
REVIEW OF FAST REACTOR ACTIVITIES AT OECD (NEA)

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The Committee on the Safety of Nuclear Installations (CSNI) initiated several studies and reports in late 1979, under the guidance of its Group of Senior Experts on LMFBR Safety R&D⁺. These activities have now reached their goal, or will do so in the course of 1981.

International status reports have been published, or are nearing completion in three relatively well-developed areas of LMFBR safety technology :

- (i) the role of fission gas release in the propagation of fuel failure /published in mid-1980 as CSNI Report N° 407/ ;
- (ii) reactivity monitoring in an LMFBR at shutdown /in the press now as CSNI Report N° 62/ ;
- (iii) increasing the reliability of fast reactor shutdown systems /to be published in 1981/.

The fourth report planned in the series will deal with interactions between sodium and concrete, including the effect of defective liners.

During 1980-1981, Expert Groups have been studying three actively evolving areas in LMFBR safety :

- (i) containment R&D : a Group of Experts produced a report in 1980 which reviewed and brought into focus the technical issues determining conceivable challenges to an LMFBR containment, having particular regard to the hypothetical core disassembly accident. Having completed its task, the Group has been disbanded.

⁺ This Group was formed in 1978, consisting of CSNI delegates (or alternates) from Member countries sponsoring major research in the field, and the Commission of the European Communities.

- (ii) natural circulation cooling : in 1980 a Group of Experts exchanged a substantial quantity of information on current and planned research pertinent to demonstrating a capability to cool an LMFBR core in normal and degraded conditions. A status report is to be completed by the Group in 1981, surveying the ongoing work and any additional R&D considered necessary.

- (iii) fuel failure modelling : an ad hoc meeting in early 1980 discussed the relationship of consequence models for fuel failure in accidents to the planning of confirmatory fuel experiments. Detailed descriptions of key fuel failure phenomena in various accident scenarios have since been exchanged, and the participants reconvened in March 1981 to discuss the descriptions and draw conclusions on the implications for future R&D.

Given recent shifts in several participating countries in the emphasis of safety research away from the LMFBR in favour of the LWR, CSNI decided in November 1980 that the Group of Senior Experts should be disbanded for the time being, and that the ongoing work it supervised should be completed in 1981.

The CSNI Group of Experts on Nuclear Aerosols in Reactor Safety organised a Specialist Meeting on the subject, which was hosted by the Oak Ridge National Laboratory in conjunction with the USNRC, on 15th-17th April 1980 in Gatlinburg, Tennessee, USA. The meeting focussed on new information since the publication in October 1979 of the CSNI State-of-the-Art Report (N° 1) on the topic, and identified areas needing additional R&D emphasis - particularly information relevant to LWR accident sequences. Another Specialist Meeting may be held around 1983.

CSNI also continued working in 1980 in the area of (molten) fuel-coolant interactions (FCI's). An interpretation exercise was completed in December 1980 which contributed to clearing up theoretical uncertainties about the physical processes involved in FCI's. Researchers in a dozen laboratories tried to generate coherent, quantitative descriptions of the micro-physical stages of two well-instrumented groups of FCI experiments. At the Workshop concluding the exercise, they agreed on the general stages that are needed for an FCI to occur, and recommended additional research needed in support of the safety cases for the LMFBR and LWR. The Workshop recommended that a second such exercise be organised, that a CSNI Group of Experts continue studying the theoretical aspects of FCI's, that another Newsletter on current research be issued in late 1981, and that a fifth CSNI Specialist Meeting (perhaps in the first half of 1982) should concentrate on the practical implications of current understanding of FCI's for LMFBR and especially LWR safety.

Gas-Cooled Fast Reactors
(Nuclear Development Division)

Since 1971, the NEA Co-ordinating Group on Gas-Cooled Fast Reactor Development endeavoured to establish a co-ordinated programme for work to be undertaken on GCFR development, at their own expense, by national research centres and by industrial undertakings in the participating countries. Ten countries and two international bodies participated in the activities of the Co-ordinating Group : Austria, Belgium, France, the Federal Republic of Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, the United States, the Commission of the European Communities, and the European Association for the Gas-Cooled Breeder Reactor (GBRA).

In addition to its programme on the consolidation of the reference design of a GCFR, the Co-ordinating Group sponsored two specialists' meetings during 1980 :

- the 6th GCFR Heat Transfer Specialists' Meeting at the Berkeley Nuclear Laboratories of the Central Electricity Generating Board, UK, on 15th-17th September 1980 ;
- a GCFR Benchmark Calculations Meeting at Windscale, UK, on 18th-19th September 1980.

An extensive GCFR Status Report was published at the beginning of the year. It concluded that the GCFR presented the possibility of an attractive system. Preparation of the Report reinforced the Group's view that no feasibility issues could be envisaged for which there was no clear line of attack.

At a meeting held in October 1980, the OECD Steering Committee for Nuclear Energy agreed that the activities of the Co-ordinating Group could not at this stage be given priority in the overall programme of NEA and decided that the mandate of the Group should not be extended beyond the end of 1980.

Fast Reactor Physics
(Nuclear Science Division)

The NEA Committee on Reactor Physics held their 23rd meeting in September 1980 at the Argonne National Laboratory-West, Idaho Falls, USA. Since 1979, and reflecting changes in the mandate of NEACRP, the Committee has established a more equal balance between its fast reactor and its thermal reactor interests. About one half of the 23rd meeting was concerned with topics relevant to fast reactor development in the NEA Member countries.

The Committee accepted with regret that for financial reasons the IAEA had not been able to send either technical or secretariat observers to this meeting. For this reason they rely heavily on NEA participation in IWGFR and IWGNPPCI meetings for coordination of their fast and thermal reactor physics activities with those sponsored by IAEA. The Committee continues to recognise that there is a need for close collaboration with the IAEA so that there is complementarity in the technical work and in the choice and scheduling of specialists' meetings and symposia. The Committee noted that this was particularly important for fast reactor development which particularly concerns the NEA Member countries.

At the 23rd meeting, four technical sessions were devoted to topics of importance in fast reactor physics : nuclear data for structural materials (for reactivity and shielding) ; the interpretation of critical assembly experiments ; new developments in heterogeneous cores ; and neutron deep penetration studies. Summaries of the papers presented, and of the Committee discussions, are available in the document NEACRP-L-248 (unrestricted).

The Committee terminated the international benchmark on a large (1250 MWe) LMFBR. This comparison calculation was the first such international comparison exercise since the so-called "Baker Model" comparison of 1970 which focussed on breeding and neutron balance. It was also the first comparison for a large "commercial sized" LMFBR system, the first comprehensive comparison between the current adjusted data sets (e.g. FGL5 and CARNAVAL-III and -IV) and the unadjusted sets (e.g. ENDF/B-IV), and is the most comprehensive of such comparisons - including a number of parameters not included in previous comparisons (e.g. control rods and certain safety parameters). Calculations and review of the observed discrepancies are now published as NEACRP-L-243.

The same LMFBR geometry has been adopted by NEACRP for a similar international benchmark exercise on fuel burn-up in a fast reactor. The parameter sets for this exercise have been distributed to NEA representatives, and calculations are expected to be submitted in June 1980 for review at the next NEACRP meeting.

In connection with the SMORN-III Specialists' Meeting on Reactor Noise, a benchmark exercise is organised to compare frequency spectra analyses of noise data. Recordings from Phenix are included as one of the sample tests in this benchmark. Participation in this Specialists' Meeting by non-OECD countries is through collaboration with IWGNPPCI.

In 1980, a Specialists' Meeting on Nuclear Data and Benchmarks for Reactor Shielding was sponsored by NEACRP and was held in Paris from October 27th to 29th. This meeting allowed experts from NEA Member countries to review progress since 1976 in their on-going collaborative projects.

The capabilities now exist for performing sensitivity analyses in complex geometries. Several papers reported the development, at different laboratories, of multi-dimensional Monte Carlo transport codes, incorporating techniques such as correlated tracking or differentiation of the scoring probabilities. These methods were illustrated by application to generic design problems. The meeting reviewed the multigroup data sets in general use and emphasised the importance of the covariance matrices which are currently available for only a limited number of materials. The major experimental shielding programs were presented and there is now general agreement on the conduct of benchmark exercises. Five papers reported the various approaches that have been adopted for data adjustment which is now widely accepted as essential in order to derive quantitative information from benchmark experiments.

A further benchmark exercise will be carried out in 1981/82. The proceedings of the 1980 meeting are available for sale at the NEA.

The 24th meeting of NEACRP will be held at the Winfrith laboratory of UKAEA, from 14th to 18th September, 1981. The agenda for this meeting includes the following technical topics relevant to fast reactors: pin/plate heterogeneity calculation and comparisons with experiment; beta and gamma decay heat measurements for fast and thermal reactors, particularly for Pu-239; progress of intercomparison of reaction rate measurements in fast reactors; delayed neutron data and reactivity scales; heterogeneous core developments; and reviews of benchmark activities.

The SMORN-III Specialists' Meeting is scheduled for 26th to 30th October 1981, in Tokyo, Japan. A Specialists' Meeting on "interpretation of in-core instrumentation" is planned for 1982.

The publication sponsored by NEACRP on "The Status of Fast Neutron Reactor Physics" is scheduled for publication by the NEA in late 1981. The six sections of this publication are prepared by experts in NEA Member countries and cover: clean core physics; control rod design; blanket physics; reactivity coefficients; burn-up characteristics; and shielding.

Nuclear Data for Fast Reactors

(Nuclear Science Division)

The NEA Nuclear Data Committee will hold their 22nd meeting in April 1981 at Cadarache. The activities of this Committee are oriented more towards long-term scientific research in support of all nuclear energy systems, rather than specifically towards current fast reactor problems. Nevertheless there are a number of activities sponsored by this Committee that refer to fast reactor applications review of high priority data requests for fast reactors; international benchmark exercises on nuclear model calculations for fast neutron reactions; and an international benchmark on derivation of nuclear excited level spacings in the resolved resonance region.

During their 22nd meeting, NEANDC will sponsor an open seminar on the convergence of integral and microscopic nuclear data for fast reactors.

Other Activities of Interest to IWGFR

(i) NEA Data Bank

The NEA Data Bank provides both secretariat and technical support to NEANDC and NEACRP, and acts as a computer code library and nuclear data centre for Japan and the European Member countries of NEA. The work of the Data Bank reflects that of the Committees and the interests of scientists and engineers in Member countries. There are no specifically fast reactor activities to report in 1980.

(ii) Nuclear Fuel Cycle Requirements and Supply (Nuclear Development Division)

A new edition of the report "Nuclear Fuel Cycle Requirements and Supply Considerations Through the Long-Term" (Yellow Book) will be published in the Autumn of 1981, a new edition of "Uranium Resources, Production and Demand" (Red Book) during the Winter.