F. Weber, T. S. Kress, W. E. Shockley and S. R. Daish

2:00 Iodine Revolatilization from Sumps in Annuli and Auxiliary Buildings Formed After A Severe Accident - G.-U. Greger, A. Bleier, and K. H. Neeb

2:20 Carry-Over of Fission Products By Droplets During Sumpwater Evaporation in Severe Reactor Accidents -- R. Richter, O. Fernholz, R. Rippel, A. Bleier and K. H. Neeb

2:40 Long Term Post Accident Chemistry in Source Term Analysis -- P. N. Clough and J. R. Mullins

3:00 Break

3:20 The Effect of Selected Binary and Mixed Solutions on Steam Condensation and Aerosol Behavior in the Containment -- J. Jokiniemi

3:40 Validation of Ice Condenser Scrubbing Models -- P. C. Owczarski and W. K. Winegardner

4:00 The Effects of Contaminants on the Performance of TEDA Impregnated Charcoal for Removing CH_3I -- J. C. Wren and C. J. Moore

Nuclear Reactor Severe Accident Chemistry Symposium VI - Thursday AM

M. Jankowski (International Atomic Energy Agency--IAEA), Session Chair

8:00 N Reactor Severe Accident Chemistry -- P. C. Owczarski

8:30 Interactions of Radionuclides Released from the Chernobyl Core -- I. Khodakovsky

9:00 Carburization as a Mechanism for the Release of Radionuclides During the Chernobyl Accident -- D. A. Powers

9:20 UO_2 Oxidation Behavior and Chernobyl Fission Product Release -- C. E. L. Hunt, F. C. Iglesias, and D. S. Cox

9:40 Examination on Graphite Burning in High Temperature Gas Cooled Reactors -- R. Moormann

10:00 Break

10:20 Chemical Aspecrs of Core Heat-Up Accidents in High-Temperature Gas Cooled Reactors -- R. Moormann

10:40 Possible Mo Fractionation from Ru in Severe Reactor Accidents -- K. S. Venkateswarlu and S. R. Bhardwaj

11:00 Characteristics of the Chernobyl Release and Fallout of Potential Generic Interest to Severe Accident Analysis -- L. Devell

11:20 Analysis of Fine Debris Released from Chernobyl-4 -- R. J. C. Dunn, K. D. Horton, A. F. Kingsley, A. L. Nichols, G. C. Allen, and K. R. Hallam

Nuclear Reactor Severe Accident Chemistry Symposium VII - Thursday PM

S. K. Loyalka (University of Missouri-Columbia), Session Chair

1:30 An Overview of In-Vessel Release and Chemistry Modelling in Severe Accident Analysis Codes -- A. J. Grimley III

2:00 Modelling of Chemistry in the Reactor Coolant System Under Severe Accident Conditions -- P. N. Clough and C. J. Wheatley

2:30 A Survey of Chemistry Uncertainties in Severe Accident Containment Analysis -- K. D. Bergeron

3:00 Break

3:20 Effects of Ex-Plant Chemistry on Nuclear Reactor Severe Accident Consequences -- S. J. Niemczyk

3:50 The Efficient Calculation of Chemical Interactions in the Primary Circuit of an LWR During A Severe Accident -- C. J. Wheatley

4:10 Formulation of Radiological Releases to Containment for the Design Basis and Beyond the Design Basis Accidents -- N. Nourbakhsh, M. Khatib-Rahbar, R. Davis and J. Read

4:30 Continuous Modelling of Chemical Reactions During Severe Accident Conditions Using Chemical Thermodynamics -- R. M. Alenljung and L.-G. Johansson

Nuclear Reactor Severe Accident Chemistry Symposium VIII - Friday AM

W. Tarbell (Sandia National Laboratories), Chair

8:00 FRG Perspective on Severe Accident Phenomena -- E. F. Hicken, E. J. Kersting, and J. Rohde

8:30 Some Uncertainties in Radionuclide Releases During Core-Concrete Interactions -- D. C. Williams and D. A. Powers

8:50 Fission Product Release from Core-Concrete Mixtures -- M. F. Roche, J. L. Settle, L. Leibowitz, and C. E. Johnson

9:10 The Release of Chemical Species During Core Debris-Concrete Interactions -- M. A. Mignanelli, P. E. Potter and P. N. Smith

9:30 Behavior of Concretes/Liquid Metals Under High Thermal Loads in Reactive Chemical Environments -- J. L. Margrave, G. P. Hansen and R. H. Hauge

9:50 Break

10:10 Gas Solubility in Molten Core Debris -- D. A. Powers

10:30 Hydrogen Generation During Fuel-Coolant Interactions: Results from the FITS-D Series -- B. W. Marshall, Jr.

10:50 Panel Discussion: What Are the Most Important Severe Accident Chemistry Topics Deserving Further Consideration? -- K. D. Bergeron, C. Alexander, A. P. Malinauskas and A. L. Nichols

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