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CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Fifth Workshop of DECOVALEX (20-5704-039)

DATE/PLACE: Paris, France, October 17-21, 1994

AUTHOR: Mikko P. Ahola

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TRIP REPORT

SUBJECT: Fifth Workshop of DECOVALEX (20-5704-039)

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AUTHOR: Mikko P. Ahola

PERSONS PRESENT: Attendance was 43 persons from the international scientific community including M. Ahola from the Center for Nuclear Waste Regulatory Analyses (CNWRA) and J. Philip from the Nuclear Regulatory Commission (NRC)

BACKGROUND AND PURPOSE OF TRIP:

DECOVALEX was organized by the Swedish Nuclear Power Inspectorate (SKI) to increase the understanding of coupled thermal-hydrologic-mechanical (THM) processes applied to the underground disposal and isolation of high-level nuclear waste (HLW). The primary objective of the DECOVALEX study is to validate coupled THM models which are believed to be important to the licensing of a HLW repository, through numerical analysis of benchmark (BMT) problems and controlled laboratory and field experimental test cases (TC) using various computer codes. Presently, nine international organizations have joined DECOVALEX as Funding Organizations. Each Funding Organization is a managing organization in radioactive waste disposal and supports one or more Research Teams. The tasks of the Research Teams are to propose BMT and TC problems and/or conduct analyses/experiments on BMT or TC problems approved by the DECOVALEX Steering Committee and report their results to their sponsoring Funding Organization and the DECOVALEX Project Secretariat. Results from the various Research Teams are compiled by the Project Secretariat and a final report is published for each phase of DECOVALEX through SKI. Workshops are also held periodically to allow presentation and discussion of results among the different Research Teams and Funding Organizations.

DECOVALEX Phases I and II are complete. A final SKI report for the Phase I study was published in June, 1993 and the final SKI report for the Phase II study is in the process of being published. Phase III of DECOVALEX is currently ongoing and involves experimental and modeling studies for five additional TC problems. The NRC/CNWRA team has proposed one of the five TC problems, the Direct Shear-Flow Experiment (TC5). This experiment involves both normal and direct shear load testing of a single, natural welded tuff joint in which the joint itself is in a fully saturated state. The intent is to measure the saturated hydraulic conductivity of the joint and determine the effect of normal and shear deformation on the fracture flow behavior. The computer code ABAQUS will be used by the CNWRA to model this experiment. In addition, the CNWRA is using ABAQUS to model the Big-Ben Experiment (TC3) as proposed by the Japanese Research Team.

The purpose of this trip by the CNWRA and NRC staffs was to attend the fifth DECOVALEX workshop hosted by ANDRA and to present both experimental results for the Direct Shear-Flow Test (TC5) and the final numerical modeling results for the Big-Ben Experiment (TC3). The agenda for the workshop and the technical tour of the French low-level radioactive disposal site (Centre de l'Aube) is given in attachment A. A list of participants who attended the workshop is provided in attachment B.

SUMMARY OF PERTINENT POINTS:

The workshop was hosted by ANDRA, France and took place at INSTN (Institute of Nuclear Science and Technology) in Saclay. Following the opening remarks, detailed presentations were made on each of the five Test Case problems of the Phase III study.

Test Case 2 (TC2) (Fanay-Augéres Field Test) A. Thoraval (INERIS) presented results using the distinct element code 3DEC for this TMH problem. He concluded that 3DEC somewhat overestimated the temperatures near the heat source and some monitoring points. He then presented a modification of the coupled thermo-mechanical calculation sequence which he felt would be able to reduce the overestimation.

L. Börgesson (Clay Technology) gave a presentation on his results for TC2 problem using the three dimensional finite element (FEM) code ABAQUS. He modeled the rock using elastic solid elements and the fractures by thin solid elements (13 cm thickness) which were assigned a Drucker-Prager material model. The use of the Drucker-Prager material model for the thin solid elements simulating the fractures allowed for the capability of dilation to occur along these zones as a result of shear deformation due to the thermal expansion of the heated rock mass. ABAQUS currently does not have the capability to simulate joint dilation using its own explicit fracture elements. L. Börgesson presented a sensitivity analysis for calculations with and without fractures, including temperature distributions, rock expansion, strain at the floor of the test room, vertical heave of the floor, and fracture opening. Based on continuum modeling, he concluded that the difference between the results with and without fractures was not that substantial for this particular experiment.

Test Case 3 (TC3) (Big-Ben Experiment) A. Kobayashi (KPH) gave a short presentation on modeling of the TC3 problem using the THAMES code. He discussed the governing equations, relationship between the hydraulic diffusivity and volumetric water content, modeling method and results of the swelling pressure, water content, temperature distribution, water movement due to hydraulic and temperature gradients, and stress distribution. This was followed by a presentation by M. Ahola (CNWRA) on the modeling results using ABAQUS for the TC3 problem. He presented both the modeling approach and results. He indicated that some difficulties with convergence were encountered during the calculation.

T. Fujita (PNC) then summarized the overall outcome of modeling of the TC3 problem. He concluded that the calculations so far were in agreement with the measured results, however, some discrepancies existed in the water content and stress distribution. Some disagreement may be due to the fact that the thermally driven flow was considered in the calculations in both the KPH and Clay Technology models, but not in the CNWRA model. He stressed that the effective stress and swelling pressure phenomena should be studied further. During the closing discussions, T. Fujita stated that upon completion and disassembly of the experiment, no cracking was visible in the bentonite buffer. He also pointed out that the discrepancies in the water content results could be due to variations in the compaction of the bentonite affecting the initial porosity.

Test Case 4 (TC4) (Triaxial Stress-Flow Test) J. Pöllä (VTT) presented experimental results of coupled normal stress-axial flow through a single rock joint within their MTS triaxial testing frame. A number of tests were conducted using samples collected from the Kuru granite in Finland. These tests included samples having both natural fractures as well as artificially induced fractures. Results were presented for the confining pressure versus normal strain, pore pressure, mechanical aperture versus hydraulic aperture, hydraulic aperture versus mechanical closure, and hydraulic conductivity versus normal stress. A recommendation was made that future testing be conducted over a wider range of normal loadings to capture the full nonlinear response of the joint under normal deformation. Also, C-F. Tsang commented that better characterization of the joint roughness be conducted. At this time, no numerical modeling is being conducted for this experiment. O. Stephansson pointed out that the full definition of TC4 be prepared so that other research teams could conduct numerical modeling of the experiments.

Test Case 5 (TC5) (Direct Shear-Flow Test) M. Ahola (CNWRA) presented the last set of experimental results for TC5, which consisted of the effect of shearing on the coupled hydro-mechanical response of a single, natural, welded tuff rock joint. The experiment was conducted in the CNWRA's direct shear apparatus modified to include hydrologic flow within the rock joint. Results were presented for the normal stress versus joint closure and pressure drop, shear stress versus shear displacement, and normal displacement and pressure drop versus shear displacement. He pointed out that a significant amount of gouge material was present in the joint at the completion of the experiment, which consisted of shearing the top joint block 25 mm and then returning it back to its initial position under constant normal stresses of 2.0, 4.0, and 5.0 MPa. The experimental results under the normal stress of 2.0 MPa showed that the hydraulic conductivity increases during the forward shear displacement of 25 mm, while it decreases during the reverse shear cycle. The increase in the forward direction is attributed to the joint dilation during shear, while the more substantial decrease in the reverse direction is likely due to the accumulated gouge formation restricting the fracture flow. The coupled shear-flow experiments at normal stress levels of 4.0 and 5.0 MPa were less successful due to fluid leakage that occurred during these tests.

Y. Ohnishi (KPH) presented his continuing development of a constitutive rock joint model in order to model this test case problem. This new model is being developed to simulate the damage of asperities when opposing joint surfaces are in contact using digitized roughness profiles. Some preliminary results were presented from the model for normal and shear deformation. In future development, the scale effect, fluid flow, large scale undulation and the base length for characterizing the roughness would be considered.

A copy of the specifications for this Test Case 5 problem was also given to S. Nguyen (AECB) who expressed an interest in possibly modeling the direct shear-flow experiment using his finite element code FRACON. He has built fracture flow elements into the code and is planning on updating his joint constitutive model to account for the formation of gouge material during joint shear deformation.

Test Case 6 (TC6) (Borehole Injection Test) J. Rutqvist (KTH) summarized the experimental results of this borehole injection test which consisted of three separate tests: i) pulse test, ii) hydraulic jacking test, and iii) constant pressure test. He analyzed the problem using the finite element code ROCMAS, and showed through sensitivity analyses that the initial normal stiffness and initial hydraulic aperture appeared to be the most important parameters in the experiment.

S. Nguyen (AECB) presented final results for TC6 using his FEM code FRACON. He presented the FEM mesh, element types for the solid rock and fractures, boundary conditions, input parameters, and models for hydraulic aperture and normal stress-normal displacement relations. He presented results for the

pressure versus time for the pulse test, pressure versus flow rate for the hydraulic jacking test, and flow rate versus time for the constant pressure test. The numerical results from FRACON compared surprisingly well with the experimental results.

K. Khair (AECL) presented his preliminary numerical modeling results of TC6 using the 3D FEM code MOTIF. At present, he had not been able to obtain good agreement with the experimental results, and stated that this was in part due to the fact that their were many parameters that had to be set in the model, the values of some of which were not adequately known. He also indicated that some of the problems could be due to the coarseness of his FEM mesh and that he would refine his mesh for the final analysis.

It was concluded in the summary/discussion of the Phase III work that additional work is needed on the applicability of the effective stress principle to unsaturated media with low water content, thermal effect on moisture content in the material close to the heat source, importance of the design of heaters to the overall thermal behavior, shear damage (gouge material) effect in joints, and additional laboratory experiments on the unsaturated buffer material behavior.

Discussions then continued on the details and schedule for the completion of the final report of Phase III. The list of persons in charge of each chapter of the Phase III final report and the schedule are given in attachment C. The DECOVALEX book project was also discussed, with each of the principal authors giving a brief summary of the coauthors selected and the suggested content of each chapter. Helpful input was provided by the Secretariat and the workshop participants about the contents of the individual chapters. The schedule is to have the authors submit first drafts of each chapter by February 15, 1995 to the editors for format checking and internal review. A second draft of the book is scheduled to be ready for the March 27-29, 1995 DECOVALEX workshop to be held in Washington, DC.

Both F. Plas and L. Dewiere (ANDRA) were given the formidable task to present their views on the lessons learned and conclusions drawn from Phases I, II, and III of DECOVALEX. Regarding the TCs dealing with single fracture behavior, F. Plas stated that the modeling results did not match very well with the experimental results, and that the validity of classical joint models implemented in the codes be further investigated. For the far-field BMTs in DECOVALEX, F. Plas stated that: i) the hydraulic results were clearly divergent, ii) differences in results were difficult to explain, iii) the pertinence of comparison was not clear, iv) it is difficult to characterize fracture sets, v) no confidence could be achieved in the far-field H-M modeling, and vi) possibility of more in situ experiments should be considered. For the near-field BMTs and TCs, F. Plas stated that: i) a relatively fair agreement between the experimental and numerical results was obtained, ii) a relative coherence between the results from different approaches and models was achieved, iii) the discrete element modeling was limited by its capability in handling large number of fractures, iv) a relative confidence on T-H-M coupling was obtained, v) a relatively good capability to characterize fracture sets might be achieved, and vi) the phenomena were attainable within the time scale for the experiments.

Two proposals were presented for the continuation of DECOVALEX beyond the Phase III study. The first was given by T. Ireland (NIREX) and A. Herbert (AEA). They proposed that the DECOVALEX project in the next phase should carry out predictive modeling activities associated with the shaft sinking by NIREX at Sellafield. Results of the predictive modeling could be compared with actual observations. This experiment would consider only H-M coupling in a saturated environment. Site characterization data obtained through borehole drilling and the conceptual models of the groundwater system were presented. The second proposal was given by T. Fujita (PNC), which consisted of a large underground T-H-M experiment in the Japanese Kamaishi Mine. The rock mass is composed of a granodiorite. The

experimental setup would be similar to the Big-Ben experiment, except that the experiment would be conducted in a natural host rock. Water would be injected from small boreholes drilled around the larger borehole containing the heater, overpack, and the clay buffer. The current proposals for each of these two experiments are available from the author of this trip report. During the DECOVALEX steering committee meeting, task force groups were formed to make more detailed review of the existing data and project plans of these two proposed Test Case problems, and to supply suggestions for additional measurements, laboratory tests, and parameter identifications with the objective of making the final proposals ready by the March 27-29, 1995 DECOVALEX workshop in Washington, DC. Both M. Ahola (CNWRA) and J. Philip (NRC) volunteered to be members of these task force groups.

SUMMARY OF TECHNICAL VISIT:

A technical visit was made to the Centre de l'Aube which is a low-level radioactive waste disposal site constructed and currently in operation by ANDRA. The total waste disposal capacity of the facility will be 1,000,000 m^3, enough for at least 30 years of short-lived low and medium level radioactive waste generated in France. In this near-surface disposal facility, waste packages are placed in large concrete vaults, which are covered by movable buildings during loading operations. After each layer of waste packages (i.e., drums) has been placed into the concrete disposal vault, the vault is stabilized by filling up the spaces between waste packages with concrete or gravel. When the disposal vault is finally filled with waste packages, it is covered with a concrete slab and sealed with a polyurethane coating. The movable building is then relocated on rails over to the next concrete disposal vault to be filled. As disposal vaults are filled and sealed, the space between the rows of vaults is backfilled with earth. In the end, a final cap made of multiple layers of clay, bitumen, draining layers and seeded top soil is placed on top of the disposal vaults in such a manner that the rainwater is shed to either side of the rows of disposal vaults.

The effectiveness of the waste isolation system is verified by a network of galleries underlying the disposal vaults. Separate piping in the galleries collect rainwater from empty disposal vaults (i.e., those not yet utilized), and any infiltrated water from full disposal vaults. The gallery is efficient in that leaks in the disposal cap, signaled by the presence of infiltration of water, can be pinpointed and repaired. Infiltrated water would be monitored for radioactivity and processed if necessary. The site was selected due to the favorable conditions in the region having a gently sloping, permeable sand formation on top of an impermeable clay formation of about 30 meters thick. The clay formation prevents surface water from reaching the subterranean water table, while the sand formation, which forms the base of the disposal vaults, filters rainwater from the site and drains it to a single stream outlet, where it can be easily monitored for radioactivity. After a period of 300 years, the radioactivity would be gone, and the site would be available for public use.

IMPRESSION/CONCLUSIONS:

The workshop was very productive. The DECOVALEX program has progressed from hypothetical benchmark test problems to more realistic and complex test case problems in the laboratory and field. Should the project continue for an additional 3 years, the plan is to focus only on one or two large scale field test cases, in which the individual research teams would be allowed to provide their input for the design of the experiments, specifically with regard to design of the monitoring systems, parameters to be measured, and needed response measurements. The next DECOVALEX workshop is scheduled to be held in Washington, DC, March 27-29, 1995. It has been proposed to arrange a one day technical visit of the

CNWRA for interested participants. Details are needed to be worked out for this proposed technical visit of CNWRA.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

None.

SIGNATURES:

Mikko Ahola

Mikko P. Ahola
Senior Research Engineer, RDCO

11/28/94
DATE

CONCURRENCE SIGNATURES:

Asadul H. Chowdhury
Manager, RDCO

11/28/94
DATE

Budhi Sagar
Technical Director

11/28/94
DATE

attachments

ATTACHMENT A

DECOVALEX
Secretariat

Document 94/162
Stockholm, October 13, 1994

The 5th DECOVALEX Workshop - programme

Paris, October 17 - 20, 1994

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Monday, 17 October, 1994 , (Chairman, C-F. Tsang)

08:00 Departure from Hotel Mecure to INSTN SACLAY by bus
09:00 - 09:30 Registration and Coffee
09:30 - 09:40 Welcome Speech (Michel Raynal, ANDRA)
09:40 - 09:50 Practical Matters (J. C. Lacombe, ANDRA)
09:50 - 10:00 Opening Address (C-F. Tsang, LBL)

Theme 1 TC2 (Fanay-Augères Field Test), Phase III

10:00 - 10:25 Further results of three calculations for TC2 (L. Börgesson, CLAY)
10:25 - 10:50 Some results of 3D T-M calculations by discrete finite element method (G. Vouille, ENSMP)
10:50 - 11:10 Further development for modelling by distinct element (A. Thoraval, INERIS)
11:10 - 11:30 Comparison between different modelling results for TC2 (A. Rejeb, IPSN)
11:30 - 11:40 Summary of results and reporting (J. C. Gros, IPSN)
11:40 - 12:00 Secretariat activities (O. Stephansson, KTH)
Special issue of J. Rock Mech. Min. Sci. & Geomech. Abstr.,
Progress in DECOVALEX Book Project

12:00 - 13:00 Lunch

Theme 2 TC3 (Big-Ben T-H-M experiments), Phase III

13:00 - 14:30 State-of-the-art of Big-Ben experiments (T. Fujita, PNC)
Further results for modelling TC3 (A. Kobayashi, KPH)
Further results for modelling TC3 (M. Ahola, CNWRA)
Optional Presentations and general discussion
Summary of results and reporting (T. Fujita, PNC)

Theme 3 TC4 (Triaxial Test), Phase III

14:30 - 15:00 State-of-the-art of TC4 (Triaxial Test) (Jukka Pöllä , VTT)
15:00 -15:30 Coffee break

Theme 4 TC5 (Direct Shear - Flow Test), Phase III

16:00 - 17:00 State-of-the-art of TC5 (M. Ahola , CNWRA)
Further results for modelling TC5 (M. Ahola, CNWRA)
Further results for modelling TC5 (Y. Ohnishi, KPH)
Summary of results and reporting (M. Ahola , CNWRA)

17:15 Return to Hotel Mercure by bus

Tuesday, October 18, 1994 , (Chairman, O. Stephansson)

Theme 5 TC6 (Borehole-Injection Test), Phase III

09:00 - 10:00 Further results for modelling Test Case 6(S. Nguyen, AECB)
AECL team results for modelling Test Case 6 (K, Khair, AECL)
Optional presentations
Summary of results and reporting (J. Rutqvist, KTH/SKI)

10:00 - 10:30 Coffee (offered)

Theme 6 Phase III Reporting

10:30 : 11:00 Specifics for report, Phase III (L. Jing, KTH)
Discussion on technical details for Reporting of Phase III
11:00 - 12:00 General discussions about Phase III
Summary of Phase III (C.-F. Tsang, LBL)

12:00 - 13:00 Lunch

Theme 7 Further Results for BMT1 and BMT3

13:00 - 13:30 Effect of the homogenization scale (A. Millard, CEA/DMT)
13:30 - 14:00 Studies of percolation on the BMT3 fracture network (R. Ababou, CEA/DMT)
General discussion
14:00 - 14:30 Further results for BMT3 (E. Vuillod & A: Thoraval, INERIS)
General discussion

14:30 - 15:00 Summary for Phase I, II and III, DECOVALEX project (C. - F. Tsang, LBL)
General discussion

15:00 - 15:30 Coffee

Theme 8 DECOVALEX Book Project

15:30 - 17:00 State-of-the-art of contributions (by first authors)

17:15 Return to Hotel Mercure by bus

Wednesday, October 19 (Chairman, F. Plas)

Theme 8 DECOVAEX Book Project (Continued)

09:00 - 10:00 Arrangements for the internal review of contributions and technical details and confirmation of time schedule (O. Stephansson)

10:00 - 10:30 Coffee

Theme 9 Lessons learned and conclusions drawn from Phase I, II and III

10:30 - 12:00 General comments (L. Dewiere and F. Plas, ANDRA)
Discussions

12:00 - 13:00 Lunch

Theme 10 Planning for the Phase IV, DECOVALEX

13:00 - 13:30 Report on the planning group (O. Stephansson, KTH)

13:30 - 15:00 Presentations of new experiments for continuation of DECOVALEX
New experiment 1 - shaft sinking at Sellafield (A. Herbert, AEA)
New experiment 2 - Buffer mass experiments in Kamaishi Mine (T. Fujita, KPH)
New experiment 3 - Moderately fractured rock experiment in URL (T. Chan, AECL)
Discussion

15:00 - 15:30 Coffee

15:00 - 16:00 Recommendations about new experiments for continuation of DECOVALEX from Workshop to the Steering Committee (discussions lead by O. Stephansson, KTH)

16:00 - 16:15 Time and locations for the 6th Workshop of DECOVALEX

16:15 - 16:30 Closing Remarks (C-F. Tsang, LBL)

16:30 Return to Hotel Mercure by bus.

Thursday, October 20 (Steering Committee meeting, Chairman F. Kautsky

8:45	Departure from Hotel Mercure to ANDRA
9:30	Steering Committee Meeting at ANDRA Head Office
11:00 - 11:15	Coffee break
13:00 - 14:00	Lunch offered by ANDRA
14:00	Departure from ANDRA to Hotel Mercure
14:30	Departure from Hotel Mercure for Technical tour (CSA)
18:00	Arrival (approximately) to Hotel Golfe de la Foret D'orient, Rouilly-Sacey, Piney.

Friday, October 21 (Technical Tour)

8:15	Departure from hotel to CSA
9:00	Welcome to CSA at B.A.P and Presentation of site
10:30 - 12:30	Visit of site
12:45 - 14:00	Lunch
14:30	Return to Paris
18:00	Arrival (approximately) to Paris

ATTACHMENT B

5TH DECOVALEX WORKSHOP

PARIS, october 17-21, 1994

List of participants

AEA Technology		
- HERBERT Alan		UK
AECB		
- NGUYEN Son		CANADA
AECL		
- CHAN Tin		CANADA
- KHAIR Khairy		CANADA
- ONOFREI Constantin		CANADA
ANDRA		
- DEWIERE Lionel	ANDRA-DEEC	FRANCE
- GURI Gérard	ANDRA-DEEC	FRANCE
- LACOMBE Jean-Claude	ANDRA - DEEC	FRANCE
- PLAS Frédéric	ANDRA - DEEC	FRANCE
- RAYNAL Michel	ANDRA - DAI	FRANCE
- TRENTESAUX Christine	ANDRA-DEEC	FRANCE
CEA		
- GAUVAIN Jean	CEA/DMT	FRANCE
- GROS Jean-Claude	CEA/IPSN/DPEI	FRANCE
- MILLARD Alain	CEA/DMT	FRANCE
- REJEB Amel	CEA - FAR	FRANCE
- STEITLEL Anne	CEA/DMT	FRANCE

Clay Technology AB

- BÖRGESSON Lennart SWEDEN

European Commission Radwaste Management

- HAIJTINK Bert BELGIUM

ENSMP

- BOUGNOUX Anne FRANCE
- VOUILLE Gérard FRANCE

ETSIM - UPM

- ELORZA Javier SPAIN

Faculty of Agriculture

- KOBAYASHI Akira JAPAN

Hazama Corporation

- CHIJIMATSU Masakazu JAPAN

INERIS

- BAROUDI Hafid FRANCE
- THORAVAL Alain FRANCE
- VUILLOD Emmanuelle FRANCE

Kyoto University

- OHNISHI Yuzo JAPAN

Lawrence Berkeley Laboratory

- NOORISHAD Jahan USA
- TSANG Fu Chin USA

NIREX Ltd

- IRELAND Tim UK

Norwegian Geotechnical Institute

- HANSTEEN Harald NORWAY

PNC

- FUJITA Tomoo — JAPAN

Royal Institute of Technology

- GRINBERGS Majia — SWEDEN
- JING Lanru — SWEDEN
- RUTQVIST Jonny — SWEDEN
- STEPHANSSON Ove — SWEDEN

SEMINORG

- GIRARD Dominique — FRANCE

SKB

- ERICSSON Lars — SWEDEN

SKI

- KAUTSKY Fritz — SWEDEN

Southwest Research Institute

- AHOLA Mikko — USA

STUK

- ELORANTA Esko — FINLAND

US Nuclear Regulatory Commission

- PHILIP Jacob — USA

VTT

- PÖLLÄ Jukka — FINLAND

ATTACHMENT C

DECOVALEX
Secretariat

1994-06-01

Phase III Report, DECOVALEX

1 Persons in charge

Editors:
C-F. Tsang (LBL)
F. Kautsky (SKI)
O. Stephansson, J. Rutqvist & L. Jing (KTH)

Authors for each chapter:

Chapter 1 (introduction)	Secretariat
Chapter 2 (TC2)	J-C. Gros, IPSN
Chapter 3 (TC3)	T. Fujita, KPH
Chapter 4 (TC4)	J. Pöllä, VTT
Chapter 5 (TC5)	M. Ahola, CNWRA
Chapter 6 (TC6)	J. Rutqvist, KTH
Chapter 7 (Closing remarks)	Secretariat
Acknowledgment + References	Secretariat

2 Word-Processor

Word for Windows for IBM PCs or Compatibles

B) Technical Details

1) Persons in charge:

Foreword	(Jing et al)
Chapter 1	(Jing et al)
Chapter 2	(J.C. Gros)
Chapter 3	(T. Fujita)
Chapter 4	(M. Ahola)
Chapter 5	(J. Rutqvist)
Chapter 6	(Jing et al)
Acknowledgment and References	(Jing et al)
Appendix	(J. Pöllä)

2) Word for Windows is the word processor to be used by all persons in charge.

3) Convention of reference
References in each chapter should be prepared by persons in charge for each chapter, but will be compiled into an overall reference list to avoid overlapping. The reference number should be given in [ ], and full reference given in a separate list in numeric order. Same convention as in report I and II.

4) Font of characters is Times new Roman with 12 Pct.

5) Figures and equations should numbered within each chapter in the same fashion as in Phase I and Phase II Reports with figure/equation number following the chapter number. For example, Fig. 2.1, Figure 2.1, Equation (3.4), etc. "Figure(s)" in stead of "Fig(s)." should be used if it appears as the first word of a sentence.

6) Word for Windows is capable to draw simple diagrams and x-y line charts. It is encouraged to be used as much as possible under the condition that the diagrams and line charts are clear. If special drawings are used, one original and three good photocopies of these drawings should be supplied together with each drawing.

3 Milestone

October 17 - 20, 1994
Reporting of the status of chapter writing by responsible persons at the Paris Workshop

January 15, 1995
Submission of the first draft of the final version of chapters of Phase III Report to the DECOVALEX Secretariat

March, 1995
Report and discussion of the first draft of Phase III Report at the 6th DECOVALEX Workshop, Washington, D. C.

C) Time Schedule (suggested)

Time	Activity
Jan. 15, 1995	Deadline for submission of each chapter to the Secretariat by persons in charge
Feb. 10, 1995	Deadline for submission of the first draft to all persons in charge of chapters by the Secretariat
Feb. 28, 1995	Deadline for review of first draft by all persons in charge and delivery of comments to the Secretariat
March, 1995	Completion of the second draft. Report and discussion of the second draft at the Steering Committee meeting, Washington, D. C. Delivery of the sencond draft to all persons in charge and research teams for further comments.
April 15, 1995	Deadline for delivery of comments to the second draft by all parties to the Secretariat.
May 10, 1995	Completion and delivery of the thrid draft to all Funding Organizations and CEC for final comments.
May 25, 1995	Delivery of comments by all Funding Organizations and CEC to the Secretariat.
June 15, 1995	Completion of the final draft and submission to printing.