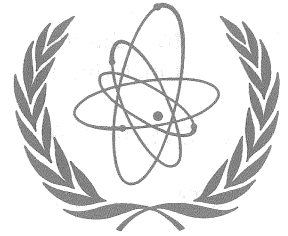




# ITER EDA NEWSLETTER

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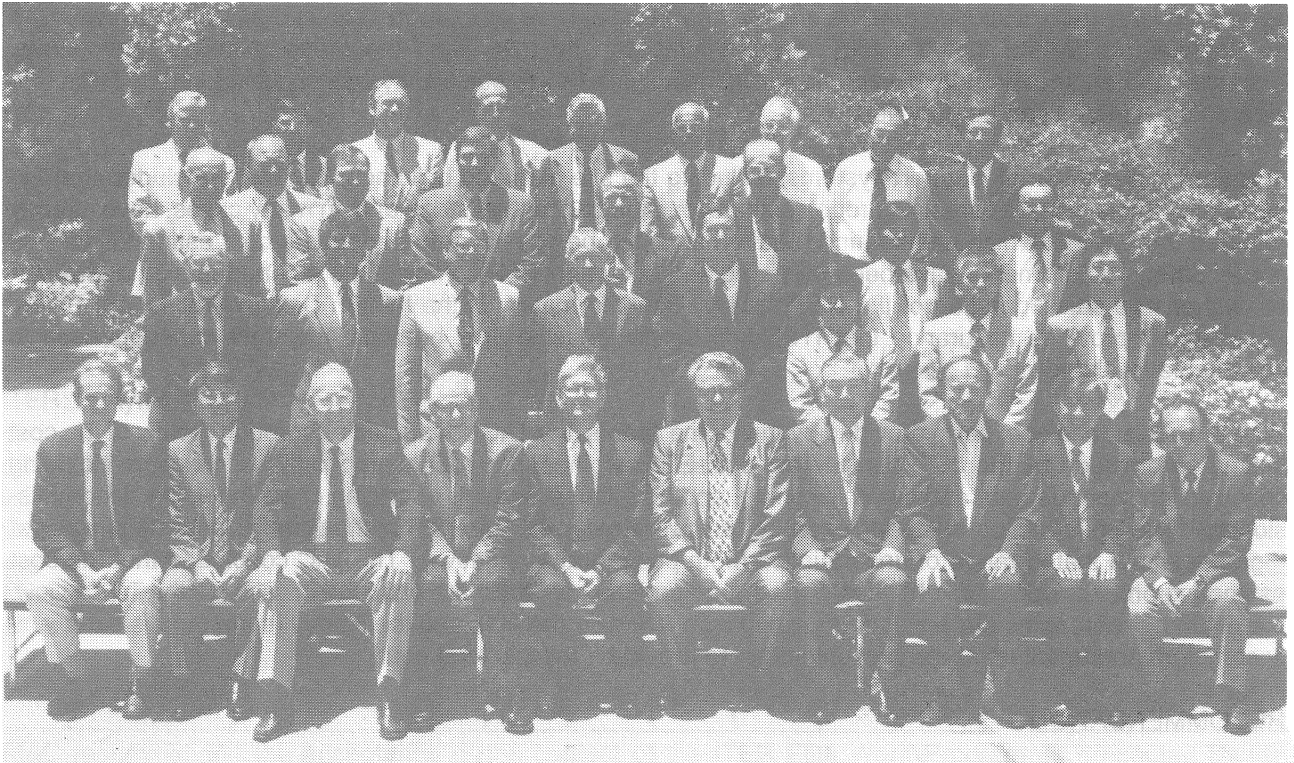
## **8th MEETING OF THE ITER TECHNICAL ADVISORY COMMITTEE (TAC-8) by Prof. P. Rutherford, Chair**

TAC-8 was held on 29 June – 7 July 1995 at the ITER San Diego Joint Work Site. A list of participants is shown on page 3.

### INTRODUCTION AND BACKGROUND

The ITER Council requested the TAC to conduct the ITER Interim Design and Cost Review (IDCR).

The TAC has followed a plan approved by the Council in which the IDCR itself was preceded by two informal technical reviews of the major tokamak systems, including related physics. The purpose of these informal technical reviews was to provide an opportunity for the participants to jointly review the status of the ITER design and provide technical input to the project for use in preparing for the IDCR and for the continuing work of the project after the IDCR. In addition, in preparing the cost estimates to be presented at the IDCR, the Joint Central Team (JCT) distributed in advance a costing document for assessment and feedback by experts nominated by the Parties. Participants in these domestic assessments of costing issues also attended the IDCR.



*Participants in the Meeting*

The Interim Design Report (draft 12 June 1995) was distributed in advance to all participants in the IDCR. In addition, a complete set of Design Description Documents (DDD's) covering all of the elements in the Work Breakdown Structure (totalling about 4,350 pages and 1,400 drawings) was made available at the IDCR. An Executive Summary of the Interim Design Report was also distributed at the IDCR. The Interim Design Report included the JCT's cost estimate.

#### TAC OVERALL RESPONSE TO THE ITER COUNCIL CHARGE

The TAC conducted a thorough Interim Design and Cost Review following the plan recommended by the ITER Council.

The TAC recognized excellent progress in all aspects of the design of ITER, which has been due to the strong leadership of the Director, together with a co-ordinated effort by the JCT and Home Teams, which have included growing contributions from industries.

The TAC concluded from its review that the present design can fully meet the ITER programmatic mission and technical objectives. Moreover, the TAC reaffirmed that these objectives are correct and are crucial to the further development of fusion at this time. These ITER technical objectives include demonstrating controlled ignition and extended burn, with steady state as an ultimate goal, demonstrating technologies essential to a reactor in an integrated system, and performing integrated testing of high heat flux and nuclear components. The TAC concluded from its review that the present ITER parameters and engineering design approaches are well suited to meet the mission and technical objectives.

The Interim Design is sufficient, in the TAC's view, to define the R&D to be carried out during the balance of the EDA; this R&D is expected to confirm the technical validity of the design and will, in many cases, also identify optimum and cost-effective manufacturing techniques. In the TAC's view, it is essential that this R&D program be fully implemented.

In regard to plasma performance, the TAC concluded that the design has sufficient margin to meet the requirements for ignition and 1000-second burn. The provision of 100 MW of auxiliary power greatly increases confidence in plasma performance so that, even with conservative assumptions, sustained driven burn at 1.5 GW fusion power is essentially assured.

In regard to tokamak engineering systems, considering both in-vessel and ex-vessel components and related physics, the TAC concluded that the engineering designs have now progressed to the point at which it can be definitely confirmed that the ITER requirements can be met using the present design approaches. Moreover, the engineering designs of these tokamak systems are sufficiently well specified in detail that reliable cost estimates can be provided.

In regard to the tokamak support systems, including the site plan and buildings, the TAC concluded that the designs of these systems are now progressing beyond the conceptual stage and, in many cases, have already reached the point at which engineering requirements can be specified and adequate cost estimates can be made. Safety requirements have been prepared and documented which, with the planned design approaches, will ensure safe operation of the ITER facility. The information in the Interim Design Preliminary Safety Assessment provides assurance that ITER will be designed to limit hazards and their consequences to acceptable levels.

With the assistance of experts provided by the Home Teams, the TAC conducted a thorough review of the cost estimates provided by the JCT, considering post-EDA engineering R&D costs, construction costs including construction management and commissioning, and, to a limited extent, operating costs including decommissioning. The construction costs for each system were given by the JCT in the form of an estimated cost together with a stated range of uncertainties (both positive and negative). The TAC concluded that the cost estimating process conducted by the JCT is sound and the cost estimate provided is valid. In the TAC's view, the estimate represents the result of an exceptional effort by the JCT and the Home Teams and is sufficiently complete and detailed, at the present stage, to provide a reliable total cost.

#### RECOMMENDATION

The TAC strongly recommended to the ITER Council that the Interim Design and Cost Report be accepted as a good basis for proceeding to the Detailed Design.

## LIST OF PARTICIPANTS

### TAC Members

EC:	JA:	RF:	US:
R. Andreani	N. Inoue	E. Adamov	D.O. Overskei
J. Jacquinet	S. Itoh	V. Glukhikh	P.H. Rutherford
D. Robinson	K. Miya	M. Solonin	J. Sheffield
F. Troyon	K. Tomabechi		

Secretary: C.A. Flanagan

### JCT Presenters

R. Aymar, V. Chuyanov, M. Huguet, R. Iotti, R. Parker, Y. Shimomura, C. Ahlfeld, C. Gordon, A. Costley, D. Dilling, R. Haange, P.-L. Mondino, A. Poucet, S. Putvinski, A. Roshal, G. Saji, M. Wykes, H. Yoshida

### Experts

EC:	JA:	RF:	US:
W. Dänner	H. Kishimoto	V.A. Belyakov	C.C. Baker
M. Heller	S. Ohira	D.A. Davydov	D.D. Lang
G. Marbach	M. Ohtsuka	O.G. Filatov	W.A. Marton
G. Sablé	T. Oikawa	Yu.A. Sokolov	D.A. Petti
E. Salpietro	T. Tsunematsu	Yu.S. Strebkov	K.L. Wilson

## 8th MEETING OF THE ITER MANAGEMENT ADVISORY COMMITTEE (MAC-8) by Dr. M. Yoshikawa, MAC Chair

MAC-8 was held at the ITER San Diego Joint Work Site on 9 and 10 July 1995. The list of participants is shown below. The replacement of JA and US MAC Members was announced:  
Mr. H. Yoshikawa by Mr. T. Nagamtsuya, and Mr. T.R. James by Mr. W.A. Marton, respectively.

## LIST OF PARTICIPANTS

### MAC Members

EC:	JA:	RF:	US:
E. Canobbio	S. Matsuda	O.G. Filatov	C. Baker
R. Toschi	N. Nagamatsuya	L.G. Golubchikov	W.A. Marton
J.E. Vetter	M. Yoshikawa	N.P. Kornev	

Secretary: T. Hirayama

ITER: R. Aymar

JCT: Y. Shimomura, V. Chuyanov, M. Huguet, R. Parker, R. Iotti

Experts: M. Drew, T. Mizoguchi, K. Iizuka, J.P. Rager, T.R. James

MAC reviewed the Work Program, the R&D Program, proposals for the 1996 Joint Fund Budget and the schedule of ITER meetings.

### WORK PROGRAM

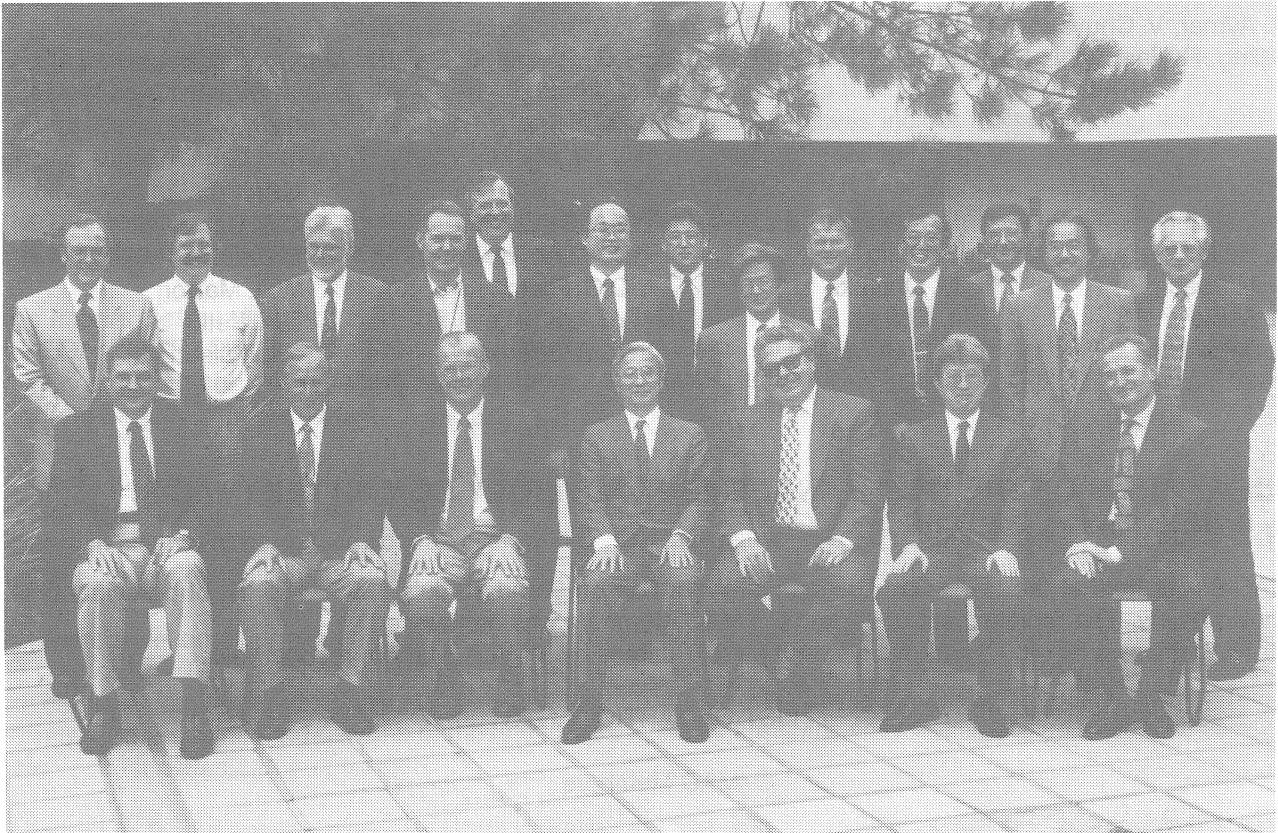
MAC recommended the acceptance of the content of the ITER EDA Work Program as presented by the Director. MAC also wished to commend the Director and the JCT for preparing a Work Program responding to previous suggestions and recommendations by MAC.

MAC strongly endorsed the Director's proposal to focus the R&D activities on seven large R&D projects for the ITER EDA. MAC suggested to the Director to consider applying this concept for appropriate grouping of other R&D tasks.

#### PROPOSALS FOR TASK AGREEMENTS

MAC reviewed and supported the modifications of the 1993 Emergency Task Agreements. MAC also noted the completion of the tasks as so modified.

MAC reviewed the Director's proposals for Task Agreements of Technology R&D and Design Tasks for the remainder of the ITER EDA. MAC also noted that, for the design tasks, the distribution within the totals between Work Breakdown Structure items and their phasing over time might vary by agreement with the Home Team Leaders concerned.



*Participants in the Meeting*

#### JOINT FUND

MAC reviewed consolidated accounts for the ITER Joint Fund Budget of 1994 as presented by the Director. On the basis of the information provided, it is recommended that ITER Council approve the consolidated annual accounts of the ITER Joint Fund for 1994.

MAC reviewed the Director's proposals for the 1996 Joint Fund budget and its allocation to Agents and main budget articles. MAC recommends the ITER Council to approve the Joint Fund Budget and allocations for 1996 as proposed by the Director.

#### CERTAIN INTERFACE ISSUES

With regard to the principles for commingled types of tasks, MAC agreed that each Party shall continue its best efforts to facilitate tax exemption and that the boundary line of responsibility between the sending and receiving Parties be at the port of entry after clearance of preliminary acceptance tests. MAC's Interface Sub-Group will also continue its efforts to facilitate interface issues including completion of the Vade Mecum.

## PROPOSED SCHEDULE OF ITER MEETINGS

MAC reviewed the schedule of Technical Meetings and Workshops proposed by the Director. MAC suggested to co-ordinate the 3rd Tritium Plant Technical Meeting with the meeting scheduled within the agreed tasks on Vacuum Pumping systems.

Upon invitation of the RF delegation, MAC suggested the Director consider to hold more ITER meetings in Russia.

MAC decided that MAC-9 will be held in St. Petersburg on 3 November 1995.

## **33rd MEETING OF THE INTERNATIONAL FUSION RESEARCH COUNCIL (IFRC)** by Dr. Thomas J. Dolan

The International Fusion Research Council is comprised of 12 renowned scientists from countries involved in fusion research. It is the IAEA's advisory body and since its duty is to provide guidance to the IAEA on its fusion research activities, some of the IFRC Meeting results might be of interest to those involved in the ITER EDA.

The IFRC held its 33rd Meeting at the IAEA Headquarters in Vienna on 11 July 1995. At that meeting, information was presented on the status of the ITER Engineering Design Activities, on IAEA activities in support of fusion research programmes and on national programmes in member states.

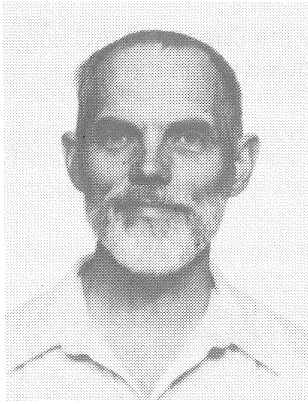
The Council agreed to recommend changing the name of the Agency's bi-annual fusion conference from "16th International Conference on Plasma Physics and Controlled Nuclear Fusion" to "16th IAEA Fusion Energy Conference". R. Bolton (CCFM, Canada), who is co-ordinating local arrangements for the 16th Conference (Montreal, October, 1996), reported that preparations for the conference are progressing well. It is planned to hold the 17th Conference in Japan in 1998.

Guidelines for the Paper Selection Committee for the 16th Conference were discussed. As at the 15th Conference in Seville, papers will be grouped by physics issues, rather than by machines. It was agreed that papers should not be descriptive of whole research programmes (such as the national programme of a country), and multiple papers on one device should be avoided or combined. It was also recommended to allow the Paper Selection Committee some latitude in admitting papers that would increase representation from developing countries. Official ITER papers will be screened by the JCT for decision and submission by the ITER EDA Director, but Home Team papers will go through the normal selection process.

On the topic of the expansion of inertial confinement fusion activities in the IAEA, it was suggested that initiatives on this should come from Member States via their missions in Vienna.

The IFRC received a presentation on the ITER Council's policy on involvement by Other Countries (based on E. Canobbio's article in the ITER Newsletter, May 1993). On this basis, the IFRC understood that in order for scientists from developing Member States to participate in the ITER project, they would need to work with one of the four Parties' Home Teams. The ITER EDA Agreement does provide for Other Countries to associate themselves with one of the Parties and thereby facilitate participation of their technical personnel in the activities of the Joint Central Team, e.g., as with Canada. But, it would probably take about two to three years to develop formal collaboration with another country from this halfway point in the EDA. This discussion of various means of participation in ITER consistent with ITER Council policy was well received by IFRC members.

The last topic was the 1997-98 IAEA Fusion Research Program Plan. This discussion was based on a "Discussion Paper" by IFRC Chair David Jackson and on an "Evaluation of the IAEA Activities in Fusion Research and Engineering" by consultants to the IAEA. The recommendations of the two papers coincided on a number of issues, which were generally accepted by the Council, while discussion of other issues was reserved for later IFRC meetings. In the process of developing the 1997-'98 plan, some proposed research activities were dropped to avoid the duplication of activities already established in the IEA or elsewhere. The results of these deliberations and additional comments received subsequently to the meeting have been incorporated in the draft 1997-98 IAEA Fusion Research Programme Plan & Budget.

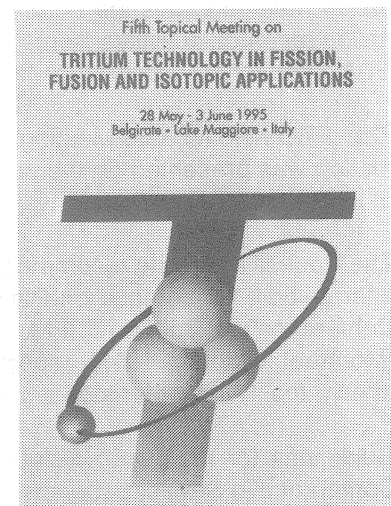


After earning a Ph.D. in nuclear engineering from the University of Illinois, Dr. Dolan studied plasma physics at the Novosibirsk Institute for Nuclear Physics, USSR. From 1971–1989 he was on the faculty of the University of Missouri-Rolla, where he wrote the textbook *Fusion Research* (Pergamon Press, 1982). From 1987–1995 he worked at the Idaho National Engineering Laboratory, where he was in the Fusion Safety Program. He has participated in fusion research activities at LLNL, ORNL, LANL, INRS-Energie (Université du Québec), and Phillips Petroleum Company, and taught at the National Tsing Hua University, Taiwan.

His scientific interests include alternate plasma confinement concepts, plasma diagnostics, fusion reactor design studies, and fusion safety. Since July 1995 he has been serving as Head of the Physics Section, IAEA, replacing Dr. David Banner, who returned to Lawrence Livermore National Laboratory. One of Dr. Dolan's duties is liaison between the IAEA and the ITER Council. By virtue of his position, he is also the Secretary of the IFRC.

**THE 5TH TOPICAL MEETING ON TRITIUM TECHNOLOGY IN FISSION, FUSION AND ISOTOPIC APPLICATION** was held on 28 May – 3 June 1995 at Belgirate, Lago Maggiore, Italy. Meetings in this series are often briefly called "Tritium Conferences". The meeting was organized by the Safety Technology Institute (EC Joint Research Centre Ispra) and was also sponsored by the Nuclear Societies of Canada, Europe, Japan and the USA.

The Chairman of the JRC-Ispra General Committee for this conference was Dr. Heinz Dworschak, Deputy Director of the Safety Technology Institute and Head of the Nuclear Fuel Cycle Division. Dr. Dworschak is a real veteran of the European joint efforts in the nuclear field. He has been employed by the EU for 32 years and joined the JRC at Ispra in 1978. Dr. Dworschak kindly agreed to provide the ITER Newsletter with his brief assessment of the Conference (see box), followed by an article by Dr. R. Haange, Head, Nuclear Technology Division, ITER Naka Joint Work Site.

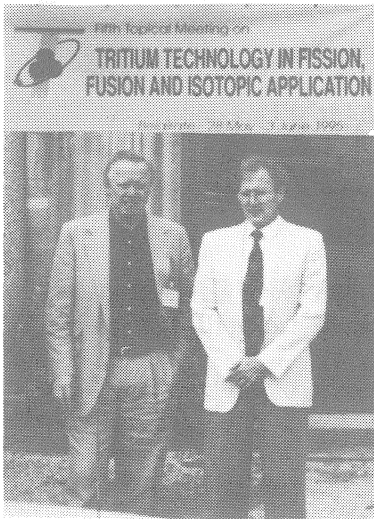


*The Fifth Topical Meeting on Tritium Technology in Fission, Fusion and Isotopic Applications held at Belgirate, Italy, was attended by nearly 300 participants among who for the first time a strong representation from Eastern Counties, especially Russia, could be welcomed. While the meeting covered an umbrella of activities involving the use of tritium and the safety issues related to it, most of the more than 200 papers addressed the fusion arena. The vast majority of fusion-related contributions not only addressed R&D activities directly supporting ITER, but gave also insight on reviewed design, licensing, operation and maintenance experience gained from existing fusion and tritium handling facilities, such as JET, TFTR and TSTA. The preponderance of ITER-related papers was not surprising given the spread of the technical programme topics which intentionally provoked the discussion of numerous likely tritium problems and phenomena in an ITER-type fusion plant. This lead was obviously reinforced by the recognition that today ITER, undoubtedly, represents the focal point of R&D activities involving tritium technology and safety.*

## ITER PARTICIPATION IN THE FIFTH TOPICAL MEETING ON TRITIUM TECHNOLOGY IN FISSION, FUSION AND ISOTOPIC APPLICATIONS

by Dr. R. Haange, Head, Nuclear Technology Division, ITER Naka Joint Work Site

A "Tritium Conference" is held roughly every three years. It may be the only conference in the world that addresses a singly isotope of the periodic system.



The 5th Tritium Conference attracted a world-wide participation of approximately 270 researchers, designers and others involved in tritium-related work. In total some 200 papers were presented in oral and poster sessions. With a clear decline in military-oriented tritium developed activities and a steady, low key interest from the fission industries, the conference was dominated by fusion-related work with a very strong emphasis on ITER.

All members of the ITER Joint Central Team Tritium Plan Group attended, as did a very large fraction of the Home Team members involved in design and development of the ITER T-Plant or related activities.

After an initial plenary session with overview talks on tritium activities in Canada, Europe, Japan, the Russian Federation, and the USA, and a status update on the design of the ITER Tritium Plant, the following special topics were dealt with in dedicated sessions:

- ◆ Tritium Processing
- ◆ Tritium Safety
- ◆ Analysis and Accountancy
- ◆ Tritium Properties and Interaction with Materials
- ◆ Design, Operation and Maintenance of Tritium Systems
- ◆ Tritium Storage, Distribution and Transportation
- ◆ Tritium Waste Management and Discharge Control
- ◆ Industrial and Bio-medical Tritium Applications

With the exception of the last mentioned, all topics were directly relevant to or included many aspects of interest to ITER applications, in particular the latest results presented on ongoing ITER Tritium Plant R&D tasks.

A series of side meetings were organized including a progress meeting on ITER R&D work, accountancy, and ITER vacuum pump design.

Laboratory visits were organized to the European Tritium Handling Experimental Laboratory (ETHEL), at the Joint Research Centre, Ispra Site, during the conference and to the Tritium Laboratory Karlsruhe (TLK), at Forschungszentrum Karlsruhe, on the Saturday following the conference.

While no spectacular new work was reported during the meeting, steady progress was evident as well as an overall further shift of emphasis towards fusion.

One participant proposed to conduct a long-term experiment with tritium by measuring over 20–30 years the weight loss of an isolated quantity of tritium and correlating this to the accumulated decay heat thereby, for the first time, giving experimental proof to Einstein's  $E=mc^2$  (or else). So far, no proposals have been received for ITER R&D credit for such an experiment!

## FORTHCOMING EVENTS \*)

2nd Confinement and Transport Expert Group Workshop, Princeton, USA, 21–23 September  
Energetic Particles, Heating and Current Drive Expert Group Workshop, Moscow, RF, 2–6 October  
4th Technical Meeting on Safety and Environment, San Diego, USA, 9–13 October  
2nd Test Blanket Working Group Meeting (TBWG-2), Naka, Japan, 16–18 October  
3rd Confinement Modelling and Database Expert Group Workshop, Naka, Japan, 16–19 October  
3rd Divertor Physics Expert Group Workshop, Naka, Japan, 16–20 October

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\*) Attendance at all ITER Meetings by invitation only.

Items to be considered for inclusion in the ITER Newsletter should be submitted to B. Kouychinnikov, ITER Office, IAEA, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria, or Facsimile: (+43 1) 237762; phone (+43 1) 2060 26392.

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