



**PROGRAMME
PROGRESS
REPORT**

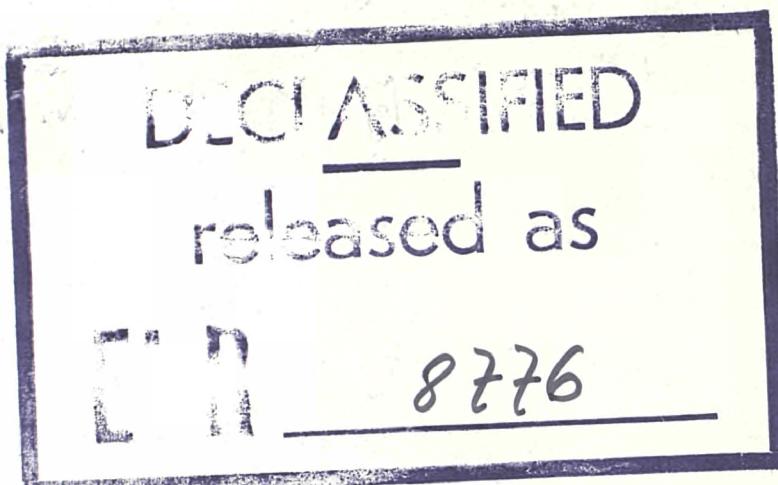
July - December 1981

COMMISSION OF THE EUROPEAN COMMUNITIES
JOINT RESEARCH CENTRE
Ispra Establishment
Italy

Central Bureau for Nuclear Measurements
Geel Establishment
Belgium

Petten Establishment
The Netherlands

European Institute for Transuranium Elements
Karlsruhe Establishment
Federal Republic of Germany



COMMUNICATION

Category **1.0**

Nr **3926**

**Specific support
for the Commission's
sectoral activities**

Informatics
Support to safeguards
Support to the Community Bureau of Reference
Training and education
Utilization of research results
Provision of scientific and technical services

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Programme Progress Report - JRC Ispra
July - December 1981

SERVICE AND SUPPORT ACTIVITIES
Education and Training

Abstract

During the period June - October 1981, five courses were held at JRC-Ispra within the Education and Training programme. They dealt with Energy Systems and Technology, Chemical Sciences and Methods, Mechanical Science and Ressources Evaluation, all subjects involved in the research activity of the Ispra Establishment.

An overall evaluation of these courses, and of the achievements of the education activity at Ispra to date is given. Then follows a detailed report on each one of these courses.

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INTRODUCTION

The "Education and Training" Programme has three main goals:

- to contribute to the dissemination of scientific and technical knowledge
- to contribute to exchanges and ties between European scientific workers
- to help satisfy the growing demand for continuing education for scientific and technical staff in scientific areas covered by the research programme of the JRC.

It is implemented by organizing at Ispra the so-called "Ispra Courses".

These consist of short courses and educational seminars designed for external participants with a scientific or technical background and some academic or professional experience. The courses should help them to specialize in a given field, or to deepen or widen their own expertise.

The need to train specialists from developing countries, explicitly considered in the 1980-1983 programme decision, should be progressively taken into account.

Teaching is provided by both JRC scientists and external specialists invited as guest lecturers. The Education and Training programme is provided with a manpower of 9 research-men and a specific budget allocation of 155.000 Ecu in 1981.

The registration fees paid by the participants contribute towards the financial resources of the programme.

The 1981 Programme of Courses, announced in autumn 1980, consisted of 15 Courses, lasting between 3 days and 3 weeks, in the following field:

- Nuclear Science and Engineering	3 courses
- Information and System Science	2 courses
- Mechanical Science	1 courses
- Energy Systems and Technology	4 courses
- Resources	1 course
- Chemical Sciences and Methods	2 courses
- Health Physics	2 courses

For further information, please contact the Programme Manager

EXECUTIVE SUMMARY

B. HENRY

1. Courses held during the reporting period*

The following courses or seminars have been held:

- Energy Systems and Technology

"Thermal Energy Storage", Course, 5 days
"Introduction to Solar Energy", Course, 3 days

(TES/81)
(INT/81)

- Chemical Sciences and Methods

"Analytical Techniques for Heavy Metals in Biological Fluids", Course, 1 week (HMB/81)

- Resources

"Remote Sensing for Land Use Inventories", Course, 3 weeks

(RS/81)

- Mechanical Science

"Advanced Seminar on Fracture Mechanics", 1 wheek

(ASFM/81)

Some relevant data of these courses or seminars are given in Table I.

(*) June - October 1981

Table I - Data on Ispra Courses held during the period June-October 1981

Course Reference	Date	New:N Repeated:R	Language	Duration (days)	No. of participants		No. partic. x days	No. of lecturers		
					ext.	ext. + int.		int.	ext.	tot.
TES/81 1)	1 - 5.6	N	English	5	16	21	105	3	13	16
HMB/81 2)	22-26.6	R	English	5	19	24	120	6	9	15
INT/81 3)	30.6-2.7	N	English	3	14	14*	42	8	—	8
RS/81 4)	31.8-18.9	N	English	15	21	21*	315	7	14	21
ASFM/81 5)	19-23.10	N	English	5	52	55*	275	1	12'	13

(*) Limited to this number

Course Coordinators:

- (1) G. Beghi, New Energies Programme.
- (2) S. Facchetti, Radiochemistry Division.
- (3) B. Henry, Education and Training Programme.
- (4) R. Savigear, Prospective Studies Directorate.
- (5) H.L. Larsson, Applied Mechanics Division.

2. Cancellation of planned courses

The two following courses had to be cancelled:

- The course "Programming for Software Sharing" planned for August 31 - September 11 attracted too few external registrations (9). This course had been held already in 1979 with good results. This year's experience shows that in the field of informatics, for which plenty of short courses are offered on the national "markets", both by research organizations and by private training bodies, the subject of courses to be held at international level should be carefully selected.
- The workshop "National Energy Planning and Management in Developing Countries" planned for October 5 -29 had to be postponed (to May 1982).

The participation was limited to senior policy-makers from the Lomé Convention and other EC association states, invited by the DG VIII and DG XVII. Apparently the information transmission channels had not worked efficiently and an insufficient number of qualified participants enrolled.

For the workshop to be held in May 1982, the necessary corrections to the invitation process will be made.

3. Publication of Course Proceedings

Since the last Programme Progress Report, the following proceedings have been issued:

- "Energy Storage and Transportation", edited by G. Beghi, published by Reidel, Dordrecht (course held in October 1979).
- "Application of Remote Sensing to Agriculture Production Forecasting" edited by A. Berg, published by A.A. Balkema, Rotterdam (Course held in October 1979).

This brings to 9 the number of Ispra Courses already published, while 7 others are in preparation.

4. Specific Projects for Developing Countries

As already mentioned under 2., the Workshop "National Energy Planning and Management in Developing Countries" will take place in May 1982, and the same Workshop in French is being planned for October 1982.

The course "Remote Sensing for Land Use Inventories", held in September 1981, will be repeated in September 1982, and offered specially to EC association countries. The content of the programme will be adapted according to some of the specific interests of these countries.

5. 1982 Programme

The 1982 Programme of the Ispra Courses has been drawn up and is currently advertised by brochures and posters.

The list of titles is reported in Table II.

6. Cooperation with external Organizations

Some courses in the 1981 and 1982 programmes are being organized in cooperation with external organizations:

- Associazione Italiana di Protezione contro le Radiazioni (AIRP): RP-A/81, RP-B/81, RP-A/82, RP-D/82
- Council of Europe and European Association of Remote Sensing Laboratories (EARSeL): RS/81
- European Working Group on Fracture (EGF): ASFM/81
- World Health Organization (WHO): HMB/81
- I. Physikalisches Institut of the Justus-Liebig Universitaet Giessen: TLD/82
- Institut für Strahlenhygiene of the Bundesgesundheitsamt, Neuherberg: NIRP/82

Table II - 1982 Ispra Courses Programme

Title	Course Reference	New: N Repeated: R	Type	Date
RESOURCES				
Remote Sensing for Land Use Inventories	RS/82	R	C	13.9-1.10
ENERGY SYSTEMS AND TECHNOLOGY				
National Energy Planning and Management in Developing Countries	ES-e/82	N	W	3-26.5
Planification Energétique Nationale dans les Pays en voie de Développement	ES-f/82	N	W	4-27.10
Performance of Solar Energy Converters:				
Part A: Thermal Collectors	PSEC-A/82	R	C	24-26.11
Part B: Photovoltaic Cells	PSEC-B/82	R	C	29.11-1.12
Energy Saving in Small and Medium Sized Industries	ESI/82	N	C	30.8-3.9
NUCLEAR SCIENCE AND ENGINEERING				
Multiphase Processes in LMFBR Safety Analysis	MPSA/82	R	SR	29.3-2.4
Workshops on Quality Assurance in Nuclear Plants:				
Part A: Problems during Installation and Commissioning	QA-A/82	N	W	21-22.6
Part B: Problems during Operation	QA-B/82	N	W	24-25.6
Operator Behaviour in Adverse Stress Conditions	OT/82	R	C	14-16.6
Monte Carlo Methods and their Application to Radiation Shielding	RSh/82	R	AC	25-29.10
ENVIRONMENT AND CHEMISTRY				
Mass Spectrometry of Large Molecules	MSLM/82	N	AC	6-10.9
Ecological Effects of Heavy Metals Specification in Aquatic Environment	HMS/82	N	AC	15-19.11
FISICA SANITARIA				
Fondamenti di Radioprotezione	RP-A/82	R	C	15-26.3
Radioprotezione negli Impianti Nucleari	RP-C/82	R	C	19-30.4
Fondamenti di Sorveglianza Medica della Radioprotezione	RP-D/82	N	C	1-11.6
HEALTH PHYSICS				
Applied Thermoluminescence Dosimetry	TLD/82	R	C	24-28.5
Protection against Non-Ionizing Radiation	NIRP/82	N	C	8-12.11

C: Course

AC: Advanced Course

SR: Seminar at research level

W: Workshop

7. Conclusions

Although all the courses 1981 have not yet been held, it is already possible to see a decrease in the level of activity in 1981 with respect to 1979 (as in 1980) as a result of a decrease in registrations.

This tendency is being taken into serious consideration.

To some extent this may be the result of the general economical situation in the EC countries which is causing many firms and public bodies to reduce their personnel expenses. The permanent inflation of courses in certain areas (informatics, solar energy) may also be playing a negative rôle.

In these areas, the Ispra Courses should definitely be oriented towards very specialized and advanced topics, for which the offer by national courses in less abundant and the treatment in an international context more attractive.

Moreover an effort should be made to open the Ispra Courses to young graduates and post-graduate students (experienced this year with the course RS/81). It requires the availability of grants in support to their sojourn and travel expenses. There is no doubt that such a departure would contribute usefully to the education of new specialists or stimulation of new vocations in areas largely open to future research.

PROJECTS

Reports on particular Courses

Thermal Energy Storage

1 - 5 June 1981

G. BEGHI

New Energies Programme

The course was designed to give a general view of the problems of thermal energy storage which is a very important aspect in energy systems, particularly in view of the extended applications of renewable primary energies.

A review of available and advanced technologies was given, with a view on their potential. Different categories of storage were described and some applications were considered, including the recovery of industrial process heat.

The course was the first Ispra Course organized on this specific subject; it was planned following another Ispra Course, held in 1979 and covering the more general field "Energy Storage and Transportation". During that course growing interest was expressed in this particular aspect of energy storage.

Participants

The course was attended by 16 external participants from EC countries (Belgium, France, Italy, Germany and the United Kingdom), half employed in public organizations, half in private companies. 60% of the participants were employed in research, and 40% in project management or teaching. The preparation of the participants was generally academic, and was sufficient for them to follow the course.

Structure of the Course

The lectures of the course were divided into different groups covering the various aspects. Firstly, an introduction gave a general survey of energy storage in the overall energy systems.

The other areas dealt with the following:

- Sensible heat and latent heat storage at low temperatures
- Large scale storage in soil, aquifers and solar ponds.
- Chemical storage, with reversible chemical reactions or hydrogen.
- Transmission of heat using hot water pipes.
- Applications of thermal energy storage.
 - in community systems
 - for recovery of industrial process heat
 - for power generation
- Special techniques such as the use of metal hydrides and heat pumps combined with thermal storage.
- Current R and D Programmes, in the USA and in the EC.

The variety of the lecturers, most of them well known specialists in their specific field, was appreciated; two lecturers were from the Commission.

A visit to Ispra solar energy programme laboratories including experimental realizations of seasonal storage in the ground, was organized.

General Evaluation

The evaluation of the course by the participants gave the following results:

- the programme (structure, content, etc.) and the achievement (quality of lectures, fulfillment of the programme) were considered as good, or better, by 11 of the 14 respondents.
- as a general appreciation of the course (14 answers) three answers were excellent, seven were good.

The course structure (theoretical development, practical aspects) was considered balanced by 10 of the 14 respondents. Some subjects were indicated as being treated in insufficient detail: storage of industrial waste heat, storage of high temperature heat, some heat transfer aspects, costs; these items are worth consideration for possible, future courses in the field. The good appreciation of the course was mainly due to the large amount of time given to the discussions. These were very useful to all participants and of particularly high quality because of the direct contribution to the discussions given by high-level lecturers. The complete coverage of all aspects of thermal energy storage was also a reason for satisfaction.

Conclusions

An important result was the interest of the participants in the practical, short term applications of thermal energy storage, both for the use of solar energy and for energy conservation in industry.

The number of participants was not very large, but satisfactory, if we consider that in the same period, in an interval of two months, there were two other specialized conferences on storage, and a large conference including storage.

The course could be repeated in 2 to 3 years, mainly considering the development of interest, applications, and techniques.

Analytical Techniques for Heavy Metals in Biological Fluids Occupational and Environmental

June 22-26, 1981

S. Facchetti

Radiochemistry Division

The course was intended to present, discuss and make practical evaluations of the most important techniques in current use for the analysis of heavy metals in biological fluids and for the evaluation of some early biological indicators of response.

Emphasis was placed on lead, cadmium and arsenic in blood and urine.

The course was mainly designed for those working in the areas of toxicology, environmental and occupational medicine and health.

The course was organized as part of the JRC Environmental Protection programme, jointly with the Health and Safety Directorate (Luxembourg) and in cooperation with the World Health Organization. It reflected the interest of the Commission of the European Communities in health and safety at work and environmental protection and in particular the need to reduce human exposure to toxic metals.

A similar course was held at Ispra from 27th November to 1st December 1978.

There were 24 participants, five of them from the Joint Research Centre. Because of the specialized character of the course, most of the participants had an appropriate background and training.

The course was divided into two main parts.

In the first, devoted to biological monitoring, presentation of the WHO/UNEP pilot project, was followed by consideration of biological monitoring for worker protection, the toxicological significance of the most diffuse heavy metals and many examples of biological indicators on occupational health.

In the second part the most sensitive and accurate analytical methods for the determination of heavy metals in biological fluids were presented and in particular the sampling and sample preparation of biological material for trace metal analysis, the determination of heavy metals by atomic absorption, emission spectrometry and electroanalytical techniques, the determination of lead by a Delves cup, anodic stripping voltammetry and isotope dilution mass spectrometry.

Internal and external quality control were also considered with special reference to lead, cadmium, mercury and arsenic.

The participants were divided into groups to carry out practical laboratory work in the afternoons and to attend instrumental demonstrations presented by the manufacturers.

The contribution of the JRC staff included a review of spectrochemical techniques and the determination of lead by a Delves cup, anodic stripping voltammetry and isotope dilution mass spectrometry techniques.

The Health and Safety Directorate (DG V-Luxembourg) contributed two lectures, one on the CEC biological screening programme of the population for environmental lead exposure and the second on biological monitoring for worker protection.

According to the opinions expressed by the participants the course fulfilled its goals. One of the reasons was the high level of the lectures and the homogeneity in the preparation of the participants. The structure of the course was judged to be balanced and the organization was felt to be very satisfactory.

We think that a new course should be considered in at least three years time.

The possibility of organizing a workshop on particular aspects of trace analysis and on metabolism and kinetics effects of heavy metals and other toxic substances could also be considered.

Introduction to Solar Energy

30 June - 2 July, 1981

B. Henry

Education and Training Programme

This course was designed at the request of the GD IX of the Commission, as part of the training programme for interpreters who specialize in scientific and technical conferences.

The scope of the course was to develop a basic knowledge of solar energy applications and research orientations. Three courses have already been organized on the same lines in the past, essentially on nuclear energy. This one was the first which specialized in solar energy.

Most of the 14 participants did not have a scientific or technical background. The technical development of the teaching was therefore voluntarily limited, emphasis being put on basic concepts, phenomena and terminology.

The course lasted for 3 days: the first was devoted to thermal applications in the habitat and storage problems, the second was devoted to photovoltaic and thermomechanical applications and the third to testing methods and to advanced subjects such as photosynthesis. 30% of the time was devoted to demonstrations and visits to the JRC laboratories.

The appreciation of the course by the participants was rewarding. The average mark given by them on the course in general was 8.2/10 (7.9 for the programme content, 7.9 for the quality of lectures and practicals and 8.9 for the logistic aspects).

Remote Sensing for Land Use Inventories

14th September - 2nd October, 1981

R.A.G. SAVIGEAR

Direktorate for Prospective Studies

This summer school was designed to enable participants to make a personal evaluation of the potential of remote sensing to provide the data and information required for the compilation of land use inventories. It was co-sponsored by the Council of Europe and the European Association of Remote Sensing Laboratories (EARSeL), and organized in association with the International Institute for Aerial Survey and Earth Sciences (ITC), from Enschede in The Netherlands. The syllabus was related to previous and current work of the Joint Research Centre, in digital image processing, ground, air and space spectral measurements, and crop and land use survey. It was a new practically-orientated course contributing to a programme designed to improve education and training in remote sensing in Higher Education in Europe.

Participation

From some fifty applications twenty four were selected but three withdrew two days before the course began.

Participants came from Britain, France, Germany, Greece, Ireland, Italy, Norway, Sweden and The Netherlands. Twelve were engaged in research, six in teaching and the remaining three in air survey management, environmental protection and planning. 50% were competent and mature scientists, while the others were post-graduate students or young scientists at the beginning of their professional career.

All contributed actively to the discussions and evaluation sessions that were an integral part of the course.

Course Structure.

The course programme consisted of four parts.

Part I included a series of review lectures describing existing methods and techniques of crop and land use inventory and mapping in Europe; existing and likely future sources of remote sensing data and information; the derivation and properties of ground, air and space spectral data.

Part II the major portion of the school programme, consisted of a series of lectures and practical exercises designed to enable the participants to understand the uses and value of air photography and satellite data for the identification of crop and land use categories. Emphasis was placed on understanding, and learning to use, selected techniques in photo interpretation and digital image analysis. Field and laboratory practicals, dealing with the problems of ground sampling and making field spectral measurements, were provided and related to the local area for which air photography had been especially flown in association with ground survey and sampling programmes prior to and during the course. Participants were able therefore to relate photographs, images and digital data to environmental terrain and land use properties that were capable of observation and measurements by them during the school. This provided the framework for a realistic evaluation of the potential of remote sensing to provide accurate data and information for the compilation of crop and land use inventories.

Part III comprised a series of practical exercises which were based on operational programmes. These included the use of remote sensing for the olive tree inventory, for survey objectives in the Cevennes National Park and for monitoring in the Exmoor National Park, the use of sidelooking airborne radar for land use mapping in Nigeria. There were, in addition, a series of evening lectures which reviewed the uses to which remote sensing had been put for practical objectives in Europe, and some developing countries, and which considered possible and required future sources of satellite data.

Part IV This consisted of a series of field and laboratory practical exercises related to the photography, imagery and data of the local field area and designed to enable each participant to evaluate for her/himself the potential of remote sensing to contribute wholly, or in part, to the making of land use inventories at large, medium and small scales.

Joint Research Centre staff contributed to the programmes on the derivation and evaluation of

spectral data for crop and land use inventories; on the techniques and equipment for field spectral measurements; on the use of remote sensing for national park survey; on the olive survey; on the methods and techniques of field sampling; on the essential preparation of the LANDSAT data for the digital image analysis work and the digital image analysis programmes of the school. They were also responsible for the organisation and control of the preliminary flying and ground survey programmes in the local area. Apart from contributions by individual colleagues from eleven different university, government or commercial groups the major contribution to the school from external organizations was made by staff from the International Institute for Aerial Survey and the Earth Sciences (ITC), in The Netherlands, who provided an essential part of the digital image analysis programme and the essential agronomic objectives concerned with the interpretation and demonstration of the applications of remote sensing for the compilation of crop and land use inventories.

Evaluation

For the evaluation of the course (which was based on the allocation of marks to (i) the structure of the programme, (ii) the quality of lectures and practicals, (iii) the standard of organization, (iv) logistical efficiency, (v) general value of the school) participants allocated 105 marks. Of these 71 were "good", 22 were "excellent", 9 were "fair", 1 was "poor", and 2 were "bad". The largest number of marks in any category were given by the participants to quality of lectures and practicals (19 "good"); the structure and content of the programme (14 "good"); organization (13 "good"). Most participants considered that the balance of the school was satisfactory: thus of 21 participants 17 considered a correct balance had been struck between theory and practical work, 15 that there was a correct balance between laboratory and field work, and 13 who considered that the length of the course was correct. The success of the course appeared to relate to its practical approach, using both classical interpretation techniques and relating these to the methodology and techniques of digital image analysis based on the use of a local field area where the difficulties of acquiring and interpreting remote sensing data could be related to the problems of field sampling, field measurements and in an actual environment whose characteristics and properties could be observed, sampled, recorded, analysed and related to air space photography, imagery and data.

Conclusion

The school appears to have been a success but the following ideas should be examined if another course in the general field of remote sensing for land use agricultural objectives is to be provided.

The course was designed and advertised for Europeans but it is clear, from letters, personal comments, and the number and sources of the applications received, that there is a real need for a course of this type for participants from developing countries as well as further courses for Europeans. It is also possible that the objectives were too narrowly defined, dealing with land use inventories and not land use (which is concerned also with land properties and land potential) which many participants believe is required. If another course is to be offered more time should be given to the working of a smaller number of laboratory and field exercises. More opportunity should be given also to individual participants to work alone and interactively with digital image processing equipment.

Further attention should be given also to the problems of understanding the relations between ground, air and space spectral measurements, and digital image processing.

3rd Advanced Seminar on Fracture Mechanics (ASFIM/3)

19 - 23 October 1981

H.L. LARSSON

Applied Mechanics Division

This seminar treated the various mechanisms by which cracks in structures can grow in service thus leading to a reduction of the residual life of the structure. The three interconnected areas which were covered concerned sub-critical crack growth due to fatigue, stress corrosion and creep.

The seminar was organized in collaboration with the European Group on Fracture (EGF) which had nominated an Advisory Board which assisted the JRC in drawing up the programme and choosing the lecturers. As shown by the title, the seminar was the third in a series, the previous seminars having taken place in 1975 and 1979 in other subjects.

In the field of fracture mechanics the Ispra Establishment has an ongoing research activity, both on mechanical and materials aspects, within the structural integrity project of the Reactor Safety Programme.

This Seminar attracted 52 external participants plus 3 from the JRC.

More than half of the participants were Italian, while the others represented eight countries. Roughly 50% were working in research and 15% in each of the following fields of activity: design, technical survey/regulation and teaching.

Three participants judged that they were not prepared to follow this advanced seminar while all the others had sufficient preparation.

This seminar lasted for five days (Monday to Friday). On the basis of the evaluation of ASFIM/2 (1979), the following modifications were introduced:

- a) Variety in the length of the lectures in order to avoid the tediousness of too many $1\frac{1}{2}$ hour long lectures per morning or afternoon session. Two or three lectures per half day were given but one half day included five short presentations.
- b) Workshop sessions. These occupied about 20% of the total time. Six problems were presented on the first day and the participants were told that they would find the necessary data for the solution in the lectures given during the week.
The solution were treated in two workshop sessions, one on Wednesday afternoon (2 problems) and the other on Friday (4 problems).

The lectures were grouped in the following sessions:

- Introduction: basic data and defect assessment.
- Stress corrosion cracking: this session given before the fatigue crack growth sessions introduced the importance of the environment.
- Fatigue crack growth: one day plus one lecture, covering various aspects of f.c.g.
- Corrosion fatigue: the electrochemical fundamentals and applications in various industries.
- Creep crack growth.
- Creep fatigue interaction.

Due to other major involvements of the JRC researchers, the JRC contribution was limited to one lecture note.

General Evaluation

The large number of participants shows the interest that this seminar had aroused in spite of the present period of austerity. The latter has had a greater effect on participation for countries other than Italy, for obvious reasons.

The analysis of the course evaluation forms showed that the course had been well received. Votes centred around upper good and excellent. The time devoted to exercises could have been slightly longer.

Conclusions

The ASFMs enjoy a good reputation. The EGF appreciated the organization of these seminars at Ispra: ASFM/4 is due in 1983 and will be devoted to elastic-plastic fracture mechanics. However, the decision to continue this series at Ispra is dependent on the continuation of JRC research activity in this field which is now under discussion.

List of Authors

- B. HENRY, Manager, Education and Training Programme
- Course Coordinators: as listed in Table I

CDNA08776ENC