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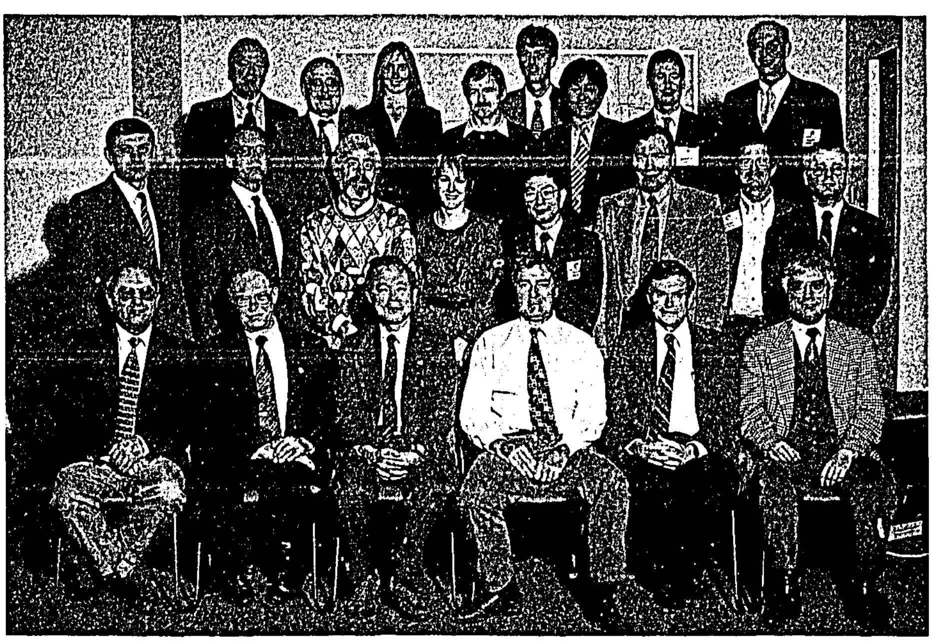
SUMMARY OF THE NSSR-1 WORKING MEETING

by A. Poucet and G. Saji, Safety Environment and Health Division (SEHD), ITER San Diego JWS

A working meeting between ITER Joint Central Team (JCT) and Home Team (HT) safety experts on the Non Site Specific Safety Report 1 (NSSR-1) was held at the San Diego Joint Work Site (JWS) on February 26 - March 1, 1996. The objectives of the meeting were:

(1) To inform HTs on the latest status of the design after the design review of February;
(2) To confirm that NSSR-1 approach, scope and depth meet HT needs;
(3) To clarify and agree on the analysis specifications, reference data and deliverables;
(4) To confirm the subdivision of work between HTs and JCT and the work scheduling.

NSSR-1 is an integrated, plant-level safety assessment of the ITER design. The main purpose of NSSR-1 is to provide sufficient information to potential Host Countries so that they can write regulatory submissions for site selection. It provides site-independent input for an environmental impact assessment and safety characterization. In addition, it should help advance the consensus within the project on safety design. NSSR-1 is not intended for a construction application (i.e. it is not a Preliminary Safety Analysis Report, PSAR). It will not follow a template or style of a typical PSAR of any Host Country, but will follow the recommendations of HTs and international organizations (e.g. such as given by the IAEA in its Safety Series No. 35-G1, Safety Assessment of Research Reactors and Preparation of the Safety Analysis Report).



Participants in the Meeting

NSSR-1 will not be a stand-alone document and will reference other documents, such as General Design Requirements Document (GDRD), General Safety and Environmental Design Criteria (GSEDC), and ITER Plant Description Document (IPDD), in providing plant descriptions, general safety criteria, operational scenarios, etc. It will also reference Design Description Documents (DDDs), in which the system specific safety design analysis is covered. NSSR-1 is being organized as an integrated document in 9 volumes plus appendices with a target of approximately 650 pages total. A first draft of NSSR-1 will be ready by the end of August 1996 for internal review. In October, there will be an informal TAC (Technical Advisory Committee) review on safety in which the main NSSR-1 results will be discussed and a second draft of NSSR-1 for formal TAC review will be issued on November 12. A safety assessment based on NSSR-1 will be a part of the Detailed Design Report to be delivered by the ITER project at the end of 1996. Emphasis will then shift to NSSR-2, to be produced by early 1998, moving more toward construction application.

The morning part of the first day of the meeting was devoted to presentations by the Director, Dr. R. Aymar, and by the design divisions on the current project status. The Director gave a survey of the main changes in the project as a result of Point Design Review Meeting held in January-February this year and briefly explained the project milestones till the end of EDA and the project agenda for 1996. The main 1996 deliverable, the Detailed Design Report (DDR), will be available for the ITER Council Meeting (IC-11) in December and will include an updated GDRD, updated versions of IPDD, the ITER Physics Performance Assessment, and the ITER Safety Assessment. F. Puhn gave a presentation of the major design improvements from IDR (Interim Design Report) to the Point Design Configuration that are important to safety. C. Ahlfeld explained tokamak building and confinement layout, and D. Dilling discussed the HVAC (Heat, Ventilation and Atmosphere Clean-up) Systems. R. Haange brought the most up to the date design information for Primary Heat Transfer Systems, Remote Maintenance, and the Tritium Reprocessing System. The main improvements from the IDR which are safety-relevant include the possible seismic isolation of the pit structure and its impact on the tokamak building, the seismic load combination principle with vertical displacement events in plasma, the use of closed heat transfer system vaults with pressure containment function for the primary heat transfer systems, the number, and lay-out of heat transfer system loops, the use of HVAC in areas in and around the pit, the inclusion of a fusion power safety shutdown system, the use of unshielded remote handling casks to contain contamination, and the use of isotopic separation system to remove protium before recycling. Many of these are in response to past HTs' comments. These design evolution will be further studied by the JCT and will be presented at the TAC-10 in July for review.

The remainder of the meeting was devoted to discussions on the individual NSSR-1 Volumes:

Volume I will present the general safety design approach, safety during normal operation, defense in depth, safety functions, lines of defense, the graded approach for implementation, and safety management.

Volume II will address safety functions, safety design requirements and assessment of design compliance to requirements for major components and systems.

Volume III is to characterize radioactive source terms, chemically hazardous materials, and hazardous energy sources.

Volume IV will address effluents during normal operation and maintenance such as tritium, activation products, direct radiation, and non-nuclear radiation. The HTs were particularly interested in completeness with respect to hazardous materials, systems and activities (including waste handling, test programs and change over to the Extended Performance Phase - EPP). However, they realized that some of the streams can only be discussed qualitatively and detailed information provided at the later stage of design (in NSSR-2). A concern is the difficulty to extrapolate the effluent analysis to the Extended Performance Phase of ITER.

Volume V will address radioactive wastes, non-radioactive hazardous waste streams, and waste management at the ITER site. The only waste handling currently planned for ITER is short-term storage of components before transferring to the potential hosts. The HTs stressed that it is important to characterize the waste expected as a function of time and to fully characterize this waste (e.g. activities, contact doses, decay heat, mass and raw volume before packaging). The main purpose of the assessment is to give the potential Host Countries sufficient information to determine how it would handle the waste.

Volume VI will present the results of an assessment of personnel radiation and other industrial hazards exposures during normal operation to show that ITER shall be designed to protect site personnel and shall be maintained ALARA. The discussion resulted in some useful suggestions to include exposure from surface contamination (skin dose), to assess doses during remote handling and during change over from Basis Performance Phase (BPP) to EPP, and to look into exposure of scientific staff in ITER.

Volume VII will address results of "Reference Accident Analysis". The HTs provided useful feedback on the selection of the reference accidents. Different opinions were expressed about the categorization of passive failures like pipe ruptures and about the relative emphasis on likely versus extremely unlikely accidents. The JCT will review the set of reference accidents in the light of the comments made.

Volume VIII will discuss beyond design basis accidents. The objectives of this volume are not only connected with the future regulatory process but also with the need to show the safety and environmental potential of fusion and to show compliance with the non-evacuation goal. Balancing this volume to the HT needs is difficult because of the various approaches to beyond design basis analysis in the different countries. Different options are possible and some were discussed during the meeting. Parameter scans looking at key safety functions and parameters extending beyond Category IV events are recognized as important to show that there is no discontinuity of the risk at the edge of the design basis. Bounding analysis assuming hypothetical situations can demonstrate how robust the design is (e.g. with respect to degradation of decay heat removal). A concern here is to avoid implying that physically impossible events or conditions could happen. The discussions were very helpful in further polishing the JCT approach for Volume VIII leading to analysis specifications and plans by mid-March.

Volume IX will include a description of site hazards for the reference site, seismic safety approach and assessment, airplane crashes, tornadoes, and extreme cold temperature.

In general, the expected contents of NSSR-1 seem to satisfy HT needs and objectives at this stage. The JCT's efforts to make the approaches and date used for safety assessment transparent, such as by developing NSSR-1 SADL (Safety Analysis Data List), NSSR-1 Analysis Specifications, and NSSR-1 Safety Analysis Guidelines, were highly acclaimed. This is a key element to achieve the necessary level of quality in the NSSR-1 analysis.

The HTs made the following recommendations:

- Explanations and discussions, even if only qualitatively, are requested on: quality assurance, commissioning information, test program, maintenance conditions, human factors, design justification during normal operation, general fire protection, and sky shine.
- Some safety assessment of beyond design basis accidents (BDBA) is indispensable for NSSR-1. However, approaches for the beyond design basis are to be modified somewhat based on discussion at the meeting. A critical point is how to avoid implying that physically impossible events or conditions could happen.
- Further work was requested in the following areas, in particular: waste management, effluents, occupational safety and Category V beyond design basis safety assessment.

All by all, the meeting was very successful in co-ordinating needs, objectives and technical contents of NSSR-1 and in preparing the safety analysis to be performed by the HTs. The participation of the design divisions was highly appreciated and showed how safety is now really being incorporated into the ITER design process. The meeting clearly demonstrated that JCT, HT safety experts, and designers are functioning as a team and are determined to facilitate the siting decision by the Parties by providing an ITER Safety Assessment of high quality and in due time.

LIST OF PARTICIPANTS

EU: W. Gulden (EU TAL, NET), G. Marbach (EURATOM-CEA), A. Natalizio (EURATOM-CFFTP)
JA: T. Inabe (JAERI), T. Maruo (JAERI)
RF: B.N. Kolbasov (Kurchatov), M. Krivosheev (Efremov), V. Korzhavin (Minatom)
US: D.A. Petti (US TAL, INEL), K.A. McCarthy (INEL), B.J. Merrill (INEL)
JCT: C.E. Ahlfeld, R. Aymar, H.W. Bartels, D.A. Dilling, C.W. Gordon, R. Haange, D.F. Holland, M. Iseli, A.V. Kashirski, R. Little, H. Matsumoto, S.I. Morozov, S.J. Piet, A.E. Poucet, F. Puhn, G. Saji, Y. Shimomura, V. Tanchuk, L.N. Topilski

FIRST INDUSTRY LIAISON MEETING

by W. Ellis, Raytheon Engineers & Constructors, Meeting Coordinator

At the eighth meeting, held in San Diego, California, at the end of July 1995, the ITER Council was informed on the initiative from the U.S. side to make preparations for the meeting of industry members to discuss informally topics related to ITER as a construction project. The Council welcomed the U.S. initiative and decided that its members would provide necessary assistance in this matter.

The meeting, named the First Industry Liaison Meeting, was held on 24-26 January 1996 in San Diego, under the chairmanship of the author, and with members of industry from Europe, Japan, Russia and the U.S. participating. The number of participants was kept low to facilitate informal discussions. The ITER Parties' Fusion Programme Directors, the Home Team Leaders from each Party, the ITER Director, R. Aymar, and staff members of the JCT attended the meeting as guests. The complete list of meeting participants and guests is to be found at the end of the article.

The purposes of the meeting were to "(1) exchange opinions and reach mutual understandings among the industries of the four ITER Parties, (2) learn about roles and responsibilities of industry as at present practiced in the four Parties, (3) discuss ITER construction and EDA issues, (4) explore informally industry's potential roles in ITER, and (5) build relationships for future interactions among the Parties' industries."

The attendees had an open and useful exchange of information and ideas on ITER. The initial discussions focused on a review of industry capabilities and experience relevant to fusion and ITER, and developing mutual understandings of the differing viewpoints, philosophies, and business cultures of the industries at the meeting.

After listening to Dr. R. Aymar, who presented draft ideas involving a possible scenario for the ITER construction phase, they exchanged ideas regarding the issues and topics facing ITER in its transition to a construction project.

The meeting produced a total of three industry's "Key Issues and Topics" lists, representing progressive versions of the key issues and topics facing ITER in its transition to a construction project, as viewed by industry. These were called "Rounds".

Round 1 - consisted of the initial lists and ideas brought to the meeting by the industry groups.

Round 2 - (see box overleaf) represented the first attempt to reconcile the four separate lists of Round 1 into a single working list. Round 2 was not a simple addition of the lists of Round 1, but instead represented an attempt to find common language and common understandings. It was produced in the middle of the meeting during round table discussions.

Round 3 - time limitations restricted the content of Round 3 (see box on page 6) to the refinement of the first item of Round 2.

Participants in the Meeting listening to

INDUSTRY "KEY ISSUES AND TOPICS" - ROUND 2

1. POLITICAL BOUNDARY CONDITIONS
   - ♦ Final target
     - Delivery of a product
     - Learning
     - Cooperate to compete
   - ♦ Possibility of Junior Parties
   - ♦ Site selection

2. BASIC PRINCIPLES FOR THE ORGANIZATION OF THE CONSTRUCTION PHASE
   - ♦ Intellectual property
   - ♦ Legal entity
   - ♦ Type of contribution
   - ♦ Teaming arrangements
   - ♦ Design responsibility
   - ♦ Functional contribution

3. PROJECT STRUCTURE/MANAGEMENT/CONTROL
   - ♦ Functions and definition
   - ♦ Management models
   - ♦ Controls

4. STANDARDS
   - ♦ Q.A.
   - ♦ Adoption of common norms, codes & standards

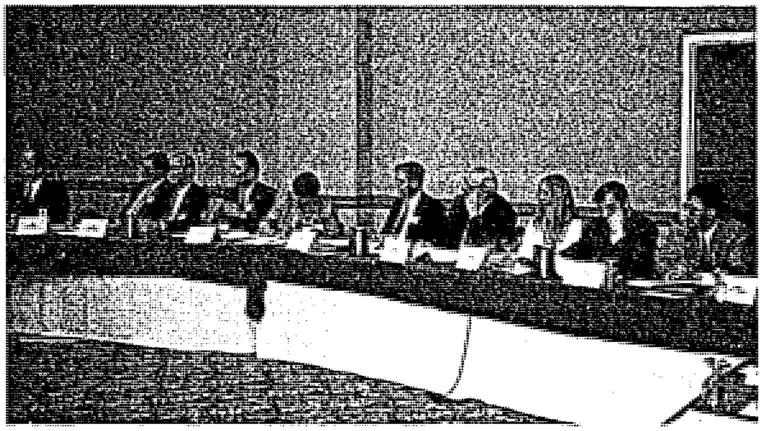
5. CONTINUITY AFTER EDA

The industries decided to meet again on a regular basis to:

a) be informed by ITER management concerning progress and issues, and

b) provide information and opinions to ITER management regarding the practical implementation of the project.

The Japanese side has offered to host the next meeting, which might be held at the end of this year, or early in 1997.



the presentation by the ITER Director, Dr. R. Aymar

INDUSTRY "KEY ISSUES AND TOPICS" - ROUND 3

1. POLITICAL BOUNDARY CONDITIONS

A. SITE SELECTION
- ♦ Continuity
- ♦ Shares will depend on site
- ♦ Standards
- ♦ Technical boundary conditions
- ♦ Timing
- ♦ Licensing, regulatory conditions

B. FINAL TARGET
- ♦ Delivery of a product
  - Meeting performance, cost, schedule

C. LEARNING
- ♦ How to do EPCM (Engineering, Procurement, Construction Management) of next step DEMO)
- ♦ Important for participating companies to experience the development of key technology/components for themselves
- ♦ This experience can be gained using the "in-kind" principle
- ♦ Reach agreement on definitions and divisions of key technologies

D. JUNIOR PARTIES

LIST OF ATTENDEES

EU:
♦ Gerard Grunblatt, GEC Alsthom (France)
♦ Feliciano Fuster Jaume, ENDESA (Spain)
♦ Joaquin Calvo, ENDESA (Spain), Technical Cabinet Director, Assistant to F. Fuster Jaume
♦ Mathias Köhler, Siemens (Germany)
Dr. Charles Maisonnier, Fusion Program Director
Prof. Romano Toschi, HTL

JA:
♦ Yuji Kaneki, JAIF
♦ Kenichi Kakizawa, Toshiba
♦ Nobuyuki Morino, Hitachi
♦ Haruhiko Tomita, Mitsubishi
Dr. Naomoto Shikazono, Executive Director, JAERI
Dr. Yoshitaka Ikeda, Deputy General Manager, Fusion Program Division, JAERI (Secretary to Dr. Shikazono)
Dr. Shinzaburo Matsuda, HTL
Ellen Shang Travis, Interpreter
Yae-Joong Kim Watkins, Interpreter

RF:
♦ Dr. Victor A. Durynin, Joint Stock Co. "Izhorsky Zavod"
♦ Dr. Vladimir I. Kolukhov, Industrial Corp. "Severnaya Verf"
♦ Dr. Yuri I. Vishnevski, Industrial Corp. "Electroapparat"
Acad. Evgenij P. Velikhov, Fusion Program Director
Dr. Nicolay S. Cheverev, Minatom
Dr. Oleg G. Filatov, HTL
Ms. Tatyana Povetnikova, Interpreter

US:
♦ John Davis, McDonnell Douglas
♦ Dr. William R. Ellis, Raytheon
♦ Dr. John Gilleland, Bechtel
♦ Robert Mucica, Rockwell (attending 1/24/96)
Warren Marton, Office of Fusion Energy, DOE
Dr. Charles C. Baker, HTL

ITER JCT: Dr. Robert Aymar, ITER Director, Dr. Yasuo Shimomura, Deputy to the Director, Martin Drew, Assistant to the Director for General Policy, Katia Golubchikova, Interpreter

♦ Industry

REMOTE CONTROL OF ITER EXPERIMENTS

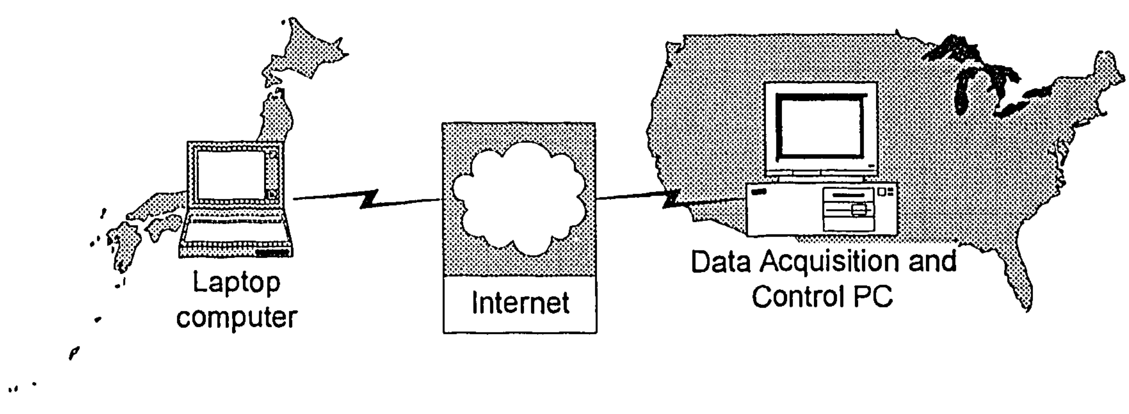
by Dr. R. Scott Willms, Los Alamos National Laboratory

Among the problems associated with the ITER project is the difficulty of sharing experimental results with colleagues on separate continents. Interrelated experiments are being conducted in Japan, Russia, Europe and the United States. Results in one place influence experiments and designs which are being performed half a world away. Free and effective communications are required to make this process successful. Fortunately, as ITER makes advances in plasma science and fusion technology, others are making advances in communications technologies. Beyond the telephone and mail, ITER personnel are now well acquainted with voice mail, fax and, of course, e-mail. All of these communications methods are effective and essential to the success of ITER.

For communicating experimental results, however, each of these techniques is indirect. That is, a researcher at one location conducts experiments, collects data, reduces the information and then communicates it to colleagues elsewhere. While this traditional means of scientific communication is fine for most results there are times when remote colleagues would benefit from observing and participating in experiments as they occur. This would enable the remote colleagues to better appreciate systems operation and dynamics.

An emerging "remote control" personal computer (PC) technology is making it relatively simple for colleagues to participate in remote experiments. This was demonstrated at the December, 1995 Combined Tritium Plant and Vacuum & Pumping Technical Meeting in Naka, Japan. Experiments are being conducted in the US at the Tritium Systems Test Assembly of Los Alamos National Laboratory on the palladium membrane reactor (PMR) for recovering hydrogen isotopes (including tritium) from water and methane which are expected torus effluent "impurities". Besides the reactor itself, the PMR test stand includes flow controllers, pressure transducers, humidity probes and thermocouples. These are monitored and controlled with a data acquisition and control PC. The PC is running one of several commercial, relatively inexpensive, easy-to-setup SCADA (supervisory control and data acquisition) software packages. This software interfaces with the experiment's transducers and controllers using standard, commercial hardware. Recently, remote control software was added to the SCADA PC. This enables the PC, and thus the experiment, to be controlled by a remote PC which is also running remote control software. For actual control to occur the two computers must, of course, be interconnected and this can be accomplished by telephones and modems, local area networks or a wide area network such as the Internet.

The accompanying diagram shows how the PMR experiment in the US was controlled by a laptop computer running in Japan. Both computers were connected to local area networks which were in turn connected to the Internet. To set this up, before leaving for Japan the US experiment was left running and the US computer was left with the remote control software waiting for a connection. After traveling to Japan a laptop computer was attached to the Internet at the Naka site. The laptop video was output not only to the laptop screen but also to a projection panel which was placed on a standard overhead projector. This allowed the live data from the US experiment to be projected before the Naka assemblage of about 35 persons. In front of the meeting participants commands were given to increase the methane, water and argon flows which was being fed to the PMR. The PMR uses catalyst and permeator tubes to recover the hydrogen in ultrapure form from the water and methane in a single processing pass. The audience watched as, indeed, the product hydrogen increased in proper proportion to the PMR feed flowrate increases. This was displayed both as instantaneous data on a mimic display and as 15 minute running results on a trend plot.



Comment on Scott Willms' Article
by R.R. Parker, Head, ITER Garching JWS

As one of the members of the audience, I found Scott Willms' on-line experiment fascinating. Of course, I had known about the successful control of the Alcator C-MOD tokamak from a remote control room in Livermore nearly one year ago, but this was the first time I had witnessed an on-line remotely controlled experiment. Although controlling a tritium processing loop, or even running a relatively small tokamak-like C-MOD cannot be compared to the complexity of running ITER, or even some of its subsystems, it is clear that the technology for doing so is here today. While there will, no doubt, be a large and elaborate control room at the ITER site, one can envision one or more similar control rooms located in each of the Parties participating in ITER's construction and operation phase. Working in such control rooms, teams of experimentalists would be able to operate ITER and carry out run campaigns tailored to the their interests. From the experimentalist's point of view, there is little difference if the machine is 500 m or 5000 km away from the control room; in fact, access vessel maintenance, installation of diagnostic systems, etc., must then be done remotely. Paradigms for conducting "science at a distance" experiments already abound within the space programme. We are indeed fortunate to be living in an era in which technology has made such activity possible. The world fusion programme should take full advantage of these opportunities in planning for the operating phase of ITER.

It was generally agreed by those who observed this demonstration that a much better appreciation of PMR operations was gained as a result of watching this live, remote control demonstration. Certainly, this form of presentation was favorably received by the Naka audience. It is believed that remote control of experiments will foster better communications on other ITER projects as well.

For more information, please contact Scott Willms, Mail Stop C-348, Los Alamos National Laboratory, Los Alamos NM 87545, USA; phone: 505-667-5802; fax: 505-665-9132; or e-mail: rsw@lanl.gov.

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