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SECOND ITER TECHNICAL MEETING ON SAFETY, ENVIRONMENT, AND REGULATORY APPROVAL

by Dr. A. Poucet, Safety Design and Analysis Group, Nuclear Integration Division, San Diego JWS

The second Technical Meeting on Safety, Environment, and Regulatory Approval was held 3-12 November 1993 at the ITER San Diego Joint Work Site.

The main objectives of the meeting were:

- to discuss and refine the strategy of the JCT for including safety and environmental issues in the design of ITER and in preparation for any subsequent justification of the design before appropriate regulatory bodies;
- to help the JCT implement the safety strategy; and
- to plan the research activities for the 1994 program.

As ITER Director P.-H. Rebut mentioned in his opening remarks, safety and environmental concerns are at the very heart of the ITER mission.

The Director pointed out that safety should be embedded from the start into the design. He urged the participants to focus on research activities that are relevant to the current design and that can be used by the design team.

The ITER outline design will be presented in early 1994. This poses direct and urgent challenges for consideration by the safety and environment experts:

- Important design choices will be made in the near future and S&E considerations should be part of these choices; and
- the site selection process involves the need to develop an Environmental Impact Statement. On the Director's proposed schedule, JCT input should be available at the end of 1994.

Since the JCT resources are limited, a focused contribution of the Home Teams in line with the JCT strategy is essential.

The technical discussions started from the external constraints and regulatory framework for ITER.

Currently, in most of the Parties' home countries there is no well established regulatory framework for fusion. And, although such an overall framework for large fusion reactors needs to be developed, the experimental nature of ITER should be acknowledged in the specific regulatory procedures applied to ITER.

To a certain extent, the Parties will have to develop new elements in their regulatory framework to deal with ITER; this should involve the JCT in a technical capacity. However, in doing so, the JCT has to consider and to understand the current regulatory constraints of the Parties that could have potential impact on the ITER case.

LIST OF PARTICIPANTS

EC Home Team

S. Ciattaglia (ENEA)
W. Gulden (NET)
C. Harfors (Studsvik)
H. Löffler (GRS Köln)
G. Marbach (CEA Cadarache)
F. Mazille (Technicatome)
A. Natalizio (CFFTP)

JA Home Team

T. Inabe (JAERI)
T. Oikawa (JAERI)
Y. Seki (JAERI)
H. Takatsu (JAERI)
H. Yamamoto (JAERI)

Joint Central Team

C. Ahlfeld
H.-W. Bartels
D. Boucher
V. Chuyanov
D. Holland
S. Morozov
S. Piet
A. Poucet
P.-H. Rebut
G. Saji
P. Smith

RF Home Team

V. Kapyshev (VNIINM)
B. Kolbasov (Kurchatov)
V. Korzhavin (Minatom)
M. Krivosheev (Efremov)

US Home Team

L. Cadwallader (INEL)
J. Crocker (Consultant)
J. Haire (INEL)
J. Herring (INEL)
K. Howe (Ebasco)
G. Longhurst (INEL)
K. McCarthy (INEL)
B. Merrill (INEL)
G. Nardella (DOE)
D. Petti (INEL)
D. Squarer (Westinghouse)

IAEA

F.-N. Flakus

The participants in the meeting agreed on a view that direct application of the regulatory framework for fission reactors does not adequately reflect the inherently different nature and level of risk in ITER. The participants also recognized, however, that the existing regulatory framework for experimental nuclear facilities and fission reactors in most countries is considered the reference framework and that deviations from these practices will have to be justified.

At the highest level, the external constraints impose dose criteria. These criteria and related safety goals for ITER were discussed and their compatibility with national and international guidance and regulations was verified.

Starting from the dose criteria, a coherent safety strategy needs to be developed for implementing safety and environmental issues into the design along the lines of the defence in depth concept. The meeting was very helpful in defining that strategy.

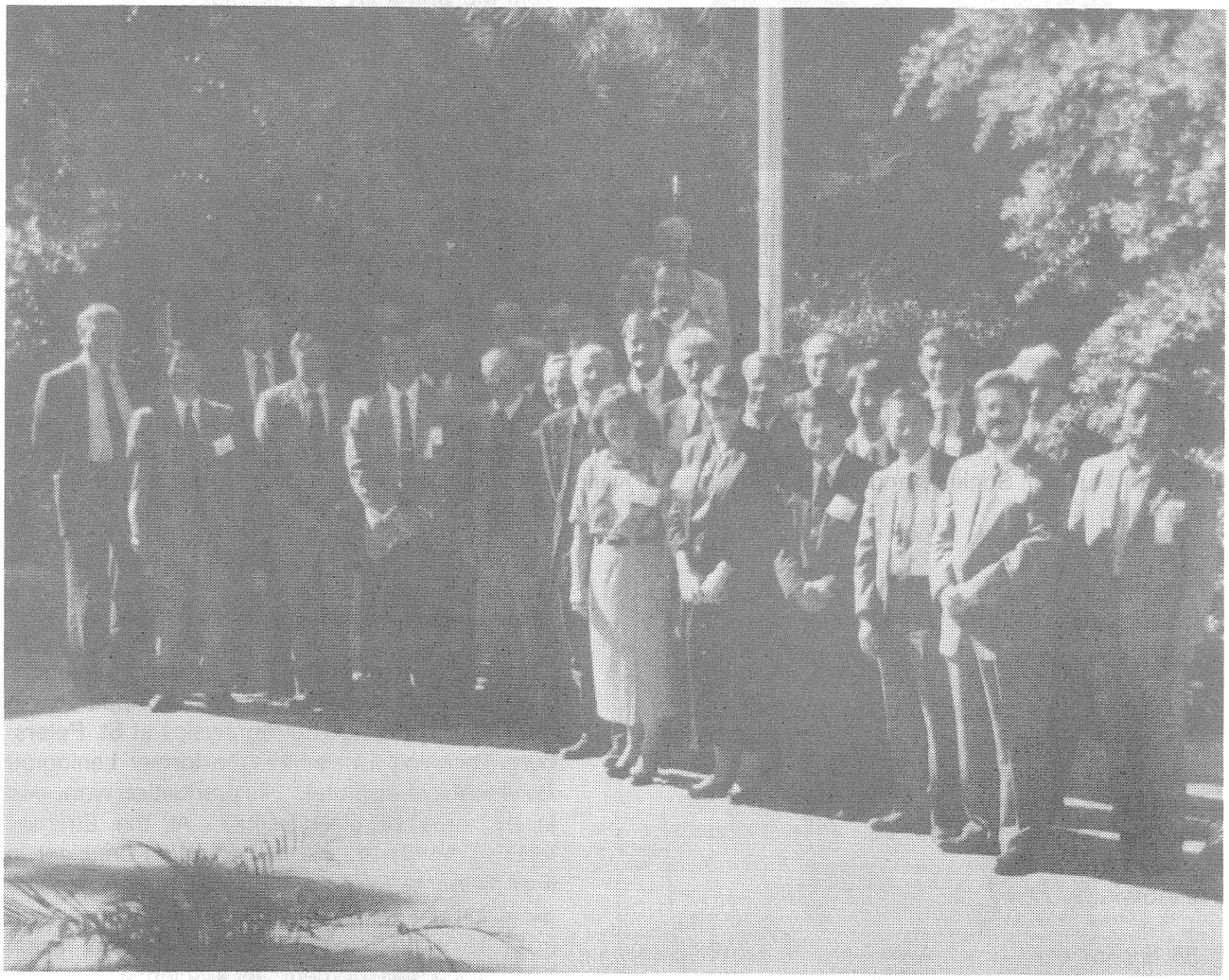
Topical discussions were held on source term (tritium and activation products), waste management, energy sources (thermal, chemical, plasma and magnet related), confinement and pressure containment. Work performed by HTs on these topics was presented and issues specific to ITER requiring further investigation were lifted from these discussions.

An impressive amount of safety analyses on specific scenarios was presented by the participants. These provided valuable insights into phenomena and issues important to be considered in ITER safety. However, a more systematic and controlled way of identifying, screening and ranking initiating events and scenarios is needed in order to focus the analysis effort on a reasonably complete set of scenarios that are relevant to the ITER design and are based on credible assumptions.

The integration of the massive amount of analysis work done in the past into the overall strategy will be very challenging to the HTs and the JCT and will require the JCT and HTs to really act as a project team.

The structure of the ITER EDA (i.e., three Joint Work Sites and four Home Teams) poses an additional challenge with respect to internal interfaces within the JCT (particularly between safety and design groups), and with respect to the interfaces with the HTs. An example is the coolant system that has many interactions with safety functions and yet is designed on a "component" basis in three continents.

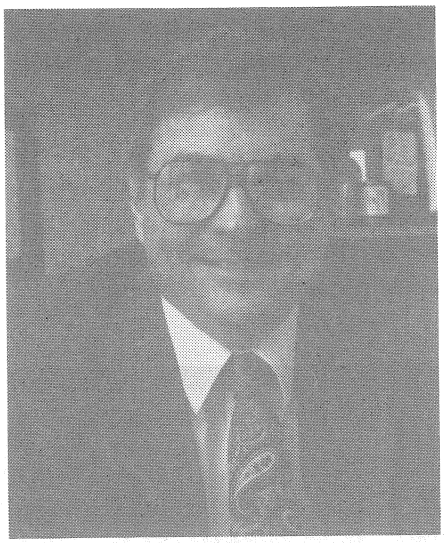
The meeting clearly showed that integration of safety into the design of ITER has an impact on very many components of the machine. The safety and environment experts should not limit their attention to the aspects of environmental and public safety alone. Reliability and operability of ITER should be considered an integrated aspect of safety and environment. A reliable machine offers the best guarantees with respect to achieving the ITER mission including its safety and environmental objectives.



Participants in the meeting

TO THE READERS:
To complete the introduction of the ITER key scientific managers, this issue on the following two pages features profiles on the four ITER Home Team Leaders.

Dr. Charles C. Baker, US ITER Home Team Leader



Dr. Baker has been actively involved in the fusion community for 21 years, beginning in 1972 as a senior physicist in the Fusion Division of the General Atomic (GA) Company. While at GA, he held various positions including Fusion Technology Department Manager (1974-76), as well as Project Manager of both the TNS Reactor Study (1976-77) and Heating Technology Projects (1977). Baker's academic training includes a B.S. degree in Applied Mathematics and Engineering Physics in 1966, a M.S. degree in Nuclear Engineering in 1967, and a Ph.D. in Nuclear Engineering with a minor in Physics in 1972, all from the University of Wisconsin.

His thesis research was performed on a cross-field plasma accelerator under Prof. Harold K. Forsen. From 1977-1989, Baker was Director of the Fusion Power Program at Argonne National Laboratory, where he led the STARFIRE reactor study with Mohamed Abdou in 1979-80 and the US Technical Program Analysis Activity (TPA) for the US Department of Energy from 1985-87. He served as the leader of the Blanket Design Unit during the ITER CDA from 1988-89.

Baker joined the Oak Ridge National Laboratory in 1989, where he was Associate Director for Technology in the Fusion Energy Division. From 1991 to 1993 he served as Technology Manager of the US ITER Home Team. He became Home Team Leader in November 1992. He was also appointed a Research Program director in the Fusion Energy Division.

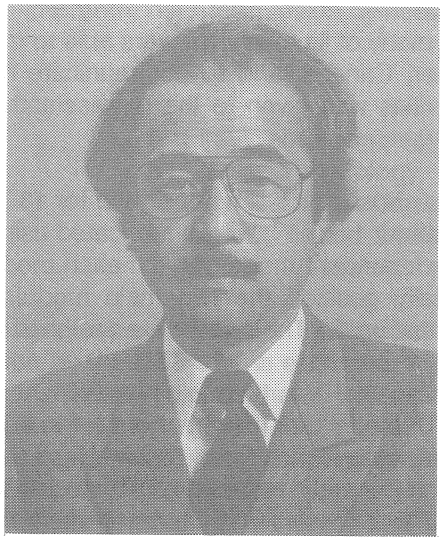
Baker is a past recipient of the DOE Distinguished Associate Award for leadership of the TPA (1988) and a past member of the Magnetic Fusion Advisory Committee (MFAC) where he served as Chairman of the panel on long-range technology. He is currently an editor of Fusion Engineering and Design, a Fellow of the American Nuclear Society, and actively involved in various committees and reviews in the fusion energy community.

Dr. Oleg G. Filatov, RF ITER Home Team Leader

Dr. Filatov entered the D.V. Efremov Scientific Research Institute of Electrophysical Apparatus in 1974 after studying Thermophysics at St. Petersburg Technical University (the former Leningrad Polytechnical Institute). His graduation work was in the area of glass-lasers. At the Efremov Institute he started his career as an engineer in the field of the superconducting magnets development for the high energy physics, and from 1976 he joined the team for the fusion technology development. As a Science Officer he participated in such projects as TSP (T-14) (high field tokamak at TRINITI) and T-15 (tokamak with superconducting TF-coils at the Kurchatov Institute), and some other projects such as T-20, different types of ignitors and neutron sources. From the beginning of the activity in the area of fusion reactor study he has participated in all such designs in Russia, including the national project OTR and international INTOR. His main scientific and engineering interests are in the area of magnet design and computation, and he received his Doctorate in the area of poloidal field computation in 1983. From 1984 he worked at the Efremov Institute as Senior Scientific Officer, and in 1988 he was elected for the position of Head of the Fusion Device Department. In this position he managed the final stage of T-15 construction from the end of Efremov Institute. In 1991 he was

promoted to the position of the Director of Scientific Technical Centre "SINTEZ" where all work for the magnetic fusion technology in the Efremov Institute is concentrated, and also all work in Russia in this field is supervised. He participated in the ITER CDA as one of the key persons of the USSR Home Team, and for the ITER EDA he was designated as the RF Home Team Leader.

Dr. Shinzaburo Matsuda, Japanese ITER Home Team Leader



Dr. S. Matsuda entered the Japan Atomic Energy Research Institute (JAERI) in 1969, after studying Heliotron magnetic confinement at Kyoto University.

He engaged in JFT-1 (internal conductor low beta torus) experiment, design and construction of the JFT-2 tokamak until 1973. He then started the neutral beam injection (NBI) experiment and injector development, organizing a new group, implemented both R&D and design, and constructed NBI systems for JFT-2 and JT-60. New records were the world's first successful extraction of a long-pulse multi-MW beam and rated power injection into JT-60 within two months after the start of beam commissioning. In the meantime he started negative ion beam development for the next step. In 1988 he was appointed Deputy Leader of the Fusion Experimental Reactor Team covering both ITER/CDA and FER. In 1992 he was appointed the Japanese Home Team Leader, and he is now responsible for ITER activities as the Director of Department of the ITER Project in the JAERI Naka Fusion Research Establishment.

Prof. Romano Toschi, EC Home Team Leader

Prof. R. Toschi received his doctorate in Electrical Engineering in 1954 from the University of Bologna, where he is now Professor at the Electrical Engineering Department.

R. Toschi took part, having the responsibility of the experimental magnet and power supply, in the design and construction of the 1000 MeV Electron Synchotron at Frascati (1954-60) and then spent two years as a visiting scientist with a Fullbright scholarship at Berkeley Radiation Laboratory and MIT.

From 1963 he was responsible for the MHD direct energy conversion programme in Italy up to 1970, when he became Director of the Italian Fusion Programme and then (1976) of the Frascati Research Center. In those years the Frascati Center carried out the design construction and operation of the High Field Tokamak (Frascati Tokamak, FT) which for some time held the n-τ record, of a large Plasma Focus and of lasers for inertial confinement research and other applications.

R. Toschi was the Chairman of the JET Supervisory Board during the JET design phase and of the JET Executive Committee during the construction phase (till 1983).

In 1983 he was appointed Leader of the NET (Next european Torus) Team at the Max-Planck-Institute in Garching. European Manager during the ITER Conceptual Design Activities, he became Euratom Home Team Leader in 1992.

SUMMARY REPORT ON ITER MAGNET TECHNICAL MEETING

by Dr. B. Green, Senior Scientist, Naka Joint Work Site

An ITER Magnet Meeting was held 5-8 October 1993 at the Massachusetts Institute of Technology (MIT) Plasma Fusion Center. The representatives from the four Home Teams and from the Joint Central Team (JCT) who participated in the meeting are identified below. A small group of structural analysts, again with representatives from each of the four Home Teams and from the JCT, also met from 25 September - 4 October for additional discussions on structural modeling as well as on recent results for operational characteristics and design options.

The Conductor Group did not convene at this meeting because many of its members were able to meet at the previous Magnet Technology Conference (MT-13) in Vancouver, Canada, and to communicate homework results by e-mail and fax. However, an overview of their activities was given to the representatives at the October Technical Magnet Meeting.

A reference design for the Central Solenoid (CS) Model Coil was chosen. It will be designed for 13 T, and will have a reference inner diameter of about 1.6 m and a height of about 1.9 m. It will be fabricated using a wind-react-transfer technology and will be radially divided into two independent modules, with each module being layer wound. The coil will have a support structure to axially position the two main modules and to accommodate the CS and Toroidal Field (TF) conductor insert test coils. The coil will be designed for test at the JAERI facility.

A reference design for the TF Model Coil was also chosen. The TF Model Coil (height about 3.1 m and breadth about 2.7 m) will be of a scale similar to the coils from Europe, Japan and the United States which were tested at the Large Coil Task (LCT) at Oak Ridge National Laboratory in the early 1980s. The TF Model Coil will be designed for testing and operation adjacent to a European LCT coil presently at interlayer shear plates and keyways typical of the full scale ITER TF coils. It is intended as a structural simulation and fabrication demonstration and will be designed to operate at 10 T. Full field conductor operation will be tested in the TF insert coil for the CS Model Coil mentioned earlier.

A preliminary approach for the full scale magnet system assembly was considered. The maintenance requirements and classification of the coils were discussed as class 3, i.e., replacement/repair is not expected, but must be possible in the event of failure. Several issues were identified for consideration as homework as well as for future discussions with the assembly maintenance groups in the Home Teams and at the ITER San Diego Joint Work Site. These will serve as the basis for further discussions to identify interface problems, to identify areas where design improvements could aid assembly and maintenance, and to evolve a complete assembly approach.

Homework topics were discussed for the Model Coil Group, the Full Scale Coils Group, and for the Conductor Group.

The next ITER Magnet Meeting is scheduled for 22-25 February 1994 at the Naka Joint Work Site.

LIST OF PARTICIPANTS

EC: C. Jong (ECN, Netherlands), M. Spadoni (ENEA), A. Torossian (CEA), A. Ulbricht (KfK)

JA: T. Ando (JAERI), M. Sugimoto (JAERI), E. Tada (JAERI), K. Yoshida (JAERI)

RF: S. Egorov (Efremov), A. Kostenko (Efremov), V. Kalinin (Efremov), A. Malkov (Efremov)

US: J. Dalessandro (General Dynamics), T. Burgess (ORNL), D. Montgomery (MIT), P. Titus (MIT)

JCT: P. Barabaschi, P.-L. Bruzzone, C. Bushnell, M. Huguet, N. Mitchell, K. Okuno, Z. Piec, C. Sborchia, R. Thome, R. Vieira, F. Wong

NEWS IN BRIEF

The 3rd International Symposium on Fusion Nuclear Technology (ISFNT-3) is planned for the period June 27 - July 1, 1994, to be held in Los Angeles, California. ISFNT is held only once every three years. Previous meetings in this series were highly successful, including ISFNT-1 (Tokyo, April 1988) and ISFNT-2 (Karlsruhe, June 1991). It is recognized as a major event for the international exchange of technical information on all aspects related to fusion nuclear technology and for promotion of international collaboration.

Papers related to technology experiments, facilities, modeling, analysis and design will be presented and discussed and both, near-term fusion devices and long-term reactor technologies, will be included.

List of Topics

1. First Wall Technology
2. Blanket Technology
3. High Heat Flux Components
4. Fuel Cycle and Tritium Processing
5. Vacuum Vessel
6. Nuclear Systems Design
7. Safety Issues and Waste Management
8. Models and Experiments for FNT
9. Repair and Maintenance

ITER nuclear component design, R&D and test module development will be a major focus. Very substantial participation by the ITER JCT is expected, including a plenary talk by the ITER Director, Dr. P.-H. Rebut, and five additional invited talks by the JCT key members.

The Symposium will include a workshop and a number of panel discussions dealing with key issues of current interest to the fusion community.

ISFNT-3 General Chairman is Professor Mohamed Abdou, UCLA.

For more information, contact Dr. Mark Tillack, Symposium Secretary, 44-139 Engineering IV, University of California, Los Angeles, Los Angeles, CA 90024-1597, USA, (310)206-1230, FAX: (310)825-2599, internet: MST@FUSION.UCLA.EDU

FORTHCOMING EVENTS *)

- TAC-4, San Diego, USA, 10-12 January

- MAC-4, San Diego, USA, 13-14 January

- Assembly & Maintenance Technical Meeting, Garching, Germany, 19-26 January

- Fuelling & Pumping Technical Meeting, Garching, Germany, 19-26 January

- IC-5, Garching, Germany, 27-28 January

*) Attendance at all ITER Meetings by invitation only.

Items to be considered for inclusion in the ITER Newsletter should be submitted to B. Kouvchinnikov, ITER Office, IAEA, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria, or Facsimile: 43 1 237762 (phone 23606392).

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