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Dr. William V. Johnston
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Division of Reaktor Safety Research
U.S. Nuclear Regulatory Commission

Washington, DC 20555

U.S.A.

Institut für
Reaktorbauelemente

Datum: August 14, 1978/de

Bearbeiter: W.B. Murfin

Telefon: 07247/ 82 - 3462

Ihre Mitteilung:



Dear Dr. Johnston:

Enclosed is my tenth monthly report, covering the months of June and July, 1978.

Sincerely,

W.B. Murfin
Kernforschungszentrum Karlsruhe
Institut für Reaktorbauelemente

Copies to:

Dr. D.J. Mc Closkey, Sandia
Prof. Dr. U. Müller, IRB
Dr. Fischer, PNS

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1. Introduction.

This is the tenth report of Walter B. Murfin, USNRC representative at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe, FRG. The report covers the period of June and July, 1978. My principal duties include core/concrete modeling, cognizance of German research efforts, and tasks assigned in Projekt Kernschmelzen.

2. Projekt Kernschmelzen.

2.1 Core/Concrete Modeling.

A model devised by Dr. M. Reimann (IRB) for pool side-wall heat transfer is being built into the WECHSL code.

2.2 Fission Product Release.

The release of a fission product element out of a pool of molten reactor components is determined by three processes:

- (1) determination of the specific chemical form(s) of the element in the multicomponent melt,
- (2) transport of the given element to a liquid/gas interface, and
- (3) transport from the liquid surface into the gas phase.

Modeling was begun with the last process, which is the most important. A theoretical model was devised by Dr. W. Ereitung of KfK (INR). This preliminary model describes the movement of molecules, starting from the liquid surface, through a laminar boundary layer, and into the flowing atmosphere.

An attempt was made to correlate the theoretical and experimental values for a SASCHA test (S-172) in which no boiling took place, none of the melt splashed out, and no significant reactions between the melt and the crucible occurred.

The theoretical model displays the correct order of magnitude of released masses for elements whose experimentally measured releases actually differed by three orders of magnitude (Cs and Sb). A direct comparison is difficult because the chemical form of the fission product elements (see point (1) above) is not well known, especially for Cs. For further development of the theoretical model, SASCHA experiments with single component melts are planned. In this case, processes (1) and (2) above are unimportant for the measured release rates.

After mid August, 1978, the new work location of Dr. Ereitung, developer of the model, will be Sandia Laboratories.

2.3 Other Core Melt Research

2.3.1 Estimation of the Liquidus and Solidus Curves of Concrete-Corium Melts.

The Schroeder-van Laar equations have been used for estimation of the solidification ranges of concrete-corium EX3 melts as a function of the concentration of the components. Liquidus and solidus curves for different concrete-corium mixtures were calculated (Figure 1). The calculations are based on experimental results which must be considered highly conservative. An approximation of this model has been built into the WECHSL code.

2.3.2 Experiments on the Interaction of Steel Melts with Concrete.

Detailed facility planning has been begun. A number of WECHSL runs have been made and the required power levels have been determined. It appears entirely feasible, without excessive power, to maintain 100 Kg steel melts at 2500° C and 300 Kg melts at 2000° C for periods of around 10 minutes. Lower temperatures can be maintained for longer times.

WECHSL runs have also established that it is feasible to maintain temperatures well above steel melt for periods of at least 10 minutes by addition of thermite in not unreasonable quantities during the test.

3. Other Nuclear Safety Research at KfK

3.1 COSIMA Facility

The COSIMA facility was designed to test fuel rod behavior during simulated out-of-pile blowdown conditions. Two types of rods are used; a simulated, internally pressurized rod (SIM) with actual cladding and spacers, or an unpressurized instrumented rod (WUS) for measurement of heat transfer.

The layout -schematically shown in Figure 2- is 5 stories tall. Immediately before the test, when pressure, temperature, etc. have reached desired values, power is applied to the test section. Valves Ve7 and Ve8 are suddenly closed, Ve11 and Ve12 are simultaneously opened, and blowdown takes place through control valves Ve13 and Ve14.

The blowdown solution, data gathering, and hardware control are managed by the CALAS system. A prompt evaluation program allows tabular and graphical data display immediately after each test.

About 50 blowdown experiments have been conducted and analyzed. So far, about every other test has been completely within the desired test range. Of the remainder, about half the measurements in each test are usable.

3.2 On-line Computer Program for Two-phase Flow.

An on-line computer program has been developed for use in the KfK two-phase flow test loop. (Figure 3). Mass flow, steam quality, theoretical void fraction, and superficial velocities in the test section are immediately printed out.

4. Kernschmelzen Sachverstaendigenkreis (SK)

The 30th meeting of the SK was held at Bonn on June 5, 1978. At this meeting, a number of suggestions for future meltdown research work were considered. Working groups were formed to report on these suggestions in the areas of:

- I. - Meltdown Paths
- II.- Steam Explosions.
- III- Core/Concrete Interactions
- IV - Containment Loading

I attended WG II as an observer and WG III as a member. Because of the preliminary nature of the actions taken, a detailed report is inappropriate now. The suggested work programs will be reported on following action by the full SK in the future.

5. Forthcoming Events of Interest.

The European Nuclear Conference will present a joint meeting of ENS and ANS entitled "ENC '79", to be held May 6-11, 1979, at Hamburg, Germany. The theme is "Nuclear Power Option for the World".

Summaries of contributed papers must reach the executive office before October 1, 1978. Because of the short time involved, and because considerable American interest can be expected, information sheets and forms are appended to this report. It should be noted that all papers will be presented in English.

Summaries should be mailed as soon as possible to:

Executive Office
European Nuclear Conference
c/o Kerntechnische Gesellschaft
Heussallee 10
5300 Bonn 1
West Germany

In order to meet the deadline, contributions must be sent airmail not later than September 20, 1978.

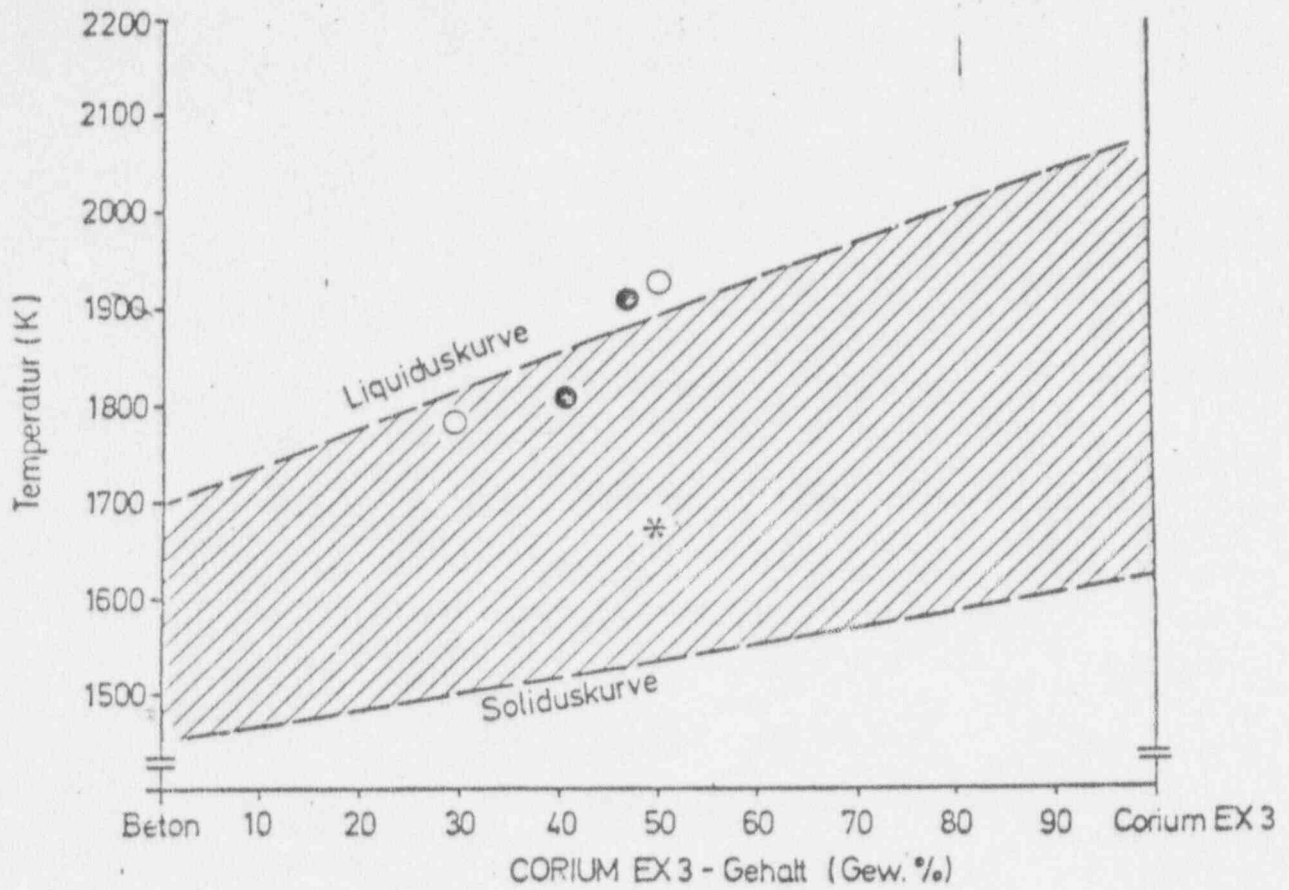
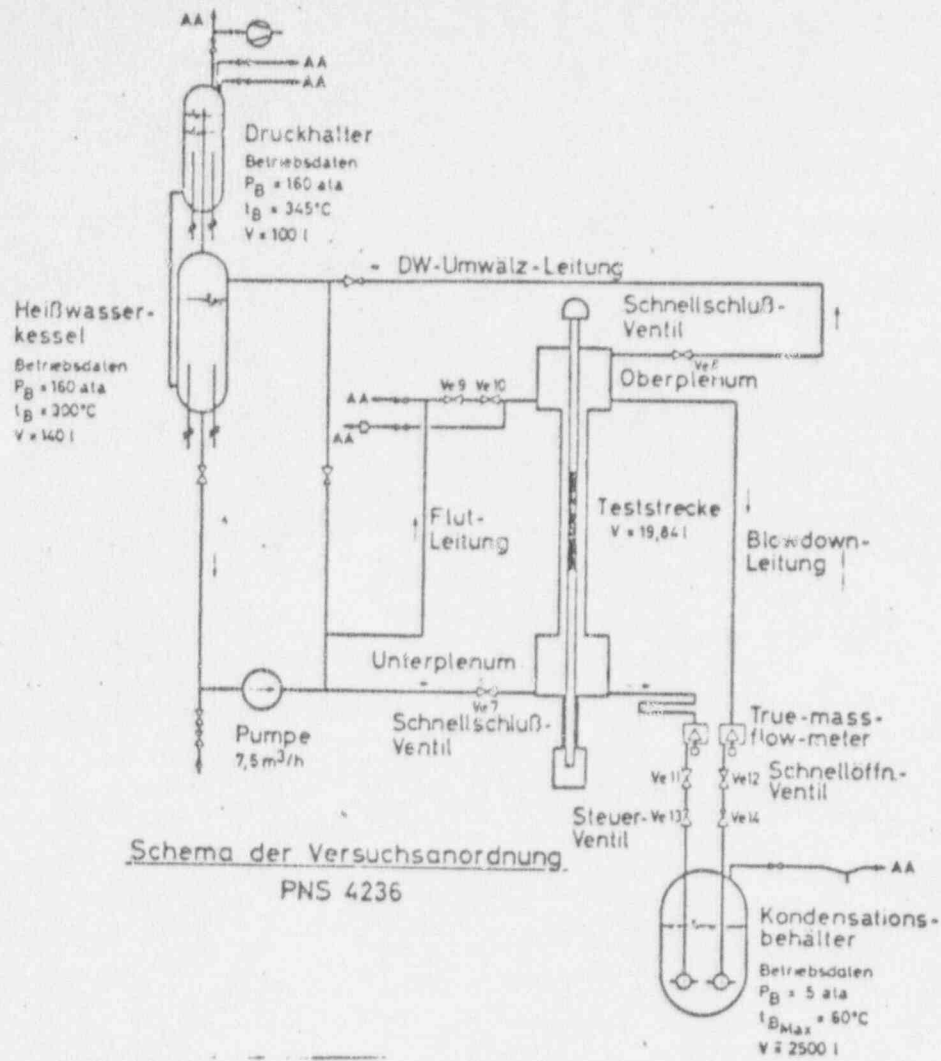


Figure 1. Liquidus and solidus temperatures of corium/concrete mixtures. The temperatures are shown as functions of the weight content of Corium EX3.



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Figure 2. Schematic of the COSIMA facility.

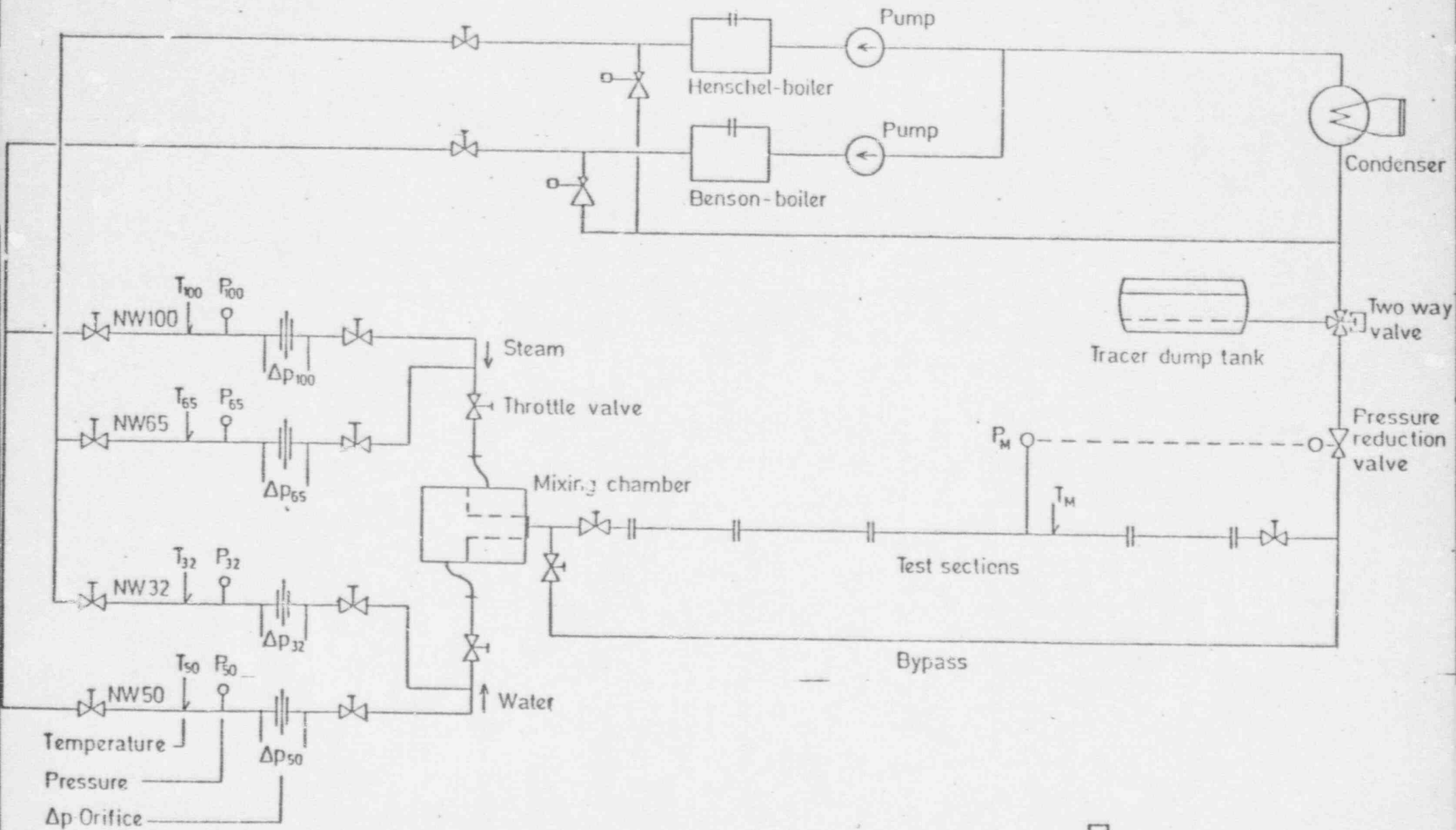


Figure 3. Schematic of the KfK two-phase steam/water loop.



ENC '79 European Nuclear Conference

A joint meeting of ENS and ANS

May 6 to May 11, 1979 - Hamburg, Germany

ANNOUNCEMENT & CALL FOR PAPERS

Theme: NUCLEAR POWER OPTION FOR THE WORLD

The Congress will be organized on behalf of the European Nuclear Society (ENS) and the American Nuclear Society (ANS) by Kerntechnische Gesellschaft im Deutschen Atomforum e. V. (KTG).

Jointly with ENC '79, Deutsches Atomforum e. V. (DAF) is organizing the 7th FORATOM-Congress from May 6 - 9, 1979, at the same location.

The conference will be focused on the achievements and goals of Nuclear Energy in Europe and the world, in particular regarding reactor design trends, operating experience and the nuclear fuel cycle. You are cordially invited to contribute one or more papers in summary form for sessions a) to j), see below.

The papers selected will be presented and discussed in a number of parallel sessions.

In addition, papers on topics of special current interest will be invited from eminent specialists and presented in full plenary sessions and special invited sessions.

The working language of the parallel sessions is English. Simultaneous translations will be provided for all plenary sessions from and into the English, French and German languages.

OFFICIALS OF THE MEETING

Chairman	Mr. K. H. BECKURTS
Vice-Chairmen	Mr. A. COLOMB Mr. A. DEJOU Mr. J. R. DIETRICH Mr. H. H. GOTT Mr. W. R. KIMEL Mr. C. SALVETTI
Program-Committee	Mr. A. GAUVENET
Technical Visits Committee	Mr. H. KRÄMER
International Supporting Committee	Mr. L. M. MUNTZING
Executive Office	Mr. P. HAUG Mr. Th. ROSER

1. Subjects for contributed papers in parallel sessions.

- Design and construction
- Operation of nuclear power plants
- Fuel technology
- Reactor physics and fuel management
- Nuclear safety, radiation protection and risk assessment
- Environmental aspects
- Quality assurance and reliability
- Reprocessing, transport and waste management
- Nuclear components
- Alternative applications of nuclear energy

2. Subjects for invited papers in parallel sessions.

- Fusion
- Energy Strategies
- Technology Transfer
- Education and Training
- Public Information
- Nuclear Power in Developing Countries
- Safeguards and Physical Security

3. Information and instructions for authors

a) General Information

Summaries of contributed and invited papers will be submitted to the Program Committee, responsible for review and selection of contributed papers.

Papers have to be presented orally in English and the summaries will be published in the "Transactions of the American Nuclear Society". All accepted contributed and all invited summaries become the property of ENS and ANS and - excluding technical content - may be edited to ensure uniformity of presentation.

b) Deadline

1 original and 19 copies of each summary, with the completed "Summary Cover Sheet" attached to each, must reach the Executive Office by October 1st, 1978.

c) Languages

Summaries must be written in English.

d) Content

The summary must present facts that are new and significant. It must define a problem, reflect the current state of the art in the field concerned, and contain the main ideas, the approach adopted, the results and conclusions, and their discussion.

e) Length of compacts

A contributed summary must not exceed 1500 words nor be less than 1200 words, an invited summary must not exceed 350 words nor be less than 250 words. Each figure and table will count as 150 words, and each line of an equation as 10 words. Limit the title to 10 words and reduce the number of authors listed under the title to the minimum possible.

f) Title and author's name

In order to have standardised title pages for all papers, the Program Committee requests authors to adopt the following pattern:

EUROPEAN NUCLEAR CONFERENCE

May 6 - 11, 1979, Hamburg

Title of paper _____

By _____
(Author(s))

Organization _____

Country _____

g) Tables, Figures

Figures and tables are normally printed one column wide (3in.). Lettering on figures must be at least 1 mm after reduction.

Each table or figure must be on a separate page. In at least one copy of the summary the figures must be high-quality gloss photographs or reproducible black-on-white drawings.

h) References

References should be listed at the end of the summary and indicated in the text by superscript numbers. Reference information should be listed in this order: author(s); title; "Journal" name, volume number, page number, and date; "Book" name, publisher, volume, edition, page number, date; "Report" name, publishing agency, report number, page number, date.

i) Restricted Information

It is the responsibility of the authors to protect classified or proprietary information.

j) Review procedures

Each contributed summary received by the deadline will be reviewed by the Program Committee and a specialized Sub-Committee.

The principal author will be notified of the status of his summary about November 15, 1978 by the Executive Office.

k) Attendance

The presence of all authors will stimulate and facilitate the discussions. Their participation in the conference will therefore be highly appreciated.

It is essential that one of the authors be in attendance to present the paper.

l) Presentation

The time allowed for presentation and discussion will be fixed when the summary is accepted. The size for slides will be 2 x 2 in. A maximum of 1 slide for every 3 min. of presentation time is advised for.

m) Mailing address

Please send summaries prepared in accordance with these instructions together with the Summary Cover Sheet to:

Executive Office ENC '79
c/o Kerntechnische Gesellschaft
Heussallee 10
D-5300 Bonn 1

4. Additional information

a) Registration

A provisional program and registration form will be distributed in autumn 1978. Additional copies may then be obtained from the Executive Office ENC '79.

b) Technical visits

Short technical visits in the Hamburg area during the conference as well as scientific and technical post congress tours will be arranged for.

c) Ladies program

A special program is being planned for accompanying persons.

d) Place

Congress Centrum Hamburg
Am Dammtor
D-2000 Hamburg 36

e) Hotel accommodation

A sufficient number of rooms will be available in all categories.

f) Receptions and banquets

Official lunches and banquets with guest speakers are planned, and in addition receptions will be offered by official organizations, local authorities and the German Organization and Supporting Committee.

g) Deutsche Lufthansa has been appointed official carrier for ENC '79 and the 7th FORATOM Congress.

<p align="center">SUMMARY COVER SHEET FOR CONTRIBUTED PAPERS</p>

For additional copies of this document, please write to

Executive Office European Nuclear Conference c/o Kerntechnische Gesellschaft, Heussallee 10, D-5300 Bonn 1

ENC '79

Hamburg

Title of Summary _____

Author(s) 1. _____

2. _____

3. _____

4. _____

Organization (please give corporate or organizational title and address)

1. _____

2. _____

3. _____

4. _____

Speaker 1 2 3 4 (please circle)

Subject No.:

a b c d e f g h i

circle only one

Alternative subject suggestion:

a b c d e f g h i

Number of pages _____

Tables _____

Figures _____

Has the substance of this summary been presented or published previously or submitted for publication?

☐ Yes☐ No

If so, where and when? _____

Would you prefer to present your paper in a poster session?

☐ Yes☐ No

Author to receive correspondence 1 2 3 4 (please circle)

Location (Street, etc.), if different from above _____

Zip _____

City _____

Country _____

Which authors will attend the conference? 1 2 3 4 (please circle)

(Place) _____

(Date) _____

(Signature) _____