SECY-99-091

March 24, 1999

FOR: The Commissioners

FROM: William D. Travers /s/
Executive Director for Operations

SUBJECT: NRC PARTICIPATION IN OECD COOPERATIVE PROJECT ON REACTOR VESSEL LOWER HEAD FAILURE

PURPOSE:

To inform the Commission of the staff's plans to formally agree to participate in the OECD/NEA Lower Head Failure Program (OLHF) at the Sandia National Laboratories (SNL). This program is a followup to the recently completed NRC supported lower head failure program at SNL.

BACKGROUND:

The Staff Requirement Memorandum (SRM) of December 19,1997, specifically directed continuation of the experimental program on reactor vessel lower head failure at SNL, conditioned upon OECD support. The objectives of this project are to characterize the timing, and characteristic sizes of lower head failure under pressurized conditions with large differential temperatures across the lower head wall without external cooling of the lower head of RPV. These experiments will be carried out in an appropriately scaled model of the lower head and will consist of five tests as followup to an eight test program that was recently completed under NRC sponsorship. Rupture size and timing of the lower head failure dictate conditions for ex-vessel phenomena and the results from this test program will be used to develop and assess a model for analysis of lower head failure under severe accident conditions.

DISCUSSION:

In a memorandum to the Commission, from L. Joseph Callan, dated August 11, 1998, AOECD Cooperative Project on Reactor Vessel Lower Head Program, the staff provided you with the status of this OECD program (Attachment 1). At this time, an agreement has been drafted (Attachment 2) and will be finalized for signatures by participating countries. We intend to sign this agreement contingent upon commitment by other participating countries.

RESOURCES:

With the assumption that seven countries will participate in this program, the total cost of this project is estimated to be $1,875,000 over a three year period, and the total US share of this cost would be approximately $1,000,000. The Department of Energy has informed us of their interest in participating in this project. We are currently discussing with the USDOE their participation in this program. In order to keep the facility and project at SNL active, the FY 1998, and part of FY 1999, share of NRC's project cost has been committed to SNL. The remainder of NRC's share would then be paid in accordance with the formal agreement.

COORDINATION:

The Office of the Chief Financial Officer and the General Counsel concur in this paper.

William D. Travers
Executive Director for Operations

Contact: T. King, DST/RES
415-5728

Attachments:
1. Memorandum dated August 11, 1998, to Chairman Jackson, Commissioner Diaz, Commissioner McGaffigan from L. Joseph Callan
2. Draft Agreement

ATTACHMENT 1

August 11, 1998

MEMORANDUM TO: Chairman Jackson
Commissioner Diaz
Commissioner McGaffigan

FROM: L Joseph Callan [ORIGINAL SIGNED BY L. J. Callan]
Executive Director for Operations

SUBJECT: OECD COOPERATIVE PROJECT ON REACTOR VESSEL LOWER HEAD FAILURE

In the Staff Requirements Memorandum (SRM) of December 19, 1997 (COMSECY-97-029), the Commission approved program adjustments to address reductions required by the FY 1998 Energy and Water Development Appropriations Act. The SRM specifically directed continuation of the experimental

program on reactor vessel lower head failure at Sandia National Laboratories, conditioned upon OECD support. The purpose of this memorandum is to provide you with the status of that activity.

In May 1998, OECD/NEA hosted a technical meeting to review the proposed project. Widespread international interest was expressed and at their June 1998 meeting the OECD/NEA Committee for the Safety of Nuclear Installations (CSNI) approved proceeding with steps to initiate this as a formal OECD cooperative project. It is expected that all the necessary steps will be completed by the Fall of 1998. The cooperative project will consist of five tests as followup to an eight test program that was recently completed under NRC sponsorship. The total project cost for the five tests is estimated to be $2.0 million with NRC's share being $600K over a three-year period. These funds are currently in the RES budget. Due to the time required to complete the formal OECD agreement, we intend to commit our FY 1998 share of the project cost ($200K) to SNL in August 1998, prior to completing all the steps leading to a formal agreement, in order to keep the facility and project active. The remainder of NRC's share ($200K In FY 1999 and $200K in FY 2000) would then be paid in accordance with the formal agreement.

If you would like further information on this project, we would be pleased to provide a briefing at your convenience.

cc: SECY
OGC
ACRS
OIP
OCA
OPA
CFO
CIO

CONTACT: T. King. DST/RES
301-415-5790

ATTACHMENT 2

AGREEMENT

on the

LOWER HEAD FAILURE PROJECT

A PROJECT FOR THE EXPERIMENTAL INVESTIGATION
OF CREEP BEHAVIOUR OF REACTOR VESSEL LOWER HEAD

The United States Nuclear Regulatory Commission, the AV Nuclear of Belgium, the Nuclear Research Institute Rez of the Czech Republic, the Valtion Teknillinen Tutkimuskeskus of Finland, the Commissariat à l'Energie Atomique/Institut de Protection et de Sûreté Nucléaire of France, the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH of Germany, the Consejo de Seguridad Nuclear of Spain, the Statens Kärnkraftinspektion of Sweden, being Governments or bodies designated by their respective Governments (hereinafter referred to as "the Signatories");

C**ONSIDERING** that the United States Nuclear Regulatory Commission (USNRC) has set up an international programme called the Lower Head Failure Project, for the experimental investigation of creep behaviour of reactor vessel lower head and has gained considerable experience and knowledge in this area;

CONSIDERING that the experiments which have already been conducted have produced highly valuable results;

CONSIDERING that there remain uncertainties related to safety decisions about the failure modes of the lower head of the reactor pressure vessel which may be reduced by a new series of experiments;

CONSIDERING that the OECD Nuclear Energy Agency (OECD/NEA) is entrusted with promoting the creation of international co-operation projects between its Member countries in the field of the peaceful uses of nuclear energy;

CONSIDERING that the USNRC has proposed to OECD/NEA Member countries that they participate in a series of experiments to be conducted in the lower head failure experimental facility at Sandia National Laboratories;

CONSIDERING that this proposal is of interest to the Signatories and that they are willing to provide financial and other support to such a joint project for a period of three years;

CONSIDERING that the development, construction and operation of the Lower head failure facility will be carried out under the USNRC's responsibility and in accordance with all relevant laws and agreements;

AGREE to participate in a project to investigate creep failure modes of the RPV lower head by the Lower Head Failure Project (hereinafter referred to as "the Project"), on the terms and conditions stated herein:

Article 1
OBJECTIVES

The Signatories shall define an experimental test matrix, experimental conditions, and parameters, and shall carry out a series of experiments, according to the Programme described in Appendix A hereto, to provide data derived from creep failure tests of lower head models to assess possible RPV lower head failure modes. To achieve this basic objective, supporting material property tests and analyses to guide the mock-up tests and develop the methodology to describe the phenomena of interest, and to produce a consistent interpretation and understanding of the results, will be performed, as further described in Appendix A.

Article 2

PROJECT COMMITTEE

(a) Control of the Project shall be vested in a Project Committee constituted under this Article.

(b) The Project Committee shall consist of one member designated by each Signatory, provided that, in the case of Signatories participating jointly in the Project, the members of the Project Committee designated by them shall be considered as a single member for the purpose of the execution of this Agreement. Signatories shall also designate alternate members to represent them in the event of members being unable to do so. Signatories shall notify the OECD/NEA the members designated to represent them on the Project Committee. Members may be accompanied by advisors provided the OECD/NEA and the Chairman are notified at least two weeks in advance.

(c) The Project Committee shall:

1) approve each year the annual programme of work and budget, including the allocation of tasks amongst Signatories, in accordance with the outline of the Programme set down in Appendix A hereto;

2) approve each year the financial report covering the previous year;

3) make such rules of procedure, directives and regulations, consistent with the objectives and provisions of this Agreement, as may be required for the sound management of the Project;

4) provide technical advice and recommendations to the USNRC acting as Operating Agent concerning the carrying out of the programme of work;

5) review the technical reports of the Project, assess the results of experiments performed and provide guidance for future work.

6) consider any matters brought before it by ad hoc project meetings, the Operating Agent or any Signatory;

7) carry out the other functions conferred upon it by this Agreement.

(d) The Project Committee shall elect each year a Chairman and a Vice-Chairman from amongst its members. It shall meet at least once a year and shall be convened by its Chairman. A special meeting shall be convened by the Chairman within a reasonable time after receiving a written request from members of the Board representing a majority of the voting strength or from the USNRC acting as the Operating Agent. A representative of the OECD/NEA may attend the meetings of the Project Committee in an advisory capacity.

(e) The Project Committee shall operate and reach its decisions to the greatest extent possible on a mutually agreed basis. However, when formal voting is requested, decisions of the Project Committee shall be taken by a two-thirds majority of the votes cast, unless unanimity is expressly required by this Agreement. Unanimity requires the agreement of each member voting. All members of the Project Committee shall each have one vote. Notwithstanding the above, the agreement of the USNRC shall be required for decisions which might affect the safety of tests, operations and personnel, or concerning insurance. The quorum for transaction of business in meetings of the Project Committee shall be two-thirds of the voting strength.

(f) If necessary, decisions of the Project Committee may also be reached by mail or telefax communication in which case unanimity shall be required. The Chairman shall be responsible for ensuring that all members are informed of each decision made pursuant to this paragraph.

(g) At least thirty days before each regular meeting, notice of the time, place and agenda of the meeting shall be given by the Chairman to each member and to other persons entitled to attend the meeting.

(h) The Project Committee Chairman shall, after each meeting, send to all the members of the Project Committee and the Operating Agent a letter that contains the Minutes of the meeting including any decisions of the Project Committee.

(i) The Project Committee shall conduct its business in the English language. Reports and other documents to be submitted to the Project Committee under this Agreement shall also be in English.

Article 3

OPERATING AGENT

(a) The Project shall be operated by USNRC as the Operating Agent. The Operating Agent shall be responsible for taking all steps and performing all legal acts required to operate the Project in accordance with this Agreement, the laws of the USA and the decisions of the Project Committee.

(b) The Operating Agent shall in particular:

1) ensure that the Project is administered in accordance with the outline of the Programme and within the limits of funds as set forth in Appendices A and B hereto;

2) secure the maximum protection and safety of the Lower head failure facility and related staff and ensure that the programme of

work is carried out according to acceptable standards of quality, budget and schedule;

3) ensure that the scientific and administrative staff necessary to perform the Programme as outlined in Appendix A hereto is made available to the Project;

4) prepare, in accordance with a format agreed by the Project Committee, the draft annual programme of work and budget not later than three months before the beginning of the financial year in question as defined in Article 4;

5) submit reports on the progress of the Project to the Project Committee twice a year or at such other intervals as the Project Committee shall determine.

(c) The Operating Agent shall have the power to enter into contracts for the procurement of equipment and materials in the interest of the Project provided that such contracts are allowed for in an approved budget, by the provisions of this Agreement or by authorisation of the Project Committee.

(d) A USNRC employee shall be designated by the Operating Agent as Programme Manager with the approval of the Project Committee. He shall attend meetings of the Project Committee in an advisory capacity. He shall supply all information which is requested of him concerning the carrying out of the Project.

Article 4
FINANCE

(a) Each Signatory hereby agrees to commit to the Project the amount set forth in Appendix B hereto. The schedule for payment of contributions shall be determined by the Project Committee on the basis of a proposal by the Operating Agent.

(b) The Project Committee shall approve the annual budget not later than thirty days before the beginning of the financial year in question. The financial year shall be from 1 January to 31 December. The Project Committee shall approve the first budget at its first meeting.

(c) A financial report covering the previous year shall be submitted by the Operating Agent to the Project Committee in a format agreed by the latter, not later than two months after the end of each financial year.

(d) It is agreed that monetary contributions to the Project shall be deposited by Signatories other than the Operating Agent in US$ into an account designated by the OECD/NEA. Payments shall be deposited on the dates specified in the corresponding invoices issued to the Signatories by the OECD/NEA. The OECD/NEA is invited to administer these contributions and shall, from time to time and in accordance with the payment schedule approved by the Project Committee, pay all or a portion of such contributions to USNRC in consideration of the work performed by or on behalf of USNRC in connection with the Project.

(e) The system of accounts employed by the Operating Agent shall be in accordance with USNRC accounting principles. The Project Committee shall be provided with financial records in a format agreed by it on an approximately 6 monthly basis by the Operating Agent. The financial records maintained by the Operating Agent shall clearly account for all funds of the Project. These records shall be kept by the Operating Agent for three years from the date of termination of the Project. The OECD/NEA is invited to maintain accurate and complete financial records of the receipt and disbursement of all contributions received for the Project for the same period for which it would normally maintain such records.

(f) The cost of the provision of the Lower head failure facility and related installations, ancillary services and the infrastructure for management and administration of the Project provided by the Operating Agent in agreement with the Project Committee, shall be allowed as a credit against the contribution due by USNRC, except for its contribution to the cost of the design and construction of experimental apparatus as listed for task 1, table 1, appendix B.

(g) Each Signatory shall bear all costs of its participation in the Project other than common costs funded by the budget of the Project.

Article 5
INFORMATION AND INTELLECTUAL PROPERTY

(a) This Article sets forth the provisions applicable to the publication, distribution, handling, protection and ownership of information and intellectual property relevant to and arising from the Project. Additional rules and procedures related thereto, where necessary, shall be adopted by the Project Committee acting by unanimity and in conformity with this Agreement.

(b) Subject to prior approval by the Project Committee and to restrictions applying to patents and copyrights, the Signatories shall have the right to publish information arising from the Project and information provided to the Project, except proprietary information. The Project Committee will review technical reports of individual participants prior to their publication.

(c) For the purposes of this Article, proprietary information shall mean information acquired prior to or outside the Project of a confidential nature such as trade secrets and know-how (for example, computer programs, design procedures and techniques, chemical composition of materials or manufacturing methods, processes or treatments) which is appropriately marked, provided such information:

1) is not generally known or publicly available from other sources;

2) has not previously been made available by the owner to others without obligation concerning its confidentiality; and

3) is not already in the possession of the recipient Signatory without obligation concerning its confidentiality.

The Operating Agent and the other Signatories shall take all necessary measures in accordance with this Article, the laws of their respective countries and international law to protect proprietary information provided to the Project. It shall be the responsibility of the Signatory supplying proprietary information to identify the information as such and to ensure that it is appropriately marked.

(d) The Signatories should aim to notify the Operating Agent of, and contribute to the Project, all pre-existing information and information developed independently of the Project which is or may potentially be relevant to the Project and the transfer of which is not subject to any contractual or legal limitation. To the extent that the provision of such information entails costs of any significance, the Project Committee acting by unanimity shall determine whether and on what terms to acquire the information.

(e) The Project Committee will be responsible for the production and publication of periodic reports and a final report on this Project. All reports of work performed under this Agreement and the results thereof, including studies, assessments, analyses, evaluations, and other documentation shall be produced and compiled in the manner and format decided by the Project Committee. Such reports shall be provided by the Operating Agent to the other Signatories.

(f) The Signatories agree with respect to the inventions made or conceived in the course of or under the Project that each Signatory shall, in its own country, own such inventions, subject to a non-exclusive, assignable, royalty-free licence for the other Signatories with the right to grant sub-licences in such inventions. In determining ownership of such inventions in third countries, the Project Committee shall, acting by unanimity, equitably apportion the rights to the Signatories taking into account the obligations, contributions, and rights and benefits of all the Signatories.

(g) All material generated under the Project may be copyrighted in the name of the Operating Agent for the benefit of the Signatories in proportion to their respective contributions to the Project, provided that each Signatory shall be free to reproduce and distribute such material. The Project Committee will decide on the transfer of know-how from the Project to Signatories.

(h) Each Signatory shall, without prejudice to any rights of authors and inventors under its national laws, take the necessary steps to secure such co-operation or assignment of rights as are required to implement the provisions of this Article. Each Signatory shall assume the responsibility to pay awards or compensation required to be paid to its employees according to the laws of its country.

Article 6

ASSIGNMENTS OF PERSONNEL AND VISITS

(a) Any Signatory may, subject to the approval of the Operating Agent, send technical experts for participation in the Project. The person to be delegated and the purpose and term of such delegation shall be agreed in writing by the Operating Agent and the Signatory sending the expert, in advance of each delegation of personnel. In addition, these parties shall sign a separate personnel assignment agreement. The personnel shall be integrated into the scientific and technical work of the Project. In this context, and to the extent permitted by such separate personnel assignment agreements, the assigned personnel shall have appropriate access to information concerning the Project and to participation in technical discussions. A Signatory sending an expert is responsible for all associated salary, transportation, living, communication, insurance and other costs. The Operating Agent shall provide suitable office space and computer access for approved tasks.

(b) Similar arrangements may also be made between Signatories in relation to any work under the Project carried out by the Signatories themselves.

(c) It is further agreed that, to the extent reasonable, visits of a Signatory's experts to the facilities where work is being performed for the Project shall be facilitated. Such visits shall be arranged with the consent of the Operating Agent, following receipt of adequate notice given by the Signatory requesting the visit.

Article 7

OECD NUCLEAR ENERGY AGENCY

(a) In accordance with its Statute, the OECD/NEA shall encourage the broadest possible participation in the Project by its Member countries, and shall endeavour to co-ordinate the Project's work with its other activities in this field.

(b) The Project Committee shall make an annual report to the Steering Committee for Nuclear Energy on the progress of the Project.

(c) The OECD/NEA is invited to provide secretarial services and technical advice to the Project Committee.

(d) The Secretariat of the OECD/NEA or, as appropriate, of the OECD, may be invited by the Project Committee to take on some administrative, financial or technical responsibilities for the implementation of the Project.

Article 8

LEGAL RESPONSIBILITY AND INSURANCE

(a) The Operating Agent and its contractor shall use all reasonable skill and care in carrying out its duties under this Agreement and shall be responsible for ensuring that its work under the Project is carried out in accordance with all applicable laws and regulations.

(b) The Operating Agent and its contractor shall propose to the Project Committee all necessary liability, fire and other insurance for its work under the

Project and, subject to availability, shall procure such insurance as the Project Committee may direct. The cost of obtaining and maintaining such insurance shall be charged to the budget of the Project.

(c) The Operating Agent shall, subject to applicable federal law, be solely liable in respect of all actions, claims, costs, expenses and damages whatsoever arising out of the execution of the Project.

(d) In so far as any work under the Project is carried out by a Signatory itself, all legal liabilities and any related costs for that work rest with that Signatory.

Article 9

LEGISLATIVE PROVISIONS

(a) Activities under this Agreement shall be subject to the laws and regulations applicable to the Signatories. Such laws and regulations shall be those of the State on whose territory the activities in question are carried out.

(b) It shall be the responsibility of each Signatory concerned to facilitate the accomplishment of the formalities involved in the movement of persons, the importation of materials and equipment and the transfer of currency which shall be required to operate the Project.

Article 10

SETTLEMENT OF DISPUTES

(a) Any dispute among the Signatories concerning the interpretation or application of this Agreement that is not settled by negotiation or other agreed mode of settlement shall be referred to a tribunal of three arbitrators to be chosen by the Signatories concerned, who shall also choose the Chairman of the tribunal. Should the Signatories concerned fail to agree upon the composition of the tribunal or the selection of its Chairman, the President of the International Court of Justice shall, at the request of any of the Signatories concerned, exercise those responsibilities. The tribunal shall decide any such dispute by reference to the terms and conditions of this Agreement and any applicable laws and regulations, and its decision shall be final and binding on the Signatories concerned.

(b) Unless otherwise agreed by the disputing parties, this Agreement shall be governed by the law of the USA and arbitral proceedings initiated to settle any dispute shall take place in Washington DC and shall be conducted in the English language.

Article 11

ACCESSION AND WITHDRAWAL OF SIGNATORIES

(a) This Agreement shall be open to accession by Governments of other OECD Member countries or bodies designated by such Governments with the unanimous assent of the Project Committee and provided that such Governments or bodies sign the Agreement and assume the rights and obligations of a Signatory, including obligations regarding financial contributions to the Project.

(b) With the agreement of the Project Committee, and upon the request of a Government, a Signatory proposed by that Government may be replaced by another party. The latter shall sign this Agreement and assume the rights and obligations of a Signatory.

(c) A Signatory may withdraw from this Agreement upon written notice six months prior to the beginning of the financial year. The withdrawal of a Signatory under this paragraph shall not affect the rights and obligations of the other Signatories, including the amount which each of the other Signatories is required to commit to the Project, unless otherwise unanimously agreed by the Project Committee.

(d) Any Signatory that fails to fulfil its obligations under this Agreement within sixty days after its receipt of notice invoking this paragraph and specifying the nature of those obligations shall be considered to have withdrawn from this Agreement.

(e) The Operating Agent, with the approval of the Project Committee, may enter into agreements with non-Signatory entities for collaboration in furtherance of the Project. Such entities shall be Associate Members. Such agreements may, in particular, cover exchange of information, patent rights, assignment of scientific and technical personnel and association with the work of the Project. The provisions of such agreements shall be consistent with the requirements of this Agreement.

Article 12

FINAL PROVISIONS

(a) Unless otherwise agreed in writing between the Operating Agent and the Project Committee, all assets acquired by the Operating Agent under the Project shall remain its property at the termination of this Agreement.

(b) This Agreement shall come into force as of 1 September 1998, and shall remain in force for 3 years. The Agreement may thereafter be renewed or extended upon the written agreement of the Signatories that desire to do so.

(c) This Agreement may be amended at any time by the agreement in writing of all the Signatories.

(d) The original of this Agreement shall be deposited with the Director General of the OECD/NEA and a certified copy thereof shall be furnished to each Signatory.

UNITED STATES NUCLEAR REGULATORY COMMISSION
AV NUCLEAR, BELGIUM

NUCLEAR RESEARCH INSTITUTE REZ OF THE CZECH REPUBLIC

VALTION TEKNILLINEN TUTKIMUSKESKUS, FINLAND

COMMISSARIAT À L'ÉNERGIE ATOMIQUE/ INSTITUT DE PROTECTION ET DE SÛRETÉ NUCLÉAIRE, FRANCE

GESELLSCHAFT FÜR ANLAGEN- UND REAKTORSICHERHEIT (GRS) mbH, GERMANY

CONSEJO DE SEGURIDAD NUCLEAR, SPAIN

STATENS KÄRNKRAFTINSPEKTION, SWEDEN

APPENDIX A
LOWER HEAD FAILURE PROGRAMME

BACKGROUND

The lower head of the reactor pressure vessel (RPV) can be subjected to significant thermal and pressure loads in the event of a severe accident. Therefore, the possibility exists that the lower head will fail releasing large amounts of molten corium into containment. The TMI-II accident involved the relocation of about 20 tonnes of corium to the lower head of the RPV. Despite the presence of water, the lower head reached temperatures of ~1300 K for 30 minutes in an area with an equivalent diameter of 1m at the time when the RCS was at 10 MPa. Although the TMI vessel did not fail, code analyses in support of an OECD/ NEA TMI-II Vessel Investigation Project (VIP) predicted creep rupture at the prevailing conditions. This implies that the then state-of-the art modelling of the lower head failure was not mature due to incomplete understanding of the thermal loading. Since TMI-VIP, these methodologies have been further developed to analyse existing and next generation reactors from the perspective of accident assessment, management, and mitigation. However, there still exists a need for experimental data on lower head deformation and failure phenomena. Ongoing international programs, i.e., French RUPTHER experiments and the Japanese WIND experiments address deformation in a heated pressurised pipe section, which provides fundamental creep data but does not simulate the lower head geometry. Results from these experiments have been used to partially validate the structural analysis codes. Recently SNL (USNRC sponsored) successfully completed eight large-scale (~1/5 scale) Lower Head Failure (LHF) tests. These tests specifically designed to address lower head failure issues with prototypic material and geometry. The present OECD project extends the USNRC supported SNL/LHF program to address additional issues such as lower RCS pressures (representative of depressurised or partially depressurised conditions) and pressure transients. These tests also represent an improvement over previous tests by simulating a large temperature gradient across RPV of lower head wall. The temperature gradient to be addressed in these tests are representative of conditions without ex-vessel cooling (flooding).

OBJECTIVE

The objectives of this project are to characterise the timing, and characteristic sizes of lower head failure for conditions of low reactor coolant system pressure with large differential temperatures across the lower head wall, and for pressure transients without external cooling of the lower head of RPV. These experiments will be carried out in a appropriately scaled model of the lower head.

WORK REQUIREMENTS

The set of tests will be decided by the Project Committee, taking into account the preliminary proposal attached here.

Task 1 Design and construction of experimental apparatus

(1a) Prepare detailed project plan for the entire project to aide in co-ordinating the experiment and analysis efforts and tracking progress. Prepare and approve a Preliminary Hazard screen and other required safety authorisation basis documents. Prepare and submit for review a US.DOE Environmental Checklist/Action Description Memorandum (ECL/ADM). A National Environmental Policy Act (NEPA) determination is required prior to beginning the facility modification for this work.

(1b) Based on the scaling analysis and insights gained in the USNRC supported SNL/LHF program the Operating Agent shall design the experimental test set-up. Provide a preliminary letter report describing the design of the test set-up.

(1c) Fabricate the experimental test set-up. Provide a letter report upon completion of the experimental test set-up.

Task 2 Perform a total of five experiments at high temperature differential across the wall. The preliminary experimental test matrix is as follows:

OLHF-1 OLHF-1 test should be conducted at 5 MPa RCS pressure at uniform heat flux.

OLHF-2 OLHF-2 test should be conducted at 2 MPa RCS pressure to complement existing tests.

OLHF-3 OLHF-3 test should address repressurisation scenarios where the RCS is initially depressurised (~2 MPa) and a sudden repressurisation event (e.g., operator adds water to the vessel) occurs when the vessel is approaching creep rupture conditions.

OLHF-4 OLHF-4 should be run at the same condition as OLH-2, but with penetrations or weldments.

OLHF-5 OLH-5 test, the vessel wall should be machined to have a thin section representing the result of wall ablation.

Before each test, an updated list of initial conditions shall be submitted prior to the conduct of the test.

Task 3 Material Property testing

For the steel used in fabrication of the scaled lower head test vessel the Operating Agent shall carry out material property measurements for temperatures up to 1300K. Four (4) weeks after completion of property measurements for the given steel, a letter report shall be submitted describing the test conditions and measured data and their comparison with available data in the literature.

Task 4 Analysis, Interpretation, and reporting of the results

A quick look report shall be issued within two (2) weeks after conduct of each OLHF test describing the test conditions, measurements taken, general observations, potential impact on the remaining tests. A test data report shall be issued within eight (8) weeks after conduct of each OLHF test containing a detailed description of test conditions, qualified real-time data, pre-and post-test surface maps and vessel thickness data, and data reduction with emphasis on but not limited to the interpretation on the strain behaviour prior to rupture, rupture time, and the resulting rupture size.

In addition to data analysis and interpretation of each experiment, the Operating Agent shall develop key constitutive relations for creep deformation with material property data obtained under task 3 and available data base in the literature. These constitutive relations will be incorporated into a suitable structural mechanics code and the Operating Agent shall perform analysis and assessment of the modelling against OLHF experiments.

A final draft project report consisting of a compilation and synthesis of the results and analysis of all of the OLHF tests will be submitted three (3) months after completion of all tests. The final project report will be issued one month (1) after receipt of all comments on the draft report.

Task 5 OECD Support

OECD/NEA shall provide secretarial services to project committee.

REPORTING REQUIREMENTS

Monthly or Quarterly progress report

Technical Reporting

1)	Preliminary letter report on design of experimental test set-up;	(Task 1b)	
2)	Letter report on design of experimental test set-up.	(Task 1c)	
3)	Letter report on test initial conditions.	(Task 2)	Before each test
4)	Letter report on material properties.	(Task 3)	4 weeks after each measurement
5)	Quick look report on each test.	(Task 4)	2 weeks after test
6)	Test data report on each test.	(Task 4)	8 weeks after test
7)	Draft project report.	3 months after completion of all tests	
8)	Final project report.	1 month after draft review	

APPENDIX B
TENTATIVE BREAKDOWN OF TOTAL EXPENDITURE AND OF CONTRIBUTIONS TO THE LHF PROJECT

B.1. Funds Required to Execute the Project

This Appendix sets the tentative breakdown of total expenditure for the execution of the programme of the Project, as shown in the table below.

Table 1. Estimated Costs (all amounts in United States dollars)

Task	Description	Estimated cost
1	Design and Construction of Experimental Apparatus	655 000
2	Experiments	708 000
3	Material Property testing	63 000

4	Analysis, Interpretation, and Reporting	414 000
5	OECD Secretarial Services	35 000
	Total	**1 875 000**

Table 2. Funding Requirements (all amounts in United States dollars)

Date	Funds Needed at SNL	Cumulative Funds
1st October 1998	200 000	200 000
1st January 1999	200 000	400 000
1st March 1999	450 000	850 000
1st September 1999	400 000	1 250 000
1st March 2000	350 000	1 600 000
1st September 2000	275 000	1 875 000

B.2. Contributions from Signatories

The Signatories agree to assign funds to the Project apportioned as follows (all amounts in United States dollars):

Table 3. Proposed contributions by country

Cost in US$

AV Nuclear, Belgium	47 000
The Nuclear Research Institute Rez of the Czech Rep	6 000
The Valtion Teknillinen Tutkimuskeskus, Finland	19 000
The Commissariat à l'Énergie Atomique/Institut de Protection et de Sûreté Nucléaire, France	258 000
The Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH., Germany	409 000
The Consejo de Seguridad Nuclear, Spain	98 000
The Statens Kärnkraftinspektion, Sweden	38 000
The United States Nuclear Regulatory Commission	1 000 000*
Total	**1 875 000**

* Part of this may be paid by the United States Department of Energy subject to funding approval.

The Head of Legal Affairs of the OECD Nuclear Energy Agency hereby certifies that the present copy conforms to the original text deposited with the Director-General of the OECD Nuclear Energy Agency.

Paris,

The HEAD OF LEGAL AFFAIRS

PATRICK REYNERS