NEA/CSNI/R(97)3

OECD

NEA

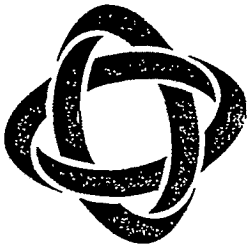
CSNI

INTERNATIONAL STANDARD PROBLEMS (ISP)

BRIEF DESCRIPTIONS

(1975-1997)

July 1997



COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS
OECD NUCLEAR ENERGY AGENCY
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OECD

The Convention establishing the Organisation for Economic Co-operation and Development (OECD) was signed on 14th December 1960.

Pursuant to Article 1 of the Convention, the OECD shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;

- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and

- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries are Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter : Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and the Republic of Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

NEA

The OECD Nuclear Energy Agency (NEA) was established on 1st February 1958 under the name of the OEEC European Nuclear Energy Agency. NEA membership today consists of all European Member countries of OECD as well as Australia, Canada, Japan, the Republic of Korea, Mexico and the United States. The Commission of the European Communities takes part in the work of the Agency.

The primary objective of NEA is to promote co-operation among the governments of its participating countries in furthering the development of nuclear power as a safe, environmentally acceptable and economic energy source.

NEA works in close collaboration with the International Atomic Energy Agency (IAEA), with which it has concluded a Co-operation Agreement, as well as with other international organisations in the nuclear field.

CSNI

The NEA Committee on the Safety of Nuclear Installations (CSNI) is an international committee made up of scientists and engineers. It was set up in 1973 to develop and coordinate the activities of the OECD Nuclear Energy Agency concerning the technical aspects of the design, construction and operation of nuclear installations insofar as they affect the safety of such installations. The Committee's purpose is to foster international co-operation in nuclear safety amongst the OECD Member countries.

FOREWORD

Over the last twenty years the NEA Committee on the Safety of Nuclear Installations (CSNI) has sponsored more than forty International Standard Problems (ISPs) in the fields of in-vessel thermal-hydraulic behaviour, fuel behaviour under accident conditions, fission product release and transport, core/concrete interactions, hydrogen distribution and mixing, containment thermal-hydraulic, and iodine behaviour in the containment. ISPs are comparative exercises in which predictions of different computer codes for a given physical problem are compared with each other or with the results of a carefully controlled experimental study. The main goal of ISP exercises is to increase confidence in the validity and accuracy of tools which are used in assessing the safety of nuclear installations. Moreover, they enable code users to gain experience and demonstrate their competence. ISP exercises are performed as "open" or "blind" problems. In an open Standard Problem exercise the results of the experiment are available to the participants before performing the calculations, while in a blind Standard Problem exercise the results are locked until the calculation results are made available for comparison.

While code verification is primarily a task for institutions developing codes, requiring considerable financial resources for performing a large number of calculations and comparing relevant experimental results with calculated data, ISP exercises can be considered as a supplementary activity validating appropriate code applications through the analyses of experts different from the code developers.

Experiments selected to support ISP exercises are exceptionally well documented; they provide the framework for several code validation matrices.

ISPs

Number	Completion Date	Title
1	1975	Standard Problem 1 - Edwards' Pipe
2	1975	Analysis of Semiscale Blowdown Test 11
3	1977	CSNI Standard Problem 3; Comparison of LOCA Analysis Codes
4	1978	United States Standard Problem 6 and International Standard Problem 4: Comparison of the Standard Problem Calculations with Measured Experimental Data for Semiscale Test S-02-6
5	1979	United States Standard Problem 6 and International Standard Problem 4: Final Comparison Report on LOFT Test L1-4
6	1978	ISP-6: Calculations Comparison Report - Determination of Water Level and Phase Separation Effects During the Initial Blowdown Phase
7	1979	Comparison Report on OECD-CSNI LOCA Standard Problem No. 7: Analysis of a Reflooding Experiment
8	1979	Semiscale MOD1 Test S-06-03 (LOFT Counterpart Test)
9	1981	LOFT Test L3-1 Preliminary Comparison Report
10	1981	Comparison Report on OECD-CSNI LOCA Standard Problem No. 10: "Refill and Reflood Experiment in a Simulated PWR Primary System (PKL)"
11	1984	LOFT L3-5 and L3-6 Comparison Reports
12	1982	ROSA-III 5% Small Break Test, Run 912
13	1983	International Standard Problem 13 (LOFT Experiment L2-5) Preliminary Comparison Report
14	1985	Behaviour of a Fuel Bundle Simulator during a Specified Heatup and Flooding Period (REBEKA Experiment) (Results of Post-Test Analyses)
15	1983	LOCA Experiment at FIX-II Facility
16	1985	Rupture of a Steam Line within the HDR Containment Leading to an Early Two-Phase Flow: Results of Post-Test Analyses: Final Comparison Report
17	1984	Marviken BWR Standard Problem
18	1987	LOBI-MOD2 Small Break LOCA Experiment A2-81: Final Comparison Report
19	1987	Behaviour of a fuel rod bundle during a large break LOCA transient with a two-peaks temperature history (PHEBUS Experiment): Final Comparison Report
20	1988	Doel 2 Steam Generator Tube Rupture Event: Final Report
21	1989	PIPER-ONE Experiment PO-SB-7: Simulation of Small and Intermediate Break LOCA for BWRs
22	1990	SPES - Loss of Feedwater Transient in Italian PWR. Final Comparison Report (1990) and Evaluation of Post-Test Analyses (1992).
23	1989	Rupture of a large diameter pipe in the HDR containment
24	1989	SURC-4 - Core-Concrete Interaction Test
25	1991	ACHILLES - N2 injection from accumulators and faster (best estimate) reflood rates
26	1992	ROSA-IV LSTF-Cold-Leg Small-Break LOCA Experiment: Comparison Report
27	1992	BETHSY - Small Break LOCA with Loss of HP Injection
28	1992	PHEBUS SFD B9+ - Experiment on the Degradation of a PWR Type Core
29	1993	HDR Experiment E11.2 - Hydrogen distribution inside the HDR containment under severe accident conditions: Final Comparison Report
30	1992	BETA II Core-Concrete Interaction Experiment (Test V5.1): Comparison Report
31	1993	CORA-13 Experiment on Severe Fuel Damage
32	---	FLHT-6 Experiment

33	1994	PACTEL-VVER-440 Natural Circulation Stepwise Coolant Inventory Reduction Experiment
34	1994	Falcon Experiments FAL-ISP-1 and FAL-ISP-2
35	1994	NUPEC Hydrogen Mixing and Distribution Test M-7-1: Final Comparison Report
36	1996	CORA-VVER Severe Fuel Damage Experiment (Test W2)
37	1996	VANAM M3-A Multi Compartment Aerosol Depletion Test with Hygroscopic Aerosol Material-Comparison Report
38	1997	Loss of the Residual Heat Removal System during mid-loop operation
39	(1997)	Fuel Coolant Interaction and Quenching
40	(1998)	STORM Test SR11 - Aerosol Deposition and Resuspension in the Primary Circuit
41	(1999)	RTF Experiment on Iodine Behaviour in Containment Under Severe Accident Conditions (provisional title)

Containment Analysis Standard Problems (CASPs)

CASP-1	1980	Comparison Report on OECD-CSNI Containment Standard Problem No. 1: "Steamline Rupture within a Chain of Compartments"
CASP-2	1982	Comparison Report on OECD-CSNI Containment Standard Problem No. 2: "Water Line Rupture in a Branched Compartment Chain"
CASP-3	1983	Final Comparison Report for Containment Standard Problem Exercise 3

Number	Starting Date	CSNI Report No.	Completion Date	Author
1	-----	None	1975	

Title
Standard Problem 1 - Edwards' Pipe

Subject
Discharge, pressure waves

Description
Analysis of the blowdown of a straight pipe filled with pressurized water. Test model is reported by A.R. Edwards and T.P. O'Brien in "Studies of Phenomena Connected with the Depressurization of Water Reactors", Journal of the British Nuclear Energy Society, pp. 125-135, April 1970.

Type
Open exercise

Facility
Edwards'Pipe

Country
UK

Number	Starting Date	CSNI Report No.	Completion Date	Author
2	---	None	1975	

Title
Analysis of Semiscale Blowdown Test 11

Subject
Large break LOCA blowdown

Description

Type
Blind exercise

Facility
Semiscale

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
3	1976	15	1977	W.T. Hancox, B.H. McDonald

Title
CSNI Standard Problem 3; Comparison of LOCA Analysis Codes

Subject
Pipe discharge

Description
Blowdown experiment of initially subcooled fluid with heat addition, conducted by CISE for AECL.

Type
Open exercise

Facility
CISE

Country
Canada

Number	Starting Date	CSNI Report No.	Completion Date	Author
4	1976	16, 50 (CVAP-TR-4-78)	1978	H.M. Delaney

Title
United States Standard Problem 6 and International Standard Problem 4: Comparison of the Standard Problem Calculations with Measured Experimental Data for Semiscale Test S-02-6

Subject
6% small break LOCA

Description
Comparison Report of Test S-02-6 of the Semiscale Mod-1 Facility. This test was a 6% small break area blowdown heat transfer test from initial conditions of 2265 psia, 542 F, and 148 lbm/sec in the cold leg using 5.5 ft. PWR type electric core heater rods.

Type
Blind exercice

Facility
Semiscale

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
5	1977	29 (+ Addendum)	1979	B.L. Hansen

Title
United States Standard Problem 6 and International Standard Problem 4: Final Comparison Report on LOFT Test L1-4

Subject
Isothermal large break LOCA

Description
Non-nuclear isothermal blowdown test with a primary volume of 7.71 cu. m. and starting from initial conditions of 552.2 K, 15.73 Mpa, and 268.4 kg/s mass flow on the intact loop. Simulation of a 200% double-ended offset shear in the cold leg of a four loop large PWR.

Type
Blind exercise

Facility
LOFT

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
6	---	30	1978	

Title
ISP-6: Calculations Comparison Report - Determination of Water Level and Phase Separation Effects During the Initial Blowdown Phase

Subject
Discharge from top of vertical vessel

Description
Simulation of a steamline rupture with a pressure vessel not equipped with internals, to determine the water level and phase separation effects during the initial blowdown phase.

Type
Open exercise

Facility
Battelle

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
7	---	55	1979	R. Deruaz, N. Tellier

Title
Comparison Report on OECD-CSNI LOCA Standard Problem No. 7: Analysis of a Reflooding Experiment

Subject
Reflood of heated tube

Description
Separate effects experiment performed on the ERSEC loop at the Grenoble Nuclear Centre. Investigated the thermal-hydraulics of the reflood phase of a loss of coolant accident.

Type
Blind exercise

Facility
ERSEC

Country
France

Number	Starting Date	CSNI Report No.	Completion Date	Author
8	---	38	1979	

Title
Semiscale MOD1 Test S-06-03 (LOFT Counterpart Test)

Subject
Large break LOCA

Description
Intended to determine the maximum cladding temperature associated with a high-powered rod peak density of 39.4 kW/m, or 75% of the maximum peak power density of 52.5 kW/m. Designed to obtain thermal-hydraulic response data from blowdown, refill, and reflood transients to assist the LOFT Program in the planning of the first LOFT nuclear test series.

Type
Open exercise

Facility
Semiscale

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
9	1980	66	1981	A.C. Peterson, C. Polk, J.A. Sellars

Title
LOFT Test L3-1 Preliminary Comparison Report

Subject
2.5 % small break LOCA

Description
Comparison report for L3-1 LOFT test. This test was a single ended small cold leg break experiment initiated from typical PWR operating conditions. Comparisons between measurements from Test L3-1 are made with calculations by 11 international participants using 7 different computer codes.

Type
Blind exercise

Facility
LOFT

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
10	1980	64	1981	D.L. Nguyen, W. Winkler

Title
Comparison Report on OECD-CSNI LOCA Standard Problem No. 10: "Refill and Reflood Experiment in a Simulated PWR Primary System (PKL)"

Subject
Large break LOCA reflood

Description
Investigation of gravity-feed refill and reflood process within a pressure vessel after a LB-LOCA considering the influence of the simulated primary loops. Comparison report of PKL test K 9.

Type
Open exercise

Facility
PKL-I

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
11	1981	99	1984	

Title
LOFT L3-5 and L3-6 Comparison Reports

Subject
2.5% small break LOCA

Description
Comparison using a pair of tests to assist in evaluating the effects of tripping the primary coolant pumps.

Type
Open exercise

Facility
LOFT

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
12	---	100 (JAERI-M 82-120)	1982	K. Tasaka et al.

Title
ROSA-III 5% Small Break Test, Run 912

Subject
5% small break in BWR

Description
Test simulated a 5% split break at the recirculation pump inlet line with the assumptions of HPCS D/G single failure. Peak cladding temperature was 839 K. All heater rods quenched after LPCS and LPCI actuation, and the effectiveness of ECCS for cooling was confirmed.

Type
Open exercise

Facility
ROSA-III

Country
Japan

Number	Starting Date	CSNI Report No.	Completion Date	Author
13	---	101	1983	J.D. Burtt, S.A. Crowton

Title
International Standard Problem 13 (LOFT Experiment L2-5) Preliminary Comparison Report

Subject
Large Break LOCA

Description
Simulation of a double ended offset shear guillotine cold leg rupture in a large PWR. A loss of offsite power was also simulated with a reactor coolant pump trip and an ECCS injection delay. The participants calculated the hydraulic response adequately, except where there were obvious modeling problems. Densities were calculated adequately in the sections where condensation did not occur. Break flows were generally over predicted. Clad temperature heatups were calculated adequately but quench times for cladding was predicted less well.

Type
Blind exercise

Facility
LOFT

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
14	1984	98	1985	H. Karwat

Title
Behaviour of a Fuel Bundle Simulator during a Specified Heatup and Flooding Period (REBEKA Experiment) (Results of Post-Test Analyses)

Subject
Behaviour of fuel rod simulator bundle

Description
Intended to predict in an integrated manner the transient behaviour of an electrically heated fuel simulator bundle with respect to its local cladding temperatures, strains and time to rupture together with the thermohydraulic boundary conditions. Original aim not fully achievable. The applied codes for mechanical fuel behaviour largely demonstrated their capabilities for pretest predictions when certain local fluiddynamic parameters are well knows to the code users. Confirmed the difficulties expected with proper analysis of thermohydraulics of the test, caused by the coupling between pin cooling conditions, rod upper plenum calculations and the feedback to clad deformation and burst simulation.

Type
Blind exercise

Facility
REBEKA

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
15	---	102	1983	

Title
LOCA Experiment at FIX-II Facility

Subject
31% break in BWR

Description
Simulated the conditions corresponding to an intermediate size break on one of the main recirculation lines of a BWR with external pumps. Comparison Report.

Type
Blind exercise

Facility
FIX-II

Country
Sweden

Number	Starting Date	CSNI Report No.	Completion Date	Author
16	1984	112 + 112 A	1985	M. Firnhaber

Title
Rupture of a Steam Line within the HDR Containment Leading to an Early Two-Phase Flow: Results of Post-Test Analyses: Final Comparison Report

Subject
Containment behaviour during large break LOCA

Description
Containment Thermal-Hydraulic Experiment. Steam Line Rupture in the HDR Containment leading to early two-phase flow.

Type
Blind exercise

Facility
HDR

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
17	---	103, 114	1984	

Title
Marviken BWR Standard Problem

Subject
BWR containment behaviour

Description
Thermal-Hydraulic experiment of reactor blowdown in the Marviken Full Scale Pressure Suppression Containment.

Type
Open exercise

Facility
Marviken

Country
Sweden

Number	Starting Date	CSNI Report No.	Completion Date	Author
18	1985	133	1987	H. Städke

Title
LOBI-MOD2 Small Break LOCA Experiment A2-81: Final Comparison Report

Subject
1% small break LOCA

Description
Simulates the transient thermo-hydraulic behaviour of a PWR in case of a small break in the cold leg pipe between pump and pressure vessel. 26 participants from 12 OECD Member countries performed blind predictions for this experiment using 9 different LWR safety codes. The results of the comparison between calculated and measured data are presented and analysed. Specific emphasis is given to the prediction capabilities of the various codes involved in the exercise, to the influence of the code users on the predicted results and to the code running times. Code strength and deficiencies are identified and recommendations are given for further effort needed to improve the reliability of small break LOCA calculations.

Type
Blind exercise

Facility
LOBI-Mod 2

Organisation
CEC (JRC Ispra)

Number	Starting Date	CSNI Report No.	Completion Date	Author
19	1986	122, 131	1987	E. Scott de Martinville, M. Pignard

Title
Behaviour of a fuel rod bundle during a large break LOCA transient with a two-peaks temperature history (PHEBUS Experiment): Final Comparison Report

Subject
Behaviour of fuel rod bundle

Description
PHEBUS test Number 218. Involves the transient behaviour of a reduced length nuclear fuel bundle submitted to a high temperature transient obtained under large break LOCA conditions.

Type
Open exercise

Facility
PHEBUS-CSD

Country
France

Number	Starting Date	CSNI Report No.	Completion Date	Author
20	1987	154	1988	E. Stubbe

Title
Doel 2 Steam Generator Tube Rupture Event: Final Report

Subject
Steam generator tube rupture

Description
Comparison report of actual event at operating nuclear power plant. Information provided in common RELAP-5 input desk format.

Type
Open exercise

Facility
Doel-2 PWR

Country
Belgium

Number	Starting Date	CSNI Report No.	Completion Date	Author
21	1988	162	1989	F. D'Auria

Title
PIPER-ONE Experiment PO-SB-7: Simulation of Small and Intermediate Break LOCA for BWRs

Subject
1.6%/2.8% small break in BWR

Description
Intended to be a "double blind" small break LOCA experiment for BWRs. Is a counterpart of tests carried out in ROSA-III and FIST facilities. Simulates a SB-LOCA in the recirculation line of a GE BWR-6 plant.

Type
Blind exercise

Facility
PIPER-ONE

Country
Italy

Number	Starting Date	CSNI Report No.	Completion Date	Author
22	1988	174 and NEA/CSNI/R(92)7	1990 and 1992	E. Negrenti et al.

Title
SPES - Loss of Feedwater Transient in Italian PWR. Final Comparison Report (1990) and Evaluation of Post-Test Analyses (1992).

Subject
Loss of feed water

Description
Double-blind of FW without mitigation by auxiliary FW or high pressure injection. Eventually, HP injection into one loop of 3-loop W-PWR simulator and natural circulation cooldown. Included non-OECD participation.

Type
Blind exercise

Facility
SPES

Country
Italy

Number	Starting Date	CSNI Report No.	Completion Date	Author
23	1988	160	1989	H. Karwat

Title
Rupture of a large diameter pipe in the HDR containment

Subject
Containment behaviour during LBLOCA, including hydrogen injection and long-term T/H behaviour in containment

Description
Comparison of pre-test predictions to a large number of measured parameters. The exercise focused on the long-lasting post-blowdown phenomena expected inside a PWR containment. Local pressurization effects and the evolution of the maximum pressure were also addressed.

Type
Blind exercise

Facility
HDR

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
24	---	155	1989	R. Bari, et al.

Title
SURC-4 - Core-Concrete Interaction Test

Subject
Core-concrete interaction

Description
First severe accident ISP, involving the interaction of 200 kg of stainless steel melt in a basaltic concrete crucible. Heat was supplied by an induction unit. During the experiment, a large chunk of Zircaloy and FP simulants were added, and the calculations attempted to predict the concrete ablation rate, the gas generation rates, the temperatures in the crucible and the melt, and the FP simulant release rates.

Type
Blind exercise

Facility
SURC

Country
USA

Number	Starting Date	CSNI Report No.	Completion Date	Author
25	1988	NEA/CSNI/R(91)11 (AEA-TRS-1043)	1991	B.J. Holmes

Title
ACHILLES - N2 injection from accumulators and faster (best estimate) reflood rates

Subject
Effect of accumulator gas during LOCA reflood

Description
The selected transient simulates the end of the accumulating discharge period in a postulated large break loss of coolant accident when the nitrogen, which is used to pre-pressurize the accumulators, enters the primary circuit. The resultant decrease in pressure drop between the accumulators and the pressure vessel causes an increase in the pressure at the top of the downcomer which in turn produces a surge of water into the core with subsequent oscillatory flow occurring between the core and downcomer. The test was performed in the ACHILLES test Facility using a Best Estimate configuration at AEA Technology Winfrith. Almost a separate effects test.

Type
Blind exercise

Facility
Achilles

Country
United Kingdom

Number	Starting Date	CSNI Report No.	Completion Date	Author
26	1989	NEA/CSNI/R(91)13	1992	Y. Kukita et al.

Title
ROSA-IV LSTF-Cold-Leg Small-Break LOCA Experiment: Comparison Report

Subject
5% small break LOCA

Description
Small Break LOCA in the ROSA-IV LSTF Facility. Included non-NEA participation.

Type
Open exercise

Facility
ROSA-IV LSTF

Country
Japan

Number	Starting Date	CSNI Report No.	Completion Date	Author
27	1991	NEA/CSNI/R(92)20	1992	CEA

Title
BETHSY - Small Break LOCA with Loss of HP Injection

Subject
0.5% small break LOCA

Description
Depressurization and use of low pressure injection, and SG cooldown. Open to non-OECD participation. BETHSY experiment 9.1B, 2 in. cold leg break without HPIS and with delayed ultimate procedure.

Type
Blind exercise.

Facility
BETHSY

Country
France

Number	Starting Date	CSNI Report No.	Completion Date	Author
28	1991	NEA/CSNI/R(92)7	1992	CEA

Title
PHEBUS SFD B9+ - Experiment on the Degradation of a PWR Type Core

Subject
Core degradation with fresh fuel

Description
Predictions of the phenomena associated with a severe fuel damage accident, including the thermal behaviour of the bundle, the cladding oxidation level, fuel dissolution by molten zircaloy, decladding, and relocation of the molten material.

Type
Semi-blind exercise

Facility
PHEBUS-SFD/In-pile test

Country
France

Number	Starting Date	CSNI Report No.	Completion Date	Author
29	1990	NEA/CSNI/R(93)4	1993	H. Karwat

Title
HDR Experiment E11.2 - Hydrogen distribution inside the HDR containment under severe accident conditions: Final Comparison Report

Subject
Hydrogen distribution in a PWR containment

Description
The objectives of the experiment E11.2 were the following:

- calculate the temperature distribution during the entire transient (small break LOCA blowdown with up to a 24 hour period of analysis of natural convection phenomena);
- study the distribution of energy during and after the SBLOCA phase;
- analyse the steam/air/hydrogen distribution within the containment atmosphere under severe accident conditions initiated by a SBLOCA.

Type
Open exercise

Facility
HDR

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
30	1991	NEA/CSNI/R(92)9	1992	M. Firnhaber and H. Alsmeyer

Title
BETA II Core-Concrete Interaction Experiment (Test V5.1): Comparison Report

Subject
Core-concrete interactions

Description
The aim of BETA Test V5.1 was to investigate the influence of a high content of metallic Zry-4 in the melt on the MCCI and to get quantitative information on the long-term aerosol generation during the interaction period

Type
Open exercise

Facility
BETA

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
31	1992	NEA/CSNI/R(93)17 (GRS106.KfK 5287)	1993	M. Firnhaber et al.

Title
CORA-13 Experiment on Severe Fuel Damage

Subject
Core degradation and quench

Description
Severe core damage experiment with quenching, of a full length simulated fuel bundle, heated with internal tungsten heaters. Investigations of the material relocation dynamics, quench phenomena and hydrogen generation.

Type
Blind exercise

Facility
CORA

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
32	---	---	---	---

Title
FLHT-6 Experiment

Subject
BWR core degradation

Description
Experimental destruction of a full length BWR fuel element, including absorber material, to investigate absorber interactions and blockage behaviour

Type
Blind exercise

Facility
FLHT (NRU)

Country
Canada

EXPERIMENT AND EXERCISE CANCELED

Number	Starting Date	CSNI Report No.	Completion Date	Author
33	1992	NEA/CSNI/R(94)24	1994	H. Purhonen et al.

Title
PACTEL-VVER-440 Natural Circulation Stepwise Coolant Inventory Reduction Experiment

Subject
VVER-440 natural circulation

Description
Investigation of the natural circulation behaviour of a VVER-440 type PWR with horizontal steam generators and loop seals in both hot and cold legs, and of the effect of opening a relief valve on the secondary side.

Type
Blind exercise

Facility
PACTEL

Country
Finland

Number	Starting Date	CSNI Report No.	Completion Date	Author
34	1992	NEA/CSNI/R(94)27 (AEA RS 3394)	1994	D.A. Williams

Title
Falcon Experiments FAL-ISP-1 and FAL-ISP-2

Subject
Fission product transport

Description
The objective of ISP-34 is to test computer codes designed to follow the transport and deposition, in both the primary circuit and containment building, of fission product and bulk reactor materials aerosols released from degrading fuel in a severe accident. Test FAL-ISP-1 had a high particle concentration and low relative humidity in the containment, with the aim of testing the impact of multicomponent aerosols involving different chemical species. Test FAL-ISP-2 studied lower particles concentrations with a high containment humidity in order to follow condensation of steam onto hygroscopic particles.

Type
FAL-ISP-1: open exercise
FAL-ISP-2: blind exercise

Facility
Falcon

Country
United Kingdom

Number	Starting Date	CSNI Report No.	Completion Date	Author
35	1993	NEA/CSNI/R(94)29 (OCDE/GD(95)29)	1994	NUPEC

Title
NUPEC Hydrogen Mixing and Distribution Test M-7-1: Final Comparison Report

Subject
Hydrogen Distribution and Mixing in a PWR-type containment

Description
The model containment vessel of the NUPEC Hydrogen Mixing and Distribution Test Facility is about 1/4 scale of an actual containment vessel and had inner structures composed of about 20 compartments. There were two periods in test M-7-1. During the pre-heating phase, steam was injected into the steam generator foundation compartment at a constant mass flow for about 3.5 hours. During the experiment itself, a steam/helium mixture was injected into the same compartment and spray water into the dome. These injections were terminated after 30 minutes. Pressure, temperatures and helium concentrations were measured during the experiment.

Type
Blind exercise

Facility
NUPEC Hydrogen Mixing and Distribution Test Facility

Country
Japan

Number	Starting Date	CSNI Report No.	Completion Date	Author
36	1994	NEA/CSNI/R(95)20	1996	M. Firnhaber, S. Yegorova, U. Brockmeier, S. Hagen, P. Hofmann and K. Trambauer

Title
CORA-VVER Severe Fuel Damage Experiment (Test W2)

Subject
VVER core degradation

Description
ISP-36 is the first VVER-related ISP in the field of severe accidents, and also the first ISP co-sponsored by a non-OECD country. The main objectives of CORA Test-W2 included studies of temperature and material behaviour and hydrogen generation of a VVER fuel bundle, especially the influence of the hexagonal grid and the different material combinations (cladding, grid spacers and absorber rods) compared to western-type PWRs.

Type
Blind exercise

Facility
CORA

Countries
Germany, Russian Federation

Number	Starting Date	CSNI Report No.	Completion Date	Author
37	1994	NEA/CSNI/R(96)26	1996	M. Firnhaber et al.

Title
VANAM M3-A Multi Compartment Aerosol Depletion Test with Hygroscopic Aerosol Material-Comparison Report

Subject
Containment thermal-hydraulics and aerosol behaviour in containment

Description
The general objective of ISP-37 was to analyse the thermal-hydraulics of a containment atmosphere and the distribution and settlement of aerosols after a severe accident with pressurizer relief valve discharge. The VANAM M3 Test involved a one-component aerosol (soluble), dry aerosol settling, wet aerosol settling, and volume condensation. ISP-37 was open to non-OECD participation.

Type
Open exercise

Facility
Battelle Model Containment

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
38	1995	---	(1997)	G. Kimber, C. Leveque, G. Lavialle

Title
Loss of the Residual Heat Removal System during mid-loop operation

Subject
BETHSY Test 6.9c

Description
ISP-38 was established to analyze reactor system response to a loss of the Residual Heat Removal System during Mid-loop operation. The overall aims of the exercise are (i) to show the status of model development and computer codes in addressing low power (0.5%), low pressure (1 bar) transients, (ii) compare different computer models, and (iii) increase the common understanding of transients at mid-loop (shutdown) operating conditions.

Type
Open exercise

Facility
BETHSY

Country
France

Number	Starting Date	CSNI Report No.	Completion Date	Author
39	1996	---	(1997)	A. Annunziato, C. Addabbo, A. Yerkess, R. Silveri, W. Brewka, G. Leva

Title
Fuel Coolant Interaction and Quenching

Subject
FARO Test L-14

Description
ISP-38 was established to investigate the interaction process of large mass of melt with water under realistic melt composition (UO2/ZrO2) and prototypical accident conditions. FARO Test L-14 represented the interaction of 125 kg of melt released by gravity in a 2 m deep water pool saturated at a system pressure of 50 bar.

Type
Open exercise

Facility
FARO

Organisation
JRC Ispra

Number	Starting Date	CSNI Report No.	Completion Date	Author
40	1997	---	(1998)	---

Title
STORM Test SR11 - Aerosol Deposition and Resuspension in the Primary Circuit

Subject
Deposition and resuspension of soluble and insoluble aerosols in a primary system tube under fast gas flow

Description
The test consists of a deposition phase in which tin dioxide aerosols (diameter 0.4 μm) deposit in the test section and a resuspension phase in which a steam/nitrogen flow (400°C) is blown into the pipe, at increasing velocities (25 m/s), until a good part of the deposit is resuspended. ISP-40 is open to non-OECD participation.

Type
Open exercise

Facility
STORM

Country
JRC Ispra

Number	Starting Date	CSNI Report No.	Completion Date	Author
41	1997	---	(1999)	---

Title
RTF Experiment on Iodine Behaviour in Containment Under Severe Accident Conditions (provisional Title)

Subject
Iodine Behaviour in Containment Under Severe Accident Conditions

Description
to be specified in October 1997

Type
Blind exercise

Facility
RTF

Country
Canada

CONTAINMENT ANALYSIS STANDARD PROBLEMS (CASPs)

Number	Starting Date	CSNI Report No.	Completion Date	Author
CASP-1	---	41	1980	W.Winkler

Title
Comparison Report on OECD-CSNI Containment Standard Problem No. 1: "Steamline Rupture within a Chain of Compartments"

Subject
Steam discharge (1:4 scale)

Description
Comparison of experimental results of history of pressure, temperature, pressure difference, and water mass after a steamline rupture within a chain of six subsequent compartments (simplified integral test) with the corresponding results of best-estimate post-test calculations from computer codes for three different time intervals.

Type
Open exercise

Facility
Battelle Model Containment

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
CASP-2	---	65	1982	D.L. Nguyen, W. Winkler

Title
Comparison Report on OECD-CSNI Containment Standard Problem No. 2: "Water Line Rupture in a Branched Compartment Chain"

Subject
Water discharge (1:4 scale)

Description
Comparison report of temperature, pressure, pressure difference, and water mass in a reactor containment following a pipe rupture. Intended to come close to the accident conditions expected during the design of a full-pressure containment. Also, rupture was located in a relatively small compartment and the compartments were arranged in a branched chain with asymetrical flow paths to ensure that water transport would heavily influence the results.

Type
Open exercise

Facility
Battelle Model Containment

Country
Germany

Number	Starting Date	CSNI Report No.	Completion Date	Author
CASP-3	---	77	1983	J. Marshall, W. Woodman

Title
Final Comparison Report for Containment Standard Problem Exercise 3

Subject
Large break LOCA (small scale)

Description
An insulated pressure vessel contains an electric heater to boil the water and raise pressure. The outlet pipe is heated by an electric heater type wound around the pipe and is thermally insulated. This pipe is blocked by a copper disc which is ruptured to start blowdown into a containment vessel which is not insulated and is freestanding within a large building.

Type
Open exercise

Facility
AAEC Lucas Heights blowdown/containment rig

Country
Australia