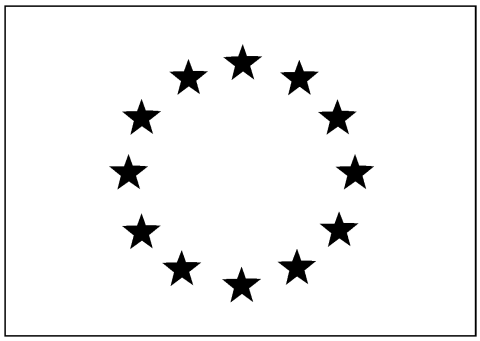
TECHNOLOGICAL IMPLEMENTATION PLAN

A Framework for the further development, dissemination and use of the results of EC RTD Projects (including also thematic networks and concerted actions)

DATA SHEETS



Preliminary version at mid-term (optional, programme per programme)

X Final version before final term (contractual obligation)

Document Number: HTR-N-04/10-P-6.0.10

Version F

Status: October 2004

Part 1: Overview and description of your project and its results
One form per project **Publishable**

1.1: Executive summary (to be used for an accurate update of the programme synopsis of projects)
1.2: Overview of all results
1.3: Quantified data on the project
1.4.: Assessment of the European interests : This section enables the co-ordinator to explain the interest for the European Union (the competitiveness of its industries, the usefulness for (part of) its population,…) of the achieved results and of their foreseen impacts.
1.5.: Expected project impact

Part 2: Description of each Result - Search for collaboration through Commission services
One form per Result **Publishable**

This section will be used to document your result(s) in CORDIS and to inform any appropriate audience

2.1 : Description of the result(s)
2.2 : Quantified data about the result
2.3 : Further collaboration, dissemination and use of the result : This section enables each partner – individually or as a consortium – to describe its needs in further collaboration in view of the dissemination an use of its results(s).

Part 3: Description of the intentions by each partner
One form per partner **Confidential**

This section enables each partner – individually or as a consortium – to describe its use and dissemination intentions (including a timetable of its future activities).
3.1 : Description of the use and the dissemination of result(s), partner per partner
3.2 : Quantified data for each partner's main result

- The Technological Implementation Plan data sheets are available as a predefined form in Microsoft Word format. The file may be downloaded from the European Commission's CORDIS web site at: http://www.cordis.lu/fp5/tip.htm or may be obtained by e-mail from your EC programme help desk or your Project Officer.
- The form should be completed electronically and returned preferably by e-mail to your project officer (Firstname.Lastname@cec.eu.int). Alternatively it can be sent on a diskette to the address provided by your Project Officer :
  - ✓ Part 1, 2 by the project co-ordinator;
  - ✓ Part 3 by the project co-ordinator or by each partner individually, as preferred.

Part 1 Overview and description of your project and its results

EC PROGRAMME :	**5th EURATOM RTD Framework Programme**
PROJECT TITLE & ACRONYM:	**High Temperature Reactor Physics and Fuel Cycle Studies (HTR-N)**
CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PROJECT WEB SITE (if any) :	http://www.jrc.nl/htr-tn/
PARTNERS NAMES :	Forschungszentrum Juelich GmbH, D (coordinator) ANSALDO ENERGIA S.p.A., I Commissariat à l'Energie Atomique, F SUBATECH, F National Nuclear Corporation, UK Nuclear Research and Consultancy Group, NL Joint Research Centre, ITU, D Delft University of Technology, NL Universitaet Stuttgart, D SIEMENS-KWU, D (now: Framatome-ANP) Universita di Pisa, I

Executive summary

Please, synthesise (in 1 or 2 pages) your project original objectives and final outcome.

a) Original research objectives

For core design and safety analysis of HTR, the reactor physics codes have to match with recent innovations on annular core geometries and different fuel cycle requirements (LEU, Pu, Pu/Th). For pebble and block type cores, the maximum allowable power sizes still being compatible with the passive safety requirements have to be defined. The capability to reach ultra high burn-up with coated particle fuel containing actinides opens the potential to burn plutonium in a way that no reprocessing is needed and that the fuel may already be well suited for final disposal due to the ceramic coating retaining the fission products from the biosphere. The aim is to design a safe HTR for minimum generation of long-lived actinides and effective plutonium burning. The waste streams associated with HTR and different fuel cycles will be analysed for identification of further waste reduction and treatment options. The long-term corrosion resistance of directly disposed fuel will be investigated.

b) Expected deliverables

Main expected deliverables in the different Work Packages (WP) are:

WP1: Nuclear Physics

- Clarification of deviations in predicting HTTR criticality
- Code validation for LEU cores at cold criticality conditions for HTTR and HTR-10.
- Code validation for annular & cylindrical core geometries.

WP2: Nuclear Data

- Sensitivity study on the need of nuclear data for high-burn-up fuel.

WP3: Fuel Cycles

- Assessment of nuclear stability of cores for minimal long-lived waste generation and optimised Pu-burning capabilities.
- Potential for power size increase.

WP4: Waste

- Quantification of HTR-specific waste streams
- First assessments of waste minimization potential.

WP5: Disposal

- Preparation of tests on corrosion and leaching behavior of directly disposed HTR fuel in different geologic conditions.
- Collection of available data and literature on disposal features of HTR-fuel
- Geologic model on disposal behavior of HTR fuel

c) Project's actual outcome

(in terms of technical achievements or if appropriate task per task)

Nuclear physics calculations on HTTR led to more exact modelling of the heterogeneity of the fuel and burnable poison as well as the large streaming effects. First calculations on HTR-10 criticality show good concurrence with experimental data as far as it was made available by the operator of the plant. Neutron flux mapping was made for for asymmetrically inserted absorber rods, too.

The capabilities of HTR for burning first generation Pu have been investigated for pebble and block cores. Results show that deep burn-up of Pu cores can be achieved and that nuclear stability is still guaranteed, in a global sense. The work has been extended for second generation Pu (Pu II) because this is of special industrial interest if spent MOX fuel from LWR will be reprocessed.

Waste generation of HTR has been quantified for operational and decommissioning. Comparison to LWR shows clear benefits of the high burn-up capabilities. Further waste minimisation can be achieved by reducing activation products. The large volumes of contaminated graphite pose specific problems and request the development of purification and conditioning processes.

The experiments on the leaching behaviour of kernels, coatings and matrix have provided first results for unirradiated materials. Reaction-sintered SiC shows a much higher corrosion resistance than glass of vitrified waste. This behaviour has to be verified for CVD deposited SiC as it is used in coated particles.

d) Broad dissemination and use intentions for the expected outputs

(such as industrial development, standards, regulations and norms, improvement of environment, health, working conditions, employment, net economic benefits, etc)

Progress in analytical tools can be used for any further core design and safety assessment of gas-cooled and graphite-moderated reactors as well as for other nuclear issues. Results have been published on an international level. Requests for more detailed exchange of information were received e.g. from licensing authorities (NRC).

Special industrial interest in waste minimisation, actinide burning and waste disposal resulted in a participation of fuel manufacturers and of reprocessing industry in HTR-N follow-up activities and in a re-orientation of the HTR-N programme towards burning of second generation Pu by HTR. The superior corrosion behaviour of SiC as compared to vitrified waste may lead to new approaches on long-term disposal of (radio)-toxic wastes in ceramic matrices.

International collaboration has been established to get access to operational data from HTTR and HTR-10 in exchange against selected HTR-N results.

Broad industrial exploitation of the results depends on the realisation of commercial HTR projects such as PBMR and GT-MHR. They can also be used for the Next Generation Nuclear Plant (NGNP) as developed within the Generation IV International Forum (GIF). The R&D output on spent HTR fuel behaviour in different repository conditions is of high relevance for the disposal of already existing spent HTR fuel from DRAGON, AVR and THTR.

1.2 Overview of all your main project results

No.	Self-descriptive title of the result	Category A, B or C*	Partner(s) owning the result(s) (referring in particular to specific patents, copyrights, etc.) & involved in their further use
1a	Method and Code Validation and Improvement in HTGR modelling (HTTR benchmark)	A	CEA, FZJ, NRG and IRI
1b	Method and Code Validation and Improvement in HTGR modelling (HTR-10 benchmark)	A	CEA, FZJ, NRG and IRI
2a	Sensitivity of nuclear data uncertainties for high-burn up LEU and Pu-based fuel on nuclear physics calculations & needs for new data	A / B	All WP 1, 2 &3 partners
3a	Analysis of nuclear stability for different fuel cycles being optimised for *1st and 2nd generation* plutonium burning and low long-term radiotoxicity for continuous reload (pebble type HTR)	A / B	NRG, FZJ, All WP 1, 2 & 3 partners
3b	Geometry and concentration of burnable particles in HTR fuel that give a reactivity curve as flat as possible	A / B	IRI -TU Delft, All WP 1, 2 & 3 partners
3c	Fuel cycles with batch-wise reload (block type HTR): *1st and 2nd generation Pu*	A / B	CEA, All WP 1, 2 & 3 partners
3d	Investigation of plutonium/minor actinides based fuel cycles: preliminary analysis of the Deep Burn HTR Transmuter Concept	A / B	CEA, All WP 1, 2 & 3 partners
3e	Improving the incineration of minor actinides in thermal reactors by generation of fast islands with thin fissile films	A / B	ITU ***(Patent granted)***
3f	Assessment of the possibilities to increase the power size of continuous reload (pebble bed) HTRs	A / B	IKE, all WP3 partners
3g	Definition of (reactor physical) parameters to assess and intercompare HTR core designs with respect to (safe and economic) Pu and MA incineration.	A	NRG, all WP3 partners

3h	Definition of a HTR-N Project Q.A. Framework system based on a double context approach able to harmonise the Partner organisations Q.A. within the HTR-N Project through use of suitable heading forms and specific procedures for issuing contractual deliverables.	A	ANSALDO, all WP3 partners
4a	Analysis & quantification of operational waste	A / B	All WP 4 partners
4b	Analysis & quantification of decommissioning waste	A / B	All WP 4 partners
5a	Data on the corrosion behaviour of silicon carbide coating under different geological conditions	A / B	NRG, All WP5 partners
5b	Data on the corrosion behaviour of non-irradiated kernels, PyC coating and fuel matrix under different geological conditions	A / B	FZJ, All WP5 partners

* A: results usable outside the consortium / B: results usable within the consortium / C: non usable results

1.3 Quantified Data on the dissemination and use of the project results

Items about the dissemination and use of the project results (consolidated numbers)	Currently achieved quantity	Estimated future* quantity
# of product innovations (commercial)	1	1
# of process innovations (commercial)	1	1
# of new services (commercial)	0	1
# of new services (public)	0	0
# of new methods (academic)	0	0
# of scientific breakthrough	1	1
# of technical standards to which this project has contributed	0	1
# of EU regulations/directives to which this project has contributed	0	1
# of international regulations to which this project has contributed	0	1
# of PhDs generated by the project	3	3
# of grantees/trainees including transnational exchange of personnel	2	2

*# = number of ... / * "Future" means expectations within the next 3 years following the end of the project*

1.4 Comment on European Interest

All projects are expected to meet European interests. This section should provide an appraisal of your project in terms of European added value and support to the implementation of European Union policies.

1.4.1 Community added value and contribution to EU policies

a. European dimension of the problem

(The extent to which the project has contributed to solve problems at European level)

Sustainable energy supply for Europe addresses the issues of safety, resource protection, waste reduction, waste disposal, proliferations resistance and economics. The HTR-N project deals with all of these aspects by investigating safety aspects related to nuclear physics of different fuel cycles which are going to be optimised for efficient Plutonium/Actinide burning and reduced radiotoxicity of discharged spent fuel. Such fuel cycles also lead to lower proliferation risk.

Waste reduction needs a qualified investigation of the waste generation processes, as a first step. First proposals for waste minimisation for operational and decommissioning waste are identified. Treatment and purification of contaminated graphite is of special importance as graphite moderated reactors are or have been operated in many European countries. Thus very large volumes of graphite wait for conditioning and disposal or reuse.

The behaviour of spent HTR fuel in a final disposal is experimentally simulated by separate-effect tests to establish geologic models for long-term prediction.

The work is done in collaboration with European partners to take benefit from their expertise. Sustainability of energy systems is a supra-national challenge of European and global dimension.

b. Contribution to developing S&T co-operation at international level. European added value

(Development of critical mass in human and financial terms; combination of complementary expertise and resources available Europe-wide)

In the past, HTR development in Europe has already been performed on an international level and reached a leading role, worldwide. The OECD-funded DRAGON reactor project in UK, as being the very first HTR at all, included most EURATOM members as well as non-European countries (US, Japan). The 300 MWel demonstration reactor THTR also had the status of a European project.

However, most European R&D activities in the HTR field were reduced in the 1990s although international interest in this technology still persisted which lead to the construction of two new HTR test reactors (HTTR, HTR 10), two commercial projects (PBMR, GT-MHR) and a demonstrator for hydrogen generation (NGNP)..

The European HTR-Technology Network (HTR-TN) has been established to recover the European know-how from the past and to advance the HTR-related key technologies. This complementary European collaboration has created a critical mass in human and financial terms which is internationally acknowledged and bound into the Generation IV International Forum (GIF).

c. Contribution to policy design or implementation

(Contribution to one or more EU policies; RTD connected with standardisation and regulation at Community and/or national levels)

The Specific Programme on Energy, Environment and Sustainable Development (EESD) focuses directly on a sustainable development perspective, which addresses objectives like use of natural resources and ecosystems, threats of global climate change, quality of life, and the impact of the production and use of the energy which is essential to European economies, standard of living and environmental issues.

Making use of the knowledge and technologies developed by the HTR development programme will make it possible to contribute to a wide range of social and economic needs so reconciling economic development with environmental sustainability. The results will support policies formulated at Community level or deriving from international commitments by including advanced nuclear energy into the energy supply options. In addition, HTR can supply process heat for highly effective decentralised combined heat and power (CHP) and for hydrogen generation.

1.4.2 Contribution to Community social objectives

a. Improving the quality of life in the Community :

Environmentally benign, safe, secure and economic energy supply is a precondition for quality of life in the Community. CO_2-free, low cost electricity from nuclear power plants allows more capacity of regenerative energy within the European energy mix by compensating their still more expensive electricity generating cost. This strategy should be continued in future by construction of innovative and advanced nuclear stations. Thus, CO_2-free nuclear energy will keep affordable for the European population and enhance quality of life.

Modular HTR are designed in a way that radioactive fission products can be kept within the fuel elements even under extreme accident scenarios. They have a very clean primary circuit with very low radiological impact on the plant personnel and the environment. HTR can also provide combined heat and power for heating or process use. Long-lived waste can be burned in HTR without multiple reprocessing. HTR fuel is also very resistant for long-term final disposal.

b. Provision of appropriate incentives for monitoring and creating jobs in the Community

(including use and development of skills) :

Same as for regenerative energy systems (e.g. water, wind, solar, biomass), advanced nuclear energy which complies to the criteria of sustainability and of public acceptance will face a considerable market in the future if the CO_2-free energy share in Europe does not imply economic burdens endangering competitiveness of European economy. A 'coalition' of regenerative energy and advanced nuclear energy leading to reasonable cost within the energy mix will therefore contribute to keep jobs in energy intensive manufacturing processes and to create more jobs in the field of CO_2-free energy system construction and application, both for regenerative and nuclear energy.

The present European HTR RTD programme helps to preserve existing know-how and to transfer it to a new generation of engineers and scientists. This paves the way for a broader industrial deployment of HTR in Europe and for participation of European experts in international programmes.

c. Supporting sustainable development, preserving and/or enhancing the environment

(including use/conservation of resources) :

Enhanced safety standards - as typical for modular HTR - directly contribute to the preservation of the environment in case of severe accidents. High burn-up, good neutron economy and high thermal efficacy are effective measures to make better use of nuclear fuel resources, both natural uranium, thorium and reprocessed actinides. Combined Heat and Power generation additionally reduces waste heat discharges. Large scale hydrogen production by HTR heat will also contribute to the introduction of an hydrogen-based energy system. Currently, there is a general public perception that the wastes generated, decommissioning activities and the liabilities involved, are one of the major weak links of the nuclear industry. A successful waste management solution to HTRs will help to sustain a viable nuclear programme in the decades to come. In turn, this will maintain fuel diversity and promote nuclear power which is currently the predominant practical way of limiting greenhouse gas emission.

1.5 Expected project impact (to be filled in by the project coordinator)

Remark: **by replying to the following questions, the coordinator is asked to express his best estimation regarding the impact of the project.**

Overall Policy Impact[1]

EU Policy Goals	I SCALE OF EXPECTED IMPACT OVER THE NEXT 10 YEARS[2] -1 0 1 2 3		II other Not applicable to project	 Project Impact too difficult to estimate
1. Improved sustainable economic development and growth, competitiveness Θ		2		
2. Improved employment Θ		2		
3. Improved quality of life and health and safety Θ		3		
4. Improved education Θ		2		
5. Improved preservation and enhancement of the environment Θ		3		
6. Improved scientific and technological quality Θ		3		
7. Regulatory and legislative environment Θ		3		
8. Other Θ				

[1] Coordinator should respond to section I or, if appropriate, to section II. If the project has had no impact, a "0" should be entered in section I. Scores other than zero in section I will prompt a more detailed subquestion on a separate screen. However, you may access in any case the subquestions by clicking on the symbol" Θ "following each main question.

[2] Indication for scale as follows: -1 represents negative impact, 0 no impact, 1 small positive impact, 2 medium positive impact , 3 is a strong positive impact

Indicate your replies below by putting in each box the number corresponding to the score you chose:

1. Economic development and growth, competitiveness	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Increased Turnover for project participants - national markets	0	2
- international markets	1	2
b) Increased Productivity for project participants	1	2
c) Reduced costs for project participants	0	1
d) Improved output quality/high technology		

2. Employment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Safeguarding of jobs	2	3
b) Net employment growth in projects participants staff	0	3
c) Net employment growth in customer and supply chains	0	3
d) Net employment growth in the European economy at large	0	2

3. Quality of Life and health and safety	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved health care	0	1
b) Improved food, nutrition	0	0
c) Improved safety (incl. consumers and workers safety)	0	3
d) Improved quality of life for the elderly and disabled	0	1
e) Improved life expectancy	0	1
f) Improved working conditions	0	2
g) Improved child care	0	2
h) Improved mobility of persons	0	2

4. Improved education	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved learning processes including lifelong learning	1	1
b) Development of new university curricula	1	3

5. Preservation and enhancement of the environment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved prevention of emissions	0	3
b) Improved treatment of emissions	0	2
c) Improved preservation of natural resources and cultural heritage	0	2
d) Reduced energy consumption	0	3

6. S&T quality		Scale of Expected Impacts over the next 10 years (2)	
		By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a)	Production of new knowledge	2	3
b)	Safeguarding or development of expertise in a research area	2	2
c)	Acceleration of RTD, transfer or uptake	2	3
d)	Enhance skills of RTD staff	2	3
e)	Transfer expertise/know-how/technology	2	3
f)	Improved access to knowledge-based networks	2	3
g)	Identifying appropriate partners and expertise	2	3
h)	Develop international S&T co-operation	2	3
i)	Increased gender equality	1	1

7. Regulatory and legislative environment		Scale of Expected Impacts over the next 10 years (2)	
		By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a)	Contribution to EU policy formulation	2	3
b)	Contribution to EU policy implementation	2	3

8. Other (please specify)	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3

I, **project co-ordinator**, confirm the published information contained in this part 1 of the TIP.

Signature: **Name: Dr. Werner von Lensa**

Date: 13.10.2004 **Organisation: Forschungszentrum Juelich GmbH**

Part 2 Description of each result

A separate part 2 must be completed for each result. This may be done by the partner responsible for the result or by the project co-ordinator.

The part 2 must be consolidated at the consortium level and transmitted to the Commission by the co-ordinator.

PARTS 2 WILL BE DISSEMINATED BY THE COMMISSION

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
1a	Method and Code Validation and Improvement in HTGR modelling (HTTR benchmark).

CONTACT PERSON FOR THIS RESULT

Name	X. RAEPSAET
Position	Scientific Researcher / Work Package Manager
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E-mail	xraepsaet@cea.fr
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Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

Seeing that the HTGR appears as a promising concept for the future, the European nuclear community must have operational tools capable to perform HTGR conceptual design studies, industrial calculations as well as best-estimate or reference calculations.
The works carried out in the WP1 concerned the HTTR's start-up core physics experiments. The number of fuel columns necessary to achieve the first criticality and the excess reactivity in the core had to be evaluated for different configurations.

This work constitutes the first opportunity in reactor physics to model and benchmark the codes and methods in thin annular core geometry. This important point led to the limitations of the classical two-steps core modeling based on a transport-diffusion chained calculations in order to take accurately into account the core/reflector interface. Moreover, the presence of uncommon big channels offering the possibility for the neutrons to leak from the active zone (*streaming effect*), associated to several heterogeneities, the HTTR core was a real challenge to model precisely.

Pre-test and post-test calculational results, obtained by the partners, have been compared with each other and with the experiment. Parts of the discrepancies between experiment and pre-test predictions has been analysed and tackled by different treatments. The results of the WP1 have been published at the HTR 2002 conference of the ENS.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-02/05-D-1.1.1	Comparative synthesis and analysis of the European results on the HTTR's core physics benchmarks	CO
HTR-N-00/12-D-1.1.2	Analyses of the European results on the HTTR's Startup core physics experiments.	CO
HTR-N-01/06-S-1.1.3	Recalculation of the First Criticality of the HTTR	CO
HTR-N-02/05-D-1.2.1	Final Report of the Task 2 of the WP1	CO
HTR-N-02/05-D-1.2.2	Analysis of the European results on the HTTR's core Physics Benchmarks	PU
HTR-N-03/08-D-1.2.3	NED article	PU
HTR-N-01/09-P-0.0.3	HTR-N Annual Technical Progress Report	CO
HTR-N-04/07-D-1.0.0-1_1	Technical Summary Report of the WP1	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	29		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	50
# of S&T publications (referenced publications only)	1	1
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	2	2
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐ x	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Verified nuclear deterministic and probabilistic codes for Low-Enriched Uranium Fuel within block-type High-Temperature Reactor cores of different geometries (cylindrical / annular).

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Designers of HTR providing detailed data from core design and materials of the core structures for block-type cores.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: **Name: Xavier RAEPSAET**

Date: October 2004 **Organisation: CEA**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
1b	Method and Code Validation and Improvement in HTGR modelling (HTR-10 benchmark).

CONTACT PERSON FOR THIS RESULT

Name	X. RAEPSAET
Position	Scientific Researcher / Work Package Manager
Organisation	CEA
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Telephone	+33 1 01 69 08 46 64
Fax	+33 1 01 69 08 23 81
E-mail	xraepsaet@cea.fr
URL	http://www.cea.fr
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

In the same framework of validating and improving the codes and the methods used for modelling the HTGR, a work is in progress concerning a benchmark proposed on the HTR-10 experiment.

The HTR-10 benchmark is composed of several parts corresponding each one to a problem: HTR-10FC is for determining the first criticality, HTR-10TC for isothermal temperature coefficient evaluation and HTR-10CR for calculating the reactivity worth of the control rods.

The NRG's calculations are ending-up concerning the HTR-10FC modelling with WIMS/PANTHER and have been presented at last PMM. They gave some good results in accordance with the experiment. A critical core height of 125 cm was obtained in comparison to the 126 cm of INET and to the experimental value of 123 cm. FZJ also began the calculations on HTR-10 with VSOP.

As far as the French calculations are concerned, the HTR-10FC and HTR-10CR problems will be completed for the next PMM. Two different models considering homogenized or not pebble bed have been considered on the basis of Monte Carlo calculations.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-03/06-D-1.3.1	Calculational Results on the HTR-10 First Criticality	PU
HTR-N-02/09-D-1.3.2	HTR-10 Benchmark	CO
HTR-N-02/09-D-1.3.3	HTR-10 Benchmark Problems	CO
HTR-N-03/06-D-1.3.4-1_0	Calculational Results for the Benchmark Problems of the HTR-10 Initial Core	CO
HTR-N-04/07-D-1.0.0-1_1	Technical Summary Report of the WP1	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	29		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	50
# of S&T publications (referenced publications only)	1	1
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	2	2
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐ x	**CONS**	Available for consultancy	☐

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Verified nuclear codes for Low-Enriched Uranium Fuel within pebble-type High-Temperature Reactor cores of different geometries (cylindrical / annular)

Treatment of stochastic geometry with Monte Carlo method in High-Temperature Reactors and particularly within the Pebble Bed reactor core cavity of a PBR.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Designers of HTR providing detailed data from core design and materials of the core structures for pebble bed designs.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: **Name: Xavier RAEPSAET**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
2a	Sensitivity of nuclear data uncertainties for high-burn up LEU and Pu-based fuel on nuclear physics calculations & needs for new data.

CONTACT PERSON FOR THIS RESULT

Name	W. Bernnat
Position	Work Package Manager
Organisation	University of Stuttgart, IKE
Address	Pfaffenwaldring 31 D-70550 Stuttgart, Germany
Telephone	+49 (0)711 685 2118
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E-mail	bernnat@ike.uni-stuttgart.de
URL	http://www.ike.uni-stuttgart.de
Specific Result URL	SINTER network

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

Nuclear data are the basis for the neutronics calculations in respect to reactivity and fuel composition as a function of burnup. Nuclear data evaluations are available from JEF-2.2 (JEFF-3) , ENDF/B-VI , JENDL-2.2 (JENDL-3). Most of the calculations performed for the WP1 and WP3 are based on the JEF-2.2 data. Comparisons of HTR specific calculations based on different data evaluations showed a quite good agreement between JEF-2.2 and JENDL-3.2 for uranium oxide fuel and between JEF-2.2 and ENDF/B-VI for plutonium based fuel. Comparisons of fission reaction rates for minor actinides and Pu-239 showed with few exceptions agreement with corresponding experiments of about 5%.

Sensitivity and uncertainty calculations were performed to analyse the impact of nuclear data on both multiplicity and fuel composition after high burn-up. Sensitivity profiles for different nuclides showed the high importance of the main fissionable nuclides (fission and capture) in respect to multiplicity for different Pu fuel (WG and RG) for low and high burn up. The data uncertainty of minor actinides, which are larger than for well known main fissionable nuclides, contribute not significantly do overall uncertainty due to the lower importance. The impact on data uncertainties on fuel composition after high burn-up is analysed too, this analysis will be continued for HTR-N1 benchmark.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-01/05-D-2.1.1	Specification of fuel cells composition and power histories relevant to WP1 and WP3	CO
HTR-N-01/05-D-2.1.3	Neutronics calculations for specified cells and power histories	CO
HTR-N-01/05-D-2.1.4	Sensitivity analysis and estimation of major impact of nuclear data uncertainties to reactivity & mass balance	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	23	29	40		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	100
# of S&T publications (referenced publications only)	1	1
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	2	2
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐ x
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ x

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

The precision of nuclear data has to be checked for each reactor system, individually. Results can be used for core designs and for finding deficiencies for further experimental validiation of cross sections which is principally poor for HTR conditions and materials as compared to other reactor systems.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Reactor designers and research organisations working in the field of nuclear reactor core physics and cross-section measurements.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: [signature] **Name:** Wolfgang Bernuat

Date: 18.10.04 **Organisation:** INSTITUT FÜR KERNENERGETIK UND ENERGIESYSTEME der Universität Stuttgart Pfaffenwaldring 31 - Postfach 80 11 40 70550 Stuttgart (Vaihingen)

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3a	Analysis of nuclear stability for different fuel cycles being optimised for *1st and 2nd generation* plutonium burning and low long-term radiotoxicity for continuous reload (pebble type HTR).

CONTACT PERSON FOR THIS RESULT

Name	J.C. Kuijper (Dr.)
Position	Task Manager Reactor Physics / Work Package Manager
Organisation	NRG
Address	Westerduinweg 3, P.O Box 25, Petten, the Netherlands
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URL	www.nrg-nl.com
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved

.

The core physics investigations at NRG and FZJ, as part of the activities within the 'HTR-N' project of the European Fifth Framework Program, are focussed on the incineration of pure first and second generation Pu in the reference pebble bed HTR ('HTR–MODUL') with a continuous reload ('MEDUL' – German: 'MEhrfach DUrchLauf', multi pass) fuelling strategy, in which the spherical fuel elements, or pebbles, pass through the core a number of times before being permanently discharged.

For pebbles fuelled with different loadings on plutonium the feasibility of a sustained fuel cycle under nominal reactor conditions were investigated by means of the reactivity and temperature coefficients of the reactor. The HTR–MODUL was found to be a very effective reactor to reduce the stockpile of first generation plutonium. It reduces the amount of plutonium to about one sixth of the original, and also reduces the risk of proliferation by denaturing the plutonium vector. For second generation plutonium the incineration is less favourable, as the amount of plutonium is only halved.

Due to the ultra-high burnup capabilities of the coated fuel particles in modern HTR concepts, these concepts are very promising from the point of view of Pu burning and waste minimisation. Therefore a large part of the project is concerned with the assessment and inter-comparison of the capabilities of a number of innovative HTR core and fuel cycle designs with respect to:

- Pu-incineration and minimisation of minor actinide production,
- economics and safety, and
- the selection of reference fuel cycles for the European coated particle development.

These studies are centred around the two main present day HTR designs, viz.

- continuous reload pebble bed HTR and
- batch-wise loaded hexagonal block type HTR.

Also the feasibility is studied of the use of "fast islands" in thermal HTRs for enhanced actinide transmutation.

For a meaningful assessment and inter-comparison of HTR concepts a common basis has been defined. Besides the definitions of the reference pebble bed and hexagonal block type this common basis includes the definition of a reference coated particle, the definition of reference *1st* and *2nd generation* Pu compositions and the definition of a set of transmutation and safety related common output parameters to be calculated for each of the concepts and cases studied.

The result of the studies enable a quantitative comparison, and possibly an optimisation, of the capabilities of a number of modern HTR concepts.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-03/11-D-3.2.1	Feasibility of burning first and second generation plutonium in pebble bed HTRs	CO
HTR-N-02/05-D-3.2.2	Incineration of LWR-plutoinium (1. generationand 2. generation) in a modular HTR using thorium-based fuel	CO
HTR-N-04/10-D-3.2.0	Studies on continuous reload pebble bed HTRs - summary report	CO
Paper/presentation ANFM-III conference	Feasibility of burning first and second generation plutonium in pebble bed HTRs (also submitted to "Nuclear Technology" journal)	PU
Paper/presentation HTR 2004 conference (su	HTR-N reactor physics and fuel cycle studies (also submitted to "Nuclear Engineering & Design" journal)	PU

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	23	29	40		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	60	60
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	-	-
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	100
# of S&T publications (referenced publications only)	2	4
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	-	-
# of publications addressing decision takers / public authorities / etc.	-	-
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐ x
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ x
			Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Plutonium burning can be more efficient by making use of high-burnup capabilities of HTR. Different fuel compositions for pebble bed cores have been investigated and shown the possibility of Pu-burning in continuously loaded HTR. Before entering into market deployment, this type of fuel has to be manufactured and tested. This will need additional R&D over at least five years. However, the results can directly be used to chose and design the experimental fuel, as a first step.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Research organisations and companies dealing with fuel cycle strategies for further optimisation of fuel design.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature:

Name: **J.C. Kuijper**

Date: **22 October 2004** **Organisation:** **NRG**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3b	Geometry and concentration of burnable poison particles in HTR fuel that give a reactivity curve as flat as possible.

CONTACT PERSON FOR THIS RESULT

Name	J.L. Kloosterman
Position/Title	Scientific researcher / Dr.
Organisation	Interfaculty Reactor Institute
Address	Mekelweg 15, NL-2629 JB Delft, Netherlands
Telephone	+31 15 278 1191
Fax	+31 15 278 6422
E-mail	Kloosterman@iri.tudelft.nl

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

A computer script has been written to perform accurate burnup calculations on HTR fuel taking into the account the double heterogeneity of that fuel. Numerous burnup calculations have been performed on a batch-wise fuelled pebble-bed type HTR with the aim to assess the influence of the radius and the concentration of burnable poison particles with different geometries. The optimal geometry and concentration has been determined for a pre-selected UO2 fuel. Only burnable poison particles made of B4C highly enriched in B-10 were studied. It was found that a reactivity swing as low as 2% can be obtained when each fuel pebble contains about 1070 burnable poison particles with a radius of 75 microns.

With the same computer script as above, the optimal geometry and concentration of burnable poison particles in PuO2 fuel has been determined. To get a reactivity swing below 4%, the optimal radius of the burnable poison particle should be 75 microns too, but the number of particles per fuel pebble should be around 1600.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
Paper	J.L. Kloosterman, *Application of boron and gadolinium burnable poison particles in UO2 and PuO2 fuels in HTRs,* Annals of Nuclear Energy, **30**:1807-1819, 2003.	PU
Paper	J.L. Kloosterman, H. van Dam, and T.H.J.J. van der Hagen, *Applying burnable poison particles to reduce the reactivity swing in high temperature reactors with batch-wise fuel loading,* Nuclear Engineering and Design, **222**:105-115, 2003	Pu
Conference Paper	J.L. Kloosterman, H. van Dam and T.H.J.J. van der Hagen, *Design of Spherical and 'Hollow' Burnable Particles for UO2 Fuels in High Temperature Reactors,* First International Topical Meeting on High Temperature Reactor Technology (HTR 2002), Petten, Netherlands (2002).	Pu
HTR-N Document : HTR-N-03/05-D-3.3.3	Design of burnable poison particles tp reduce the reactivity swing in batch-wise fuelled HTR	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	23	29	40		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	60	60
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	100
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐

		Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Plutonium burning can be more efficient by making use of high-burnup capabilities of HTR. In case of batch loaded cores with Pu (or U) fuel, the excess reactivity has to be compensated by burnable poison. It was found that the diameter of the burnable poison particles can be optimized to reach long operation cycles between reloads and to get flat reactivity evolution.
Before entering into market deployment, this type of absorber particles has to be manufactured and tested. This will need additional R&D over at least five years. However, the results can directly be used to chose and design the experimental absorber particles, as a first step.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Research organisations and companies manufacturing coated particles and designing HTR fuel / cores.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: **Name: J.L. Kloosterman**

Date: 18 October 2004 **Organisation: Delft University of Technology**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3c	Fuel cycles with batch-wise reload (block type HTR): *1st generation Pu.*

CONTACT PERSON FOR THIS RESULT

Name	F. DAMIAN
Position	Scientific Researcher
Organisation	CEA
Address	33 rue de la Federation 75752 Paris Cedex 15
Telephone	+33 1 01 69 08 38 79
Fax	+33 1 01 69 08 23 81
E-mail	fdamian@cea.fr
URL	http://www.cea.fr
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

The work carried out in the WP3 concerned the assessment of the fuel cycles performances in the block type HTR concept. The preliminary analyses have been performed on the Gas Turbine Modular Helium-cooled Reactor (GT-MHR) for 1st generation plutonium based fuel. Indeed, by accommodating different neutronic parameters, such as particle volume fraction in the graphite matrix, burnable poison etc., the HTGR appears as an attractive way to exploit the merits of the plutonium.

Physical parameters such as fuel cycle length, fuel loading and burnable poison impact on core reactivity margin, temperature coefficients, plutonium and minor actinides balance have been evaluated. As far as the plutonium fuel is concerned, preliminary investigations showed that:

1/ the fuel cycle length increases linearly with the mass of plutonium loaded into the core,

2/ there is an optimum for the fuel loaded into the core with respect to the discharged burnup. This optimum allows using at best the plutonium.

Besides, despite the strong decrease of the moderator temperature coefficient during fuel irradiation, the preliminary results have shown that the global core temperature effect is negative and therefore self-stabilizing, with a fuel management by 1/3rd where the average core burnup ranges roughly from 200 and 400 GWd/t between the beginning and the end of cycle.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
Deliverable Report HTR-N Document: HTR-N-04/07-D-3.3.1	***"Feasibility of Burning First and Second Generation Plutonium in Prismatic Blocks HTRs"***	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	29		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	60	60
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	100
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Plutonium burning can be more efficient by making use of high-burnup capabilities of HTR. Different fuel compositions for block-type cores have been investigated and shown the possibility of Pu-burning in batch-loaded HTR. Before entering into market deployment, this type of Pu fuel has to be manufactured and tested. This will need additional R&D over at least five years. However, the results can directly be used to chose and design the experimental fuel, as a first step.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Research organisations and companies dealing with fuel cycle strategies for further optimisation of fuel and core design.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature:  **Name: DAMIAN**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3d	Investigation of plutonium/minor actinides based fuel cycles: preliminary analysis of the Deep Burn HTR Transmuter Concept.

CONTACT PERSON FOR THIS RESULT

Name	F. DAMIAN
Position	Scientific Researcher
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E-mail	fdamian@cea.fr
URL	http://www.cea.fr
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result, which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non-confidential information on entities potentially involved.

The work carried out in the WP3 concerned the assessment of different fuel cycles performances such as plutonium/minor actinides fuel cycles in the block type HTR concept. The preliminary analysis has been performed on the GENERAL ATOMICS Deep-Burn HTR-Transmuter concept. In this kind of design, the plutonium and the minor actinides are located in separate driver and transmuter fuel particles. The concept is based on an optimisation of the physical parameters such as the volumetric filling fraction of the fuel particles and the size of the particles in order to ensure a better use of the matter (fissile and non-fissile matter).

Preliminary results show that the driver particles (particles that contain the plutonium fuel) must be as large as possible in order to ensure a better utilisation of the fissile isotopes. Furthermore, it has been demonstrated that there is an optimum with respect to the mass of plutonium loaded into the core. On the opposite, a small particle size and a high mass of minor actinides are necessary to achieve a better transmutation rate.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
Deliverable Report Document HTR-N-04/07-D-3.3.2	***"Feasibility of Burning Plutonium and Minor Actinides in Prismatic Blocks HTRs"***	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	29		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	120	120
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	50
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Plutonium & actinide burning can be more efficient by making use of high-burnup capabilities of HTR. This will allow strong reduction of Pu and actinide content in the spent fuel without multiple reprocessing and multi-refabrication of the fuel. Different fuel compositions for block-type cores have been investigated and shown the possibility of Pu and actinide burning in batch-loaded HTR. Before entering into market deployment, this type of Pu and actinide fuel has to be manufactured and tested. This will need additional R&D over at least ten years. However, the results can directly be used to chose and design the experimental fuel, as a first step.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Research organisations and companies dealing with fuel cycle strategies for further optimisation of fuel, core design and back-end issues.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature:  **Name: DAMIAN**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3e	Improving the incineration of minor actinides in thermal reactors by generation of fast islands with thin fissile films.

CONTACT PERSON FOR THIS RESULT

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E-mail	magill@itu.fzk.de
URL	
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

The disposal of nuclear waste is one of the major problems to be solved to guarantee a future for the nuclear industry. For this reason, the incineration of plutonium and minor actinides (MA) is probably the most interesting and effective option in reducing the radio-toxicity of the wastes produced by the nuclear fuel cycle.

An alternative solution to Fast Reactor or ADS is to make use of thin fissile films as flux converters to generate regions with fast fluxes inside a thermal reactor and thereby improve their incineration capabilities. The basic idea is to isolate some regions inside the reactor by de-coupling them from the main core with a flux converter. Provided that no moderating material is present inside these regions, the flux there will be prevalently fast and allow a more effective incineration of minor actinides.

The scope of this work is to analyze the feasibility of fast islands in thermal reactor, by giving a rough estimation on basic dimensioning, flux conversion and incineration performances. Some of the outstanding results are that the block-type HTGR seems to offer the best conditions for an optimal design of a fast island, and that the typical incineration rates in fast islands are two-three times higher than the corresponding rates in thermal reactors.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531			

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	☐
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
JRC-ITU-TN-2001/10 JRC Technical Report	Improving the incineration of minor actinides in thermal reactors by generation of fast islands with thin fissile films	PU
P-CEP-03/LU WO 01/82306, PCT/EP01/04573 **World Patent**	Method of incineration of minor actinides in nuclear reactors	PU

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-ex Tick a detail appro**
	Current				**Foreseen**	**Ti**
	Tick	**NoP 1)**	**NoI 2)**	**Details**	**Tick**	
Patent applied for	☐				☐	☐
Patent granted	☒	PCT/ EP01/ 04573	WO 01/04 573		☐	☐
Patent search carried out	☐				☐	☐
Registered design	☐				☐	☐
Trademark applications	☐				☐	☐
Copyrights	☐				☐	☐
Secret know-how	☐				☐	☐
Other - please specify :	☐				☐	☐

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	23	29	40		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result :		
of which : number of SMEs :		
of which : number of entities in third countries (outside EU) :		
Targeted user audience: # of reachable people		
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	Yes / No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: **Name: Joseph Magill**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3f	Assessment of the possibilities to increase the power size of continuous reload (pebble bed) HTRs.

CONTACT PERSON FOR THIS RESULT

Name	W. Bernnat
Position	Task Manager
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Fax	+49 (0)711 685 2010
E-mail	bernnat@ike.uni-stuttgart.de
URL	http://www.ike.uni-stuttgart.de
Specific Result URL	SINTER network

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

The maximisation of the power size of modular pebble bed HTR's with Brayton and Rankine cycle under the constraints that defined temperatures of fuel and structure components will not be exceeded even under all kinds of loss of coolant accidents was investigated for several design and reload concepts.

Comparing concepts with dynamic and solid inner columns with inactive material regarding the maximum fuel temperature after DLOCA an advantage for the solid inner part can be seen. For both designs (400 MW range), the behaviour is quite similar and the differences are mainly caused by the lower thermal inertia of the pebbles compared to a massive graphite column. Thus, the maximum temperature is reached at an earlier time, when the decay heat to be removed is still at a higher level.

For the PLOCA accident, the fuel temperatures remain below the corresponding temperatures of a DLOCA accident, but the mechanical stability of the Reactor Pressure Vessel must be considered. To limit the RPV temperature during PLOCA, a corresponding thermal isolation of the reflector must be used.

Generally, the maximum core size is limited by the DLOCA and PLOCA criteria, as well as physical (e.g. shutdown reactivity, Xe-stabiity), technological and economic constraints.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531			

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-04.06.-D-3.2.3	U based fuel and maximum power size	CO
The 2nd International Toping Meeting on HTR Technology, Beijing, INET, China, Sept. 22-24, 2004	The impact of Design on the Decay Heat Removal Capabilities of a Modular Pebble Bed HTR	PU
Nuc. Eng. Design 220, 2003, 331-347 paper	Models for reactor physics calculations for HTR pebble bed modular reactors	PU

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	23	29	40		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	100
# of S&T publications (referenced publications only)	1	1
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	2	2
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐ x
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ x

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Increasing the power of the unit is the most effective way to reduce the electricity costs of modular pebble bed High Temperature Reactor power plants. Doing this while keeping the feature of inherent safety is a complex optimization process of operating data, the core geometry and configuration of structures. The range of design parameters is limited by physical requirements (e.g. ability to shutdown only with absorber rods in reflector, removal of the decay heat from the core by passive means, stability against Xenon oscillations ...) and technical-economical constraints (the size and manufacture technology of the reactor pressure vessel, technology used for compensating the pressure drop over the system ...). The methods applied and the results achieved can be used for further development of HTRs.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Reactor designers and research organisations working in the field of HTR reactor development. Licensing authorities.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: W. Bernnat **Name:** Wolfgang Bernnat

Date: 18.10.04 **Organisation:** INSTITUT FÜR KERNENERGETIK UND ENERGIESYSTEME der Universität Stuttgart Pfaffenwaldring 31 - Postfach 80 11 40 70550 Stuttgart (Vaihingen)

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3g	Definition of (reactor physical) parameters to assess and intercompare HTR core designs with respect to (safe and economic) Pu and MA incineration.

CONTACT PERSON FOR THIS RESULT

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Fax	+31 224 56 8490
E-mail	kuijper@nrg-nl.com
URL	www.nrg-nl.com
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

Due to the ultra-high burnup capabilities of the coated fuel particles in modern HTR concepts, these concepts are very promising from the point of view of Pu burning and waste minimisation. Therefore a large part of the project is concerned with the assessment and inter-comparison of the capabilities of a number of innovative HTR core and fuel cycle designs with respect to:

- Pu-incineration and minimisation of minor actinide production,
- economics and safety, and
- the selection of reference fuel cycles for the European coated particle development.

These studies are centred around the two main present day HTR designs, viz.

- continuous reload pebble bed HTR and
- batch-wise loaded hexagonal block type HTR.

Also the feasibility is studied of the use of "fast islands" in thermal HTRs for enhanced actinide transmutation.

For a meaningful assessment and inter-comparison of HTR concepts a common basis has been defined. Besides the definitions of the reference pebble bed and hexagonal block type this common basis includes the definition of a reference coated particle, the definition of reference *1st* and *2nd generation* Pu compositions and the definition of a set of transmutation and safety related common output parameters to be calculated for each of the concepts and cases studied.

The result of the studies enables a quantitative comparison, and possibly an optimisation, of the capabilities of a number of modern HTR concepts.

Please categorise the result using codes from Annex 1

Subject descriptors codes	128	129	531		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐ x
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-02/09-D-3.1.1	Definition of common parameters and reference HTR designs for HTR-N[1]	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	29		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	-	-
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	50
# of S&T publications (referenced publications only)	-	-
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	-	-
# of publications addressing decision takers / public authorities / etc.	-	-
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ X	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐ X
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ X
			Other	(please specify) _____	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

-

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

-

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature:

Name: **J.C. Kuijper**

Date: **22 October 2004** **Organisation:** **NRG**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
3h	Definition of a HTR-N Project Q.A. Framework system based on a double context approach able to harmonise the Partner organisations Q.A. within the HTR-N Project through use of suitable heading forms and specific procedures for issuing contractual deliverables.

CONTACT PERSON FOR THIS RESULT

Name	A. Negrini
Position	Senior engineer
Organisation	ANSALDO
Address	Corso Perrone 25, I-16161 Genova, Italy
Telephone	+ 39 010 6558516
Fax	+39 010 64018516
E-mail	negrini@ansaldo.it
URL	www.nrg-nl.com
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

The participation of a large number of Partners (research organisations, universities, industry) in the HTR-N project together with the need of acknowledging the status, validity and consistency of information and documents has required to settle a common ground for harmonising different working procedures ruled under possibly different work organisation environments, or practices, in order the HTR-N Project Partners could be confident they were interacting with the necessary degree of coherency and reliability when performing their common Project activity. It has then been agreed between the Partners to endow the HTR-N with a Q.A. based system that, while assuring the Partners on the consistency of information reported and utilised between them, would also at the same time entitle the HTR-N Project with qualified results and final document reports (project deliverables). The final goal of the ANSALDO contribution has been hence to provide the HTR-N Project with a substantial added value as concerns the worthiness, confidence and traceability of the Project's eventual findings by supporting the activity with a practical experience stemming from industrial environment certified production and interaction with regulatory bodies. General Q.A. guidelines suitable for addressing and controlling the procedure applied in the production of the results, their control, approval and filing, have been issued for that purpose.

The definition of Q.A. requirements for the HTR-N Project was considered a basic framework for certifying the Project activity: the Quality Assurance requirements provided by ANSALDO have in particular addressed the procedure for the preparation of project documents according to a double context Q.A. system based, on a side, on the current certified Q.A. standards which were credited to be in force at the Partner organisations and, on the other, on suitable HTR-N Project Q.A. contents to be constructed through suitable procedures harmonising the consolidated practice available between the Partners. The HTR-N Project Q.A. has also adopted specific form sheets throughly reflecting the preparation/reviewing and issuing process by the Partners and the HTR-N Project: two forms, HTR-N 01/1 and HTR-N 02/1, have been prepared for use as front/cover page and second page for general purpose application in the HTR-N project. Moreover, the adopted Q.A. procedure (document "HTR-N Project Q.A. Requirements") can synergically through implementation under the SINTER Network.

Please categorise the result using codes from Annex 1

Subject descriptors codes	522	511	220	436	

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	☐ x
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.): Q.A. & Evaluation applied to Nuclear Engineering RTD Project	☐ x

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-02/06-D-3.5.1-1_0	HTR-N PROJECT Q.A. REQUIREMENTS	PU

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	29		

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	25	>30
of which : number of SMEs :	-	-
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	50
# of S&T publications (referenced publications only)	-	-
# of publications addressing general public (e.g. CD-ROMs, WEB sites)	-	-
# of publications addressing decision takers / public authorities / etc.	-	-
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ X
			Other	(please specify) _____	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

-

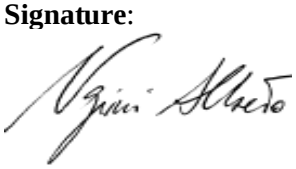
PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

-

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature:



Name: **A. Negrini**

Date: **2 November 2004** **Organisation:** **ANSALDO**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
4a	Analysis & quantification of operational waste from HTR

CONTACT PERSON FOR THIS RESULT

Name	Mr. Antony Norman Nuttall
Position	
Organisation	NNC Limited
Address	Booths Hall, Chelford road, WA16 8QZ Knutsford, United Kingdom
Telephone	0044 1565 84 3113
Fax	0044 1565 84 3082
E-mail	tony.nuttall@nnc.co.uk
URL	
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved

.

This item addresses spent fuel analysis, irradiated graphite analysis (for replaceable reflector and graphite fuel wastes) and operational wastes from shutdown HTRs.

The spent fuel activation analysis for GT-MHR indicates that when compared to LWRs for equivalent output, the volume of spent fuel is favourable to HTRs, in some cases by a factor of nearly 2. If it is considered that the graphite compacts holding the fuel can be separated after operation, then the factor in favour of HTR approaches 10.

Graphite wastes during operation arise from replacing the reflector periodically, and from fuel compacts if separated as described above. The activation analysis identifies the quantities of the graphite per 1000Mwe.

Archive data for shut down HTRs identifies quantities of operational wastes and discharges.

The effects of Wigner energy on graphite disposal have been assessed. For some types of reactors it is considered necessary to anneal the graphite prior to final disposal, to avoid possible release of energy during storage. For HTR operation however this is not considered necessary, as minimum operating temperatures are above the self-annealing levels.

Please categorise the result using codes from Annex 1

Subject descriptors codes	665	666	436		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-10/03-D-4.0.3	HTR Specific Wastes. Report presenting an assessment of HTR operating wastes. The wastes determined for HTR are compared with LWR wastes. The potential for waste minimisation is also reviewed.	CO
HTR-N-04/11-D-4.0.4	HTR N, Technical Summary Report of WP4-Specific Wastes	PU

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	37	29	

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	100
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐ x
JV	Joint venture	☐	**CONS**	Available for consultancy	☐

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

The operational waste streams of HTR have been quantified. They show some advantage as compared to other reactor systems if the management of contaminated graphite can be improved. First proposals for graphite treatment have been elaborated and patent applications prepared (see HTR-N1). These methods can also be used for existing graphite waste from former / present HTR, MAGNOX and AGR.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Collaboration with organisations from radioactive waste management and graphite industry would provide complementary input for development of graphite conditioning processes. Reactor designers might profit by minimising operational waste already by design and material choice.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature:  **Name: Antony N Nuttall**

Date: 8 November 2004 **Organisation: NNC Ltd**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
4b	Analysis & quantification of decommissioning waste from HTR

CONTACT PERSON FOR THIS RESULT

Name	Mr. Antony Norman Nuttall
Position	
Organisation	NNC Limited
Address	Booths Hall, Chelford road, WA16 8QZ Knutsford, United Kingdom
Telephone	0044 1565 84 3113
Fax	0044 1565 84 3082
E-mail	tony.nuttall@nnc.co.uk
URL	
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

These wastes are addressed in two categories, namely, analytical, and actual from archive.
The activation analysis gives indicative volumes of graphite that will arise during decommissioning. The archive primarily identifies decommissioning wastes. Five shutdown HTRs, AVR, THTR, DRAGON, FSV and Peach Bottom were researched. The majority of information available was obtained from the German and UK reactors. The information was examined with a particular view to quantify these wastes and a comparison table was compiled. Tentative conclusions were
- Larger reactors and longer operating lives produce less relative waste quantities
Approximately 90 to 95% of total station quantities are free release.

It is possible that with direct cycle machines (e.g. a helium turbine) the power circuit can become contaminated. The contamination can increase the waste quantity by one third. The potential sources of contamination include, graphite dust, tritium and silver deposits from fission (noted in DRAGON operation).

Please categorise the result using codes from Annex 1

Subject descriptors codes	665	666	436		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐ x
Guidelines, methodologies, technical drawings	☐ x
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-10/03-D-4.0.3	HTR Specific Wastes. Report presenting an assessment of HTR decommissioning wastes. The wastes determined for HTR are compared with LWR wastes. The potential for waste minimisation is also reviewed.	CO
HTR-N-04/11-D-4.0.4	HTR N, Technical Summary Report of WP4-Specific Wastes	PU
HTR-N-02/06-D-4.1.1	Literature Archive of wastes arising from shutdown HTRs.	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	37	29	

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)	1	1
Number of (public or private) entities potentially involved in the implementation of the result :	10	10
of which : number of SMEs :	?	?
of which : number of entities in third countries (outside EU) :	5	5
Targeted user audience: # of reachable people	50	100
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐

		Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

The decommissioning waste streams of HTR have been quantified. They show some advantage as compared to other reactor systems if the management of contaminated graphite can be improved. First proposals for graphite treatment have been elaborated and patent applications prepared (see HTR-N1). These methods can also be used for existing decommissioning graphite waste from former / present HTR, MAGNOX and AGR.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Collaboration with organisations from radioactive waste management and graphite industry would provide complementary input for development of graphite conditioning processes. Reactor designers might benefit by minimising decommissioning waste already by design and material choice.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: 

Name: Antony N Nuttall

Date: 8 September 2004

Organisation: NNC Ltd

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
5a	Data on the corrosion behaviour of silicon carbide coating under different geological conditions

CONTACT PERSON FOR THIS RESULT

Name	M.J. den Exter
Position	Scientific Researcher / Dr.
Organisation	Nuclear Research and Consultancy Group, NRG
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Telephone	+ 31 22456 8102
Fax	+31 22456 8608
E-mail	denexter@nrg-com.nl
URL	www.nrg-nl.com
Specific Result URL	

SUMMARY *(200 words maximum)*

Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.

HTR is a promising concept for the future. Next to conceptual design studies, reactor physics and safety issues during operation, the European nuclear community realises that possibilities for adequate safe long-term storage of burned-up fuel enhances public acceptance for nuclear power.

From a chemical point of view, direct disposal of spent HTR fuel is justified by some favorable characteristics of HTR fuel elements, in particular the presence of chemically resistant coating layers around the radioactive fuel kernels such as the silicon carbide layer which are further embedded in a highly stable graphite matrix.
It is therefore essential to develop geochemical models describing behaviour of the fuel materials in envisaged repositories.

The works carried out in the WP5 concerns the corrosion behaviour of HTR fuel under geological repository conditions.
Graphite corrosion, fuel corrosion and corrosion of silicon carbide, one of the coating layers, has been investigated.

The silicon carbide layer proves to be extremely resistant to leachants, representative for geological conditions in salt domes, clay layers and granite rock environment. Life-times upto 1.E5 years are found, presuming integral and uniform corrosion, when keeping the temperature in the repository low. At more elevated temperatures, silicon carbide life-times are decreased to values of 1.E3 years. Results are encouraging and keep options for direct disposal of spent HTR fuel open. Silicon carbide has been irradiated in the High Flux reactor in Petten and is currently studied for leaching behaviour.

Please categorise the result using codes from Annex 1

Subject descriptors codes	665	666	436			

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	X
Guidelines, methodologies, technical drawings	☐
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
HTR-N-02/05-D-5.3.1a	Aqueous Phase Corrosion of Silicon Carbide	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	37	29	

2.2 Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result :		
of which : number of SMEs :		
of which : number of entities in third countries (outside EU) :		
Targeted user audience: # of reachable people		
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	Yes / No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3 Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐ X	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐ X
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ X

	Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

Fundamental research on leaching behaviour of fuel and fuel related materials under geological repository conditions.

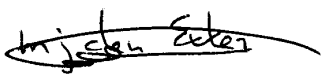
PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

Research Institutes with facilities for carrying out leaching research and more specific with URL facilities.

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature:



Name: M.J. den Exter

Date: September 9, 2002 **Organisation: NRG**

2.1 Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
5b	Data on the corrosion of non-irradiated kernels, coating and fuel matrix under different geological conditions

CONTACT PERSON FOR THIS RESULT

Name	Bernd Grambow
Position	Head of Radiochemistry Laboratory, Professor
Organisation	SUBATECH/Ecole des Mines de Nantes
Address	4 rue Alfred Kastler 44307 Nantes, France
Telephone	+33251858470
Fax	+33251858452
E-mail	Grambow@subatech.in2p3.fr
URL	http://www-subatech.in2p3.fr
Specific Result URL	

SUMMARY *(200 words maximum)*

Radionuclide Release from the Fuel Kernel

The corrosion resistance of fuel kernels has been measured in simulated repository groundwater as a function of temperature, pH and of redox potential both under static and dynamic conditions. Surface and solution analyses show non-uniform incongruent corrosion as well as pitting phenomena. Release rates of Th were always significantly lower than that of uranium.

In mixed Th/UO_2 kernels Uranium dissolution rate reach its maximum during first months and than decrease significantly till the end of experiment. With time inventory normalised U and Th release rates become more and more close.

Corrosion rates under oxidizing conditions are high (about 2 mg/m^2d), not allowing to attribute anny barrier performance to the fuel kernel; but under the reducing conditions expected for a deep repository the rates are about 0.02 mg/m^2d and seem to decrease further with time. This would assure fuel dissolution times of more than 10^5-10^6 years, however, the impact of radiation damage and radiolysis on fuel live times has yet to be determined. The results apply to the fuel matrix for various U/Th ratio, but not to potentially segregated fission product deposits.

Geochemical Modelling of the Radionuclide Release

A corrosion model has been developed to describe fuel kernel dissolution in the fuel pebble considering the following scenario: diffusion of water into the pebble in few years, failure of the SiC coating in 10000 years, dissolution of Kernels in about 10^6 years under reducing and 10^{-4} years under oxidizing conditions. Solubility limits in the fuel pebble pore space are considered as well. The results show that the for conventional LWR fuel very important instant release fraction is much less important for HTR fuel. This is due to the stability of the SiC coating. Significant release reduction can be achieved by solubility constraints on the release of radiotoxic actinides.

Please categorise the result using codes from Annex 1

Subject descriptors codes	665	210	436		

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ☐

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	☐
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details (Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
	HTR-N Annual Technical Progress Report	CO
Radionuclide Release from the Fuel Kernel	Data will be used to constrain further model development, as a base for comparison to irradiated fuel studied in the project HTR-N1, and to data generated in the VHTR project concerning the effect of radiolysis on fuel dissolution	CO
Geochemical Modelling of the Radionuclide Release	The model needs further development in the VHTR model to describe more realistically the pore fluid composition within the fuel pebble considering as well radiolysis effects	CO

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	37	29	

2.2. Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result :		
of which : number of SMEs :		
of which : number of entities in third countries (outside EU) :		
Targeted user audience: # of reachable people		
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	Yes / No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3. Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: **Name: Prof. Grambow**

Date: 19.10.2004 **Organisation**

2.1 : Description of the result(s), one form per result

No. & TITLE OF RESULT (same as in table 1.2)

No.	Self-descriptive title of the result
5c	Data on the corrosion of non-irradiated fuel matrix (graphite) and coating material (pyrocarbon) under different geological conditions

CONTACT PERSON FOR THIS RESULT

Name	Dr. J. Fachinger
Position	Group leader
Organisation	Research Centere Jülich
Address	Leo Brandt Str., 52425 Jülich, Germany
Telephone	+49 2461 61 6671
Fax	+49 2461 61 8231
E-mail	J.Fachinger@FZ-Juelich.de
URL	www.fz-juelich.de
Specific Result URL	

SUMMARY (200 words maximum)**Provide an overview of the result which gives the reader an immediate impression of the nature of the result, its relevance and its potential; Briefly describe the current status/applications of the result (if appropriate) with non confidential information on entities potentially involved.**

The High Temperature Reactor (HTR) concept integrates sustainability with respect to resource and waste management.

The HTR fuel consist of small particles embedded in a graphite matrix. The particles are composed of fuel kernels, encapsulated by pyrocarbon and additionally by a silicon carbide layers in the case of advanced fuel particles. Each coating layer and the graphite matrix act as barriers against the release of radionuclides under operation and disposal conditions.

A mobilisation of radioactive nuclides can only occur, if water comes into contact with them. The graphite matrix restricts the penetrating water amount to its open pore volume. The diffusion coefficients of nuclides in the pores of the graphite matrix had been measured. It is the same order of magnitude as the physical diffusion in cement blocks without chemical retardation. The pore volume could be increased by corrosion of the graphite. Therefore the corrosion rate of graphite under final disposal conditions had to be determined. The pyrocarbon coating layer has a dense structure and therefore water did not penetrate this barrier. In this case the corrosion of the pyrocarbon will be the dominant factor for the estimation of the live time of this barrier.

The corrosion rate of unirradiated graphite and pyrocarbon in final repository relevant solution had been determined in presence of oxygen as well as in argon atmosphere. No corrosion could be detected under this conditions. Corrosion experiments with a external γ-irradiation will be performed in the project HTR-N1.

Please categorise the result using codes from Annex 1

Subject descriptors	665	210	436			

CURRENT STAGE OF DEVELOPMENT

Please tick one category only ◻

Scientific and/or Technical knowledge (Basic research)	☐ X
Guidelines, methodologies, technical drawings	☐
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify.):	☐

DOCUMENTATION AND INFORMATION ON THE RESULT

List main information and documentation, stating whether public or confidential.

Documentation type	**Details(Title, ref. number, general description, language)**	**Status: *PU*=Public *CO*=Confidential**
Report	HTR Final Report, English	CO
Internal Report	Corrosion behavior of graphite and pyrocarbon (in press), English	CO
Internal Report	Diffusion of radionuclides through water saturated graphite (in press), English	CO
PhD-Thesis	Graphite corrosion in aquatic phases and graphite treatment (in press), English	PU

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP [1)]**	**NoI [2)]**	**Details**	**Tick**		
Patent applied for	☐				☐	☐	
Patent granted	☐				☐	☐	
Patent search carried out	☐				☐	☐	
Registered design	☐				☐	☐	
Trademark applications	☐				☐	☐	
Copyrights	☐				☐	☐	
Secret know-how	☐				☐	☐	
Other - please specify :	☐				☐	☐	

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

MARKET APPLICATION SECTORS

Please describe the possible sectors for application using the NACE classification in Annex 2.

Market application sectors	40	23	37	29	

2.2. Quantified data about the result

Items (about the results)	**Actual current quantity [a]**	**Estimated (or future) quantity [b]**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result :		
of which : number of SMEs :		
of which : number of entities in third countries (outside EU) :		
Targeted user audience: # of reachable people		
# of S&T publications (referenced publications only)		
# of publications addressing general public (e.g. CD-ROMs, WEB sites)		
# of publications addressing decision takers / public authorities / etc.		
Visibility for the general public	Yes / No	

[a] *Actual current quantity = the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve within the next 3 years.*

2.3. Further collaboration, dissemination and use of the result

(Optional; to be completed if partner is willing to set up new collaborations, and seeking dissemination support from the CORDIS services.)

COLLABORATIONS SOUGHT

Please tick appropriate boxes (☐) corresponding to your needs.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing	☐	**INFO**	Information exchange	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

Please, clearly describe your input, the value and interest of the applications and the dissemination and use opportunities that you can offer to your potential partner.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Please, clearly describe the profile and the expected input from the external partner(s).

I confirm the information contained in part 2 of this Technological Implementation Plan and I authorise its dissemination to assist this search for collaboration.

Signature: **Name: von Lensa**

Date: 11.11.2004 **Organisation:**

Part 3 Description of the intentions by each partner

This part 3 must be completed by each partner who is essential for the dissemination and use (i.e. result owners and/or major project contributors and/or major dissemination and use contributors). Each will detail its own use and dissemination intentions concerning the result(s) they are involved with. This description must be made result by result.

These different parts may be transmitted to the Commission either assembled at the consortium level, or individually by each partner to safeguard confidential matters if necessary (through any appropriate media). Obviously, when all partners are implementing a single dissemination and use scheme all together, a single part 3 is needed.

PARTS 3 WILL ALWAYS BE KEPT CONFIDENTIAL BY THE COMMISSION

3.1 : Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**Forschungszentrum Juelich GmbH (FZJ)**

CONTACT PERSON(S):

Name	Werner von Lensa
Position/Title	Dr.
Organisation	FZJ-ISR
Address	52425 Jülich Leo-Brandt-Strasse
Telephone	+49 2461 616629
Fax	+49 2461 615342
E-mail	w.von.lensa@FZ-Jülich.de

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	Literature Archive HTR Head End A full text searchable literature archive had been implement at FZJ which contains old reports of the FZJ related to the head end of the HTR fuel cycle.
2	Determination of the mechanical stability of unirradiated fuel kernels A new method for the determination of the hardness of HTR fuel kernels. This methods allows the comparison of the crushing strength with respect to the fracturing of kernels. The method had been used to compare the quality of the different fuel kernels used in the HTR-N project.
3	Determination of corrosion rates of unirradiated graphite and pyrocarbon. Graphite and pyrocarbon powders from unirradiated HTR fuel elements had been immersed in final repository relevant solutions and the corrosions rates had been determined by the evolution of CO_2. It had been proofed, that corrosion of graphite and pyrocarbon can be neglected in absence of irradiation.
4	Determination of uranium and thorium leaching rates from unirradiated HTR fuel kernels. Unirradiated UO_2, ThO_2 and $(U,Th)O_2$ had been leached with final repository relevant solutions. The dissolution rates of Th und U had been determined and compared with simple model developed for the simulation of dissolution of solid solutions. The results as well as the model show the stabilising effect of the inert ThO_2 matrix.
5	Verification of nuclear physics codes with recent results from HTR-10 and HTTR
6	Nuclear fuel cycle studies for burning of plutonium in HTR

FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
Literature review	The archive system is foreseen to review old reports about the HTR head end by FZJ and, if a solution of the intellectual property rights of third parties are regulated, by the partners of the HTR-N project	0
Mechanical stability	Use in the HTR-N1 and VHTR project for the investigation of the irradiated material and coated particles.	0
Corrosions rates of graphite and pyrocarbon	Basic data for the HTR-N1 and VHTR project.	0
Leaching behaviour of U and Th from unirradiated HTR fuel kernels	Basic data for the HTR-N1 and VHTR project.	0
Application of nuclear codes	Use of verified nuclear codes for safety evaluations and waste issues concerning plutonium inventory reductions and radiotoxicity determination	0

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐) corresponding to your most probable follow-up.

R&D	Further research or development	☐ X	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐ X
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

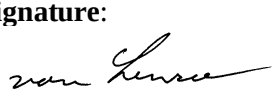
3.2 Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)		
# of licenses issued (within EU)		
# of licenses issued (outside EU)		
Total value of licenses (in EURO)		
# of entrepreneurial actions (start-up company, joint ventures…)		
# of direct jobs created [c]	3	5
# of direct jobs safeguarded [c]		
# of direct jobs lost		

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name: Dr. W. von Lensa**



Date:11.11.2004

3.1 : Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**Ansaldo Energia – Nuclear Division**

CONTACT PERSON(S):

Name	A. Negrini
Position/Title	Senior Engineer
Organisation	ANSALDO
Address	Corso Perrone 25 I-16161 Genova, Italy
Telephone	+ 39 010 6558516
Fax	+39 010 64018516
E-mail	negrini@ansaldo.it

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	Definition of a multi-partner Q.A. framework system based on a double context approach aimed at harmonising the single partners' Q.A. within a common international project through use of suitable Q.A. requirements, specific procedures and heading forms for preparing and issuing project documents.

FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
Q.A. procedures for FP-EU supported projects	**Use of Q.A. requirements for future HTR projects, consistent PM procedures and forms for checking/control of project documents quality, reliability, traceability and filing.**	**TBD**

FOREseen COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐ corresponding to your most probable follow-up.

R&D	Further research or development	☐ X	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ X
			Other	(please specify)	☐

3.2 : Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)	-	-
# of licenses issued (within EU)	-	-
# of licenses issued (outside EU)	-	-
Total value of licenses (in EURO)	-	-
# of entrepreneurial actions (start-up company, joint ventures…)	-	-
# of direct jobs created [c]	-	-
# of direct jobs safeguarded [c]	-	-
# of direct jobs lost	-	-

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature:  **Name: A.Negrini**

Date: 15 November 2004

3.1 Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	
PARTNER's NAME :	**COMMISSARIAT A L'ENERGIE ATOMIQUE**

CONTACT PERSON(S):

Name	BARBIER
Position/Title	Project manager
Organisation	CEA
Address	Bât. 212 BP1 13108 Saint Paul Lez Durance
Telephone	(33) 4 42 25 76 18
Fax	(33) 4 42 25 71 87
E-mail	Dominique.barbier@cea.fr

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	
2	
3	
4	
5	

FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐) corresponding to your most probable follow-up.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

3.2 Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)		
# of licenses issued (within EU)		
# of licenses issued (outside EU)		
Total value of licenses (in EURO)		
# of entrepreneurial actions (start-up company, joint ventures…)		
# of direct jobs created [c]		
# of direct jobs safeguarded [c]		
# of direct jobs lost		

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name: D. BARBIER**

Date:18 October 2004

3.1 : Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020 (HTR-N)**
PARTNER's NAME :	**ARMINES-SUBATECH; ENSTIMN-SUBATECH**

CONTACT PERSON(S):

Name	Bernd Grambow
Position/Title	Head of Radiochemistry Laboratory, Professor
Organisation	SUBATECH/Ecole des Mines de Nantes
Address	4 rue Alfred Kastler 44307 Nantes
Telephone	+33251858470
Fax	+33251858452
E-mail	Grambow@subatech.in2p3.fr

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	*Radionuclide Release from the Fuel Kernel* The corrosion resistance of fuel kernels has been measured in simulated repository groundwater as a function of temperature, pH and of redox potential both under static and dynamic conditions. Surface and solution analyses show non-uniform incongruent corrosion as well as pitting phenomena. Release rates of Th were always significantly lower than that of uranium. In mixed Th/UO_2 kernels Uranium dissolution rate reach its maximum during first months and than decrease significantly till the end of experiment. With time inventory normalised U and Th release rates become more and more close. Corrosion rates under oxidizing conditions are high (about 2 mg/m^2d), not allowing to attribute anny barrier performance to the fuel kernel; but under the reducing conditions expected for a deep repository the rates are about 0.02 mg/m^2d and seem to decrease further with time. This would assure fuel dissolution times of more than 10^5-10^6 years, however, the impact of radiation damage and radiolysis on fuel live times has yet to be determined. The results apply to the fuel matrix for various U/Th ratio, but not to potentially segregated fission product deposits.
2	*Geochemical Modelling of the Radionuclide Release* A corrosion model has been developed to describe fuel kernel dissolution in the fuel pebble considering the following scenario: diffusion of water into the pebble in few years, failure of the SiC coating in 10000 years, dissolution of Kernels in about 10^6 years under reducing and 10^{-4} years under oxidizing conditions. Solubility limits in the fuel pebble pore space are considered as well. The results show that the for conventional LWR fuel very important instant release fraction is much less important for HTR fuel. This is due to the stability of the SiC coating. Significant release reduction can be achieved by solubility constraints on the release of radiotoxic actinides.

FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
Radionuclide Release from the Fuel Kernel	**Data will be used to constrain further model development, as a base for comparison to irradiated fuel studied in the project HTR-N1, and to data generated in the VHTR project concerning the effect of radiolysis on fuel dissolution**	
Geochemical Modelling of the Radionuclide Release	**The model needs further development in the VHTR model to describe more realistically the pore fluid composition within the fuel pebble considering as well radiolysis effects**	

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (□ corresponding to your most probable follow-up.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

3.2 : Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)	0	0
# of licenses issued (within EU)	0	0
# of licenses issued (outside EU)	0	0
Total value of licenses (in EURO)	0	0
# of entrepreneurial actions (start-up company, joint ventures…)	0	0
# of direct jobs created [c]	0	0
# of direct jobs safeguarded [c]	0	0
# of direct jobs lost	0	0

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name: Bernd Grambow**

Date: 19/10/2004

3.1 Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**National Nuclear Corporation Ltd**

CONTACT PERSON(S):

Name	Mr Antony N Nuttall
Position/Title	Senior Analyst
Organisation	**NNC Ltd**
Address	Booths Hall, Chelford Road, Knutsford, Cheshire, WA16 8QZ United Kingdom.
Telephone	+44 1565 843113
Fax	+44 1565 843082
E-mail	tony.nuttall@nnc.co.uk

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	**Operational Wastes (except spent fuel)**: Assessment has shown HTR operational wastes to be less than those of LWR on the same generated power basis.
2	**Operational Wastes (spent Fuel)**: Assessment has shown that the mass of fission products is essentially similar for all designs of HTR and LWR on the same generated power basis. Generally, a slight advantage for HTR in the mass of actinides in the spent fuel.
3	**Operational Wastes (spent Fuel)**: Assessment has shown that the volume of spent fuel generally shows a disadvantage for HTR compared to LWR on the same generated power basis. This disadvantage is essentially removed if the kernels are separated from the compact/pebble graphite.
4	**Decommissioning Wastes:** Graphite is an additional waste stream for HTR. It has been shown by assessment that most of the (non-fuel) activity is retained within the graphite. The radionuclide activities preventing free release of activated graphite are tritium, ^{14}C and ^{36}Cl.
5	**Waste Minimisation**: It has been identified by assessment that improvements in the initial levels of lithium, nitrogen and chlorine impurities in the graphite, and of nitrogen in the He coolant, would reduce the amount of HTR waste requiring non-surface disposal.

FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
1	Results to be used for future activities within HTR-TN on European HTR Development	12 months
2	Results to be used to support UK, European and International Collaboration activities on advanced projects	12 months

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐) corresponding to your most probable follow-up.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐ x
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

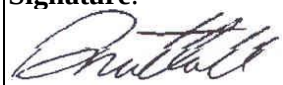
3.2 Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)	-	-
# of licenses issued (within EU)	-	-
# of licenses issued (outside EU)	-	-
Total value of licenses (in EURO)	-	-
# of entrepreneurial actions (start-up company, joint ventures…)	-	-
# of direct jobs created [c]	-	-
# of direct jobs safeguarded [c]	-	-
# of direct jobs lost	-	-

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature:



Name: Antony N Nuttall

Date: 8 November 2004

3.1 Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**Nuclear Research & Consultancy Group (NRG)**

CONTACT PERSON(S):

Name	Dr. R.P.C. Schram
Position/Title	Product Group Manager
Organisation	NRG Fuels, Actnides & Isotopes group
Address	Westerduinweg 3; P.O. Box 25 NL-1755 Zg Petten, The Netherlands
Telephone	+31 224 564082
Fax	+31 224 568490
E-mail	schram@nrg-nl.com

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	Improved methods for the reactor physics analysis of pebble-bed High-Temperature Reactors (temperature reactivity coeficients and control rod worths)
2	Improved methods for the reactor physics analysis of hexagonal block type High-Temperature Reactors (temperature reactivity coeficients and control rod worths)
3	Asessment of Pu-burning capabilities of continuous reload pebble-bed High-Temperature Reactors
4	Set of (reactor physical) parameters to assess and intercompare HTR core designs with respect to (safe and economic) Pu and MA incineration.
5	Data on the corrosion behaviour of silicon carbide coating under different geological conditions

FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
Reactor physics analysis of HTR systems	Use of improved HTR modelling methods in future HTR reactor physics analyses, e.g. in EU FP6 projects V/HTR-IP ("Core Physics") and GCFR (Results 1a, 1b, 3a)	3
Publication in scientific journal	"Feasibility of burning first and second generation plutonium in pebble-bed HTRs", to be published in Nuclear Technology (Result 3a)	3
Publication in scientific journal	"HTR-N reactor physics and fuel cycle studies", to be published in Nuclear Engineering & Design (Results 1a/b, 2, 3a-g)	6

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐) corresponding to your most probable follow-up.

R&D	Further research or development	☐ X	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐ X
JV	Joint venture	☐	**CONS**	Available for consultancy	☐ X
			Other	(please specify)	☐

3.2 Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)	-	-
# of licenses issued (within EU)	-	-
# of licenses issued (outside EU)	-	-
Total value of licenses (in EURO)	-	-
# of entrepreneurial actions (start-up company, joint ventures…)	-	-
# of direct jobs created [c]	-	-
# of direct jobs safeguarded [c]	-	-
# of direct jobs lost	-	-

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name:** R.P.C. Schram

Date: 27-10-09

3.1 : Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**EC – JRC - IUT**

CONTACT PERSON(S):

Name	J. MAGILL
Position/Title	Dr.
Organisation	European Commission – Joint Reasearch Centre
Address	Postfach 2340 D- 76125 KARLSRUHE - GERMANY
Telephone	+ 49 7247 951 366
Fax	+ 49 7247 951 590
E-mail	magill@itu.fzk.de

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	Report on 'Improving the incineration of minor actinides in thermal reactors by generation of fast islands with thin fissile films' Report JRC-ITU-TN 2001/10
2	World Patent on 'Method of incineration of minor actinides in nuclear reactors' WO 01/82306, PCT/EP01/044573
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FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
none		

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐ corresponding to your most probable follow-up.

R&D	Further research or development	☐ x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

3.2 : Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)		
# of licenses issued (within EU)		
# of licenses issued (outside EU)		
Total value of licenses (in EURO)		
# of entrepreneurial actions (start-up company, joint ventures…)		
# of direct jobs created [c]		
# of direct jobs safeguarded [c]		
# of direct jobs lost		

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name:** Dr. J. Ribeiro

Date: 19/10/2004

3.1 Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**Delft University of Technology**

CONTACT PERSON(S):

Name	J.L. Kloosterman
Position/Title	Senior Researcher / Dr.
Organisation	Delft University of Technology / Interfaculty Reactor Institute
Address	Mekelweg 15, NL-2629 JB Delft, Netherlands
Telephone	++31 15 278 1191
Fax	++31 15 278 6422
E-mail	J.L.Kloosterman@iri.tudelft.nl

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	A computer script to perform accurate burnup calculations on HTR fuel taking into the account the double heterogeneity of that fuel.
2	The optimal geometry and concentration of burnable poison particles in UO2 fuel and PuO2 fuel to reduce the reactivity swing in batch-wise fuelled HTRs.
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FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
Burnup calculations on HTR	Generation of macroscopic cross sections as a function of burnup for the fuel design of pebble-bed reactors	24

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐) corresponding to your most probable follow-up.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

3.2 : Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)		
# of licenses issued (within EU)		
# of licenses issued (outside EU)		
Total value of licenses (in EURO)		
# of entrepreneurial actions (start-up company, joint ventures…)		
# of direct jobs created [c]		
# of direct jobs safeguarded [c]		
# of direct jobs lost		

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature:  **Name: J.L. Kloosterman**

Date: 18 October 2004

3.1 Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020 HTRN**
PARTNER's NAME :	**Uni Stuttgart**

CONTACT PERSON(S):

Name	W. Bernnat
Position/Title	Work Package Manager/Dr.
Organisation	University of Stuttgart
Address	Pfaffenwaldring 31 D-70550 Stuttgart, Germany
Telephone	00 49 711 685 2118
Fax	00 49 711 685 2010
E-mail	bernnat@ike.uni-stuttgart.de

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	Sensitivity of nuclear data uncertainties for high-burn up LEU and Pu-based fuel on nuclear physics calculations & needs for new data (WP 2): There is a further need of verification of nuclear data for the high burnup range and improved covariance data for uncertainty analysis. The graphite scattering law data available are sufficiently good for HTR applications
2	U-based fuel and maximum power size (WP 3): Maximum power size was investigated under constraints of inherent safety of the core and integrity of RPV during loss of coolant and loss of forced circulation accidents. The maximum power for Pebble bed HTR with annular core and fixed inner reflector was estimated to about 400 MWth.
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FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
Validation of nuclear data and methods for HTR analysis (WP2)	Benchmarking nuclear data and investigation of availability for Gen. IV reactor designs, e.g. V/HTR-IP and HPLWR	3
Application for HTR analysis (WP2)	Contacting Institutions in EU and outside EU for applications (Design, Licensing)	6
Upscaling of HTR desings (WP3)	Contacting Institutions (EU and non EU) for applications and development of criteria for maximum power size of HTR	6

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐) corresponding to your most probable follow-up.

R&D	Further research or development	☐	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	☐
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	☐
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

3.2 Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)		
# of licenses issued (within EU)		
# of licenses issued (outside EU)		
Total value of licenses (in EURO)		
# of entrepreneurial actions (start-up company, joint ventures…)		
# of direct jobs created [c]		
# of direct jobs safeguarded [c]		
# of direct jobs lost		

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name:** Wolfgang Bernuat

Date: 18.10.04 **Organisation:**

INSTITUT FÜR
der Universität Stuttgart
Pfaffenwaldring 31 - Postfach 80 11 40
70550 Stuttgart (Vaihingen)

3.1 Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**Siemens-KWU, D; now: Framatome-ANP GmbH**

CONTACT PERSON(S):

Name	Brinkmann, Gerd
Position/Title	General Manager HTR/Dr.
Organisation	Framatome-Anp GmbH
Address	Freyeslebenstraße 1 91058 Erlangen, Germany
Telephone	+49 9131 1896630
Fax	+49 9131 1894872
E-mail	gerd.brinkmann@framatome-anp.com

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	Core Physics (neutronics): understanding of HTR-core questions and problems, good agreement of the benchmark results
2	Waste: Collection of experience and data, interpretation of the hugh problem of graphite waste
3	Back end of fuel cycle: Interesting results of the behaviour of coated particles in a final repository
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FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
Development of VHTR (NGNP)	Not known, depending on outcome in USA or 6th FP EU	

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (☐) corresponding to your most probable follow-up.

R&D	Further research or development	x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	x
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	x
JV	Joint venture	☐	**CONS**	Available for consultancy	☐
			Other	(please specify)	☐

3.2 Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)	0	0
# of licenses issued (within EU)	0	0
# of licenses issued (outside EU)	0	0
Total value of licenses (in EURO)	0	0
# of entrepreneurial actions (start-up company, joint ventures…)	0	0
# of direct jobs created [c]	0	0
# of direct jobs safeguarded [c]	0	0
# of direct jobs lost	0	0

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name: Dr. Gerd Brinkmann**

Date: 12. November 2004

3.1 Description of the use and the dissemination of result(s), partner per partner

MANDATORY INFORMATION :

CONTRACT NUMBER :	**FIKI-CT-2000-00020**
PARTNER's NAME :	**University of Pisa (UNIPI)**

CONTACT PERSON(S):

Name	Giuseppe Forasassi
Position/Title	Full Professor
Organisation	University of Pisa
Address	C/o DIMNP Via Diotisalvi n. 2 – 56126 Pisa - Italy
Telephone	+39-050-836615
Fax	+39-050-836665
E-mail	forasassi@ing.unipi.it

No, TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)

1	PROGRESS MADE IN THE FRAMEWORK OF THE HTR-N CONTRACT BY UNIPI (period September 2000 till September 2001)
2	HTR-N PROJECT PEER REVIEW
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FOR EACH MAIN RESULT:

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT

Mention the use and dissemination related activities, the main associated partners, the related milestones and give an indicative timescale		
Activity	**Brief description of the activity, including main milestones and deliverables (and how it relates to data in sections 2.2 and 3.2).**	**Timescale (months)**
1	Acquisition, installation and validation of proper codes suitable for ultra high burnup calculations	12
2	Collaboration with ANSALDO in performing peer review of selected deliverables/documents	48

FORESEEN COLLABORATIONS WITH OTHER ENTITIES

Please tick appropriate boxes (4) corresponding to your most probable follow-up.

R&D	Further research or development	x	**FIN**	Financial support	☐
LIC	Licence agreement	☐	**VC**	Venture capital/spin-off funding	☐
MAN	Manufacturing agreement	☐	**PPP**	Private-public partnership	
MKT	Marketing agreement/Franchising	☐	**INFO**	Information exchange, training	x
JV	Joint venture	☐ x	**CONS**	Available for consultancy	☐ x
			Other	(please specify)	☐

3.2 Quantified data for each partner's main result

Items	Currently achieved quantity [a]	Estimated future quantity [b]
Economic impacts (in EURO)	0	0
# of licenses issued (within EU)	0	0
# of licenses issued (outside EU)	0	0
Total value of licenses (in EURO)	0	0
# of entrepreneurial actions (start-up company, joint ventures…)	0	0
# of direct jobs created [c]	0	0
# of direct jobs safeguarded [c]	0	0
# of direct jobs lost	0	0

[a] *The added value or the number of items already achieved to date.*
[b] *Estimated quantity = estimation of the quantity of the corresponding item or the number of items that you foresee to achieve in the future (i.e. expectations within the next 3 years following the end of the project).*
[c] *"Direct jobs" means jobs within the partner involved. Research posts are to be excluded from the jobs calculation*
 # = number of ...

I confirm the information contained in part 3 of this Technological Implementation Plan and I certify that these are our exploitation intentions

Signature: **Name: Prof. Ing. Giuseppe Forasassi**

Date: 18-11-2004