Review of European hot cells and collaborations

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with the collaboration of

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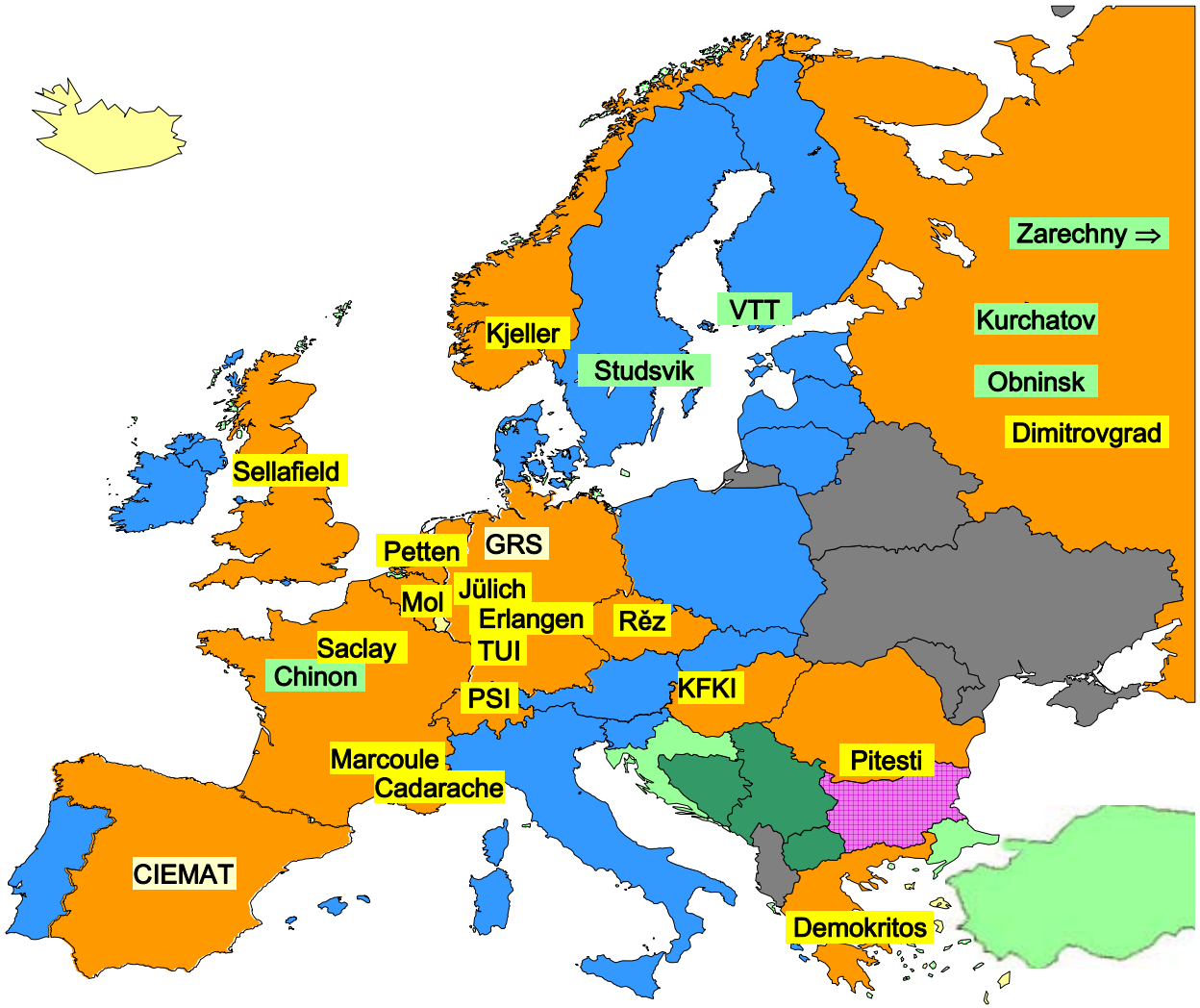
P. Chaix for Actinet

HOT CELL LABORATORIES

- Introduction
- Main characteristics of hot laboratories.
- To whom belong these labs?
- Fields of activities
- Future programmes
- Evolution of hot labs
- Great refurbishment programmes
- European integration
  - -HOTLAB
  - -ACTINET
- Conclusion

Hot laboratories in Europe

~ 25 hot labs
Various sizes and fields of activities



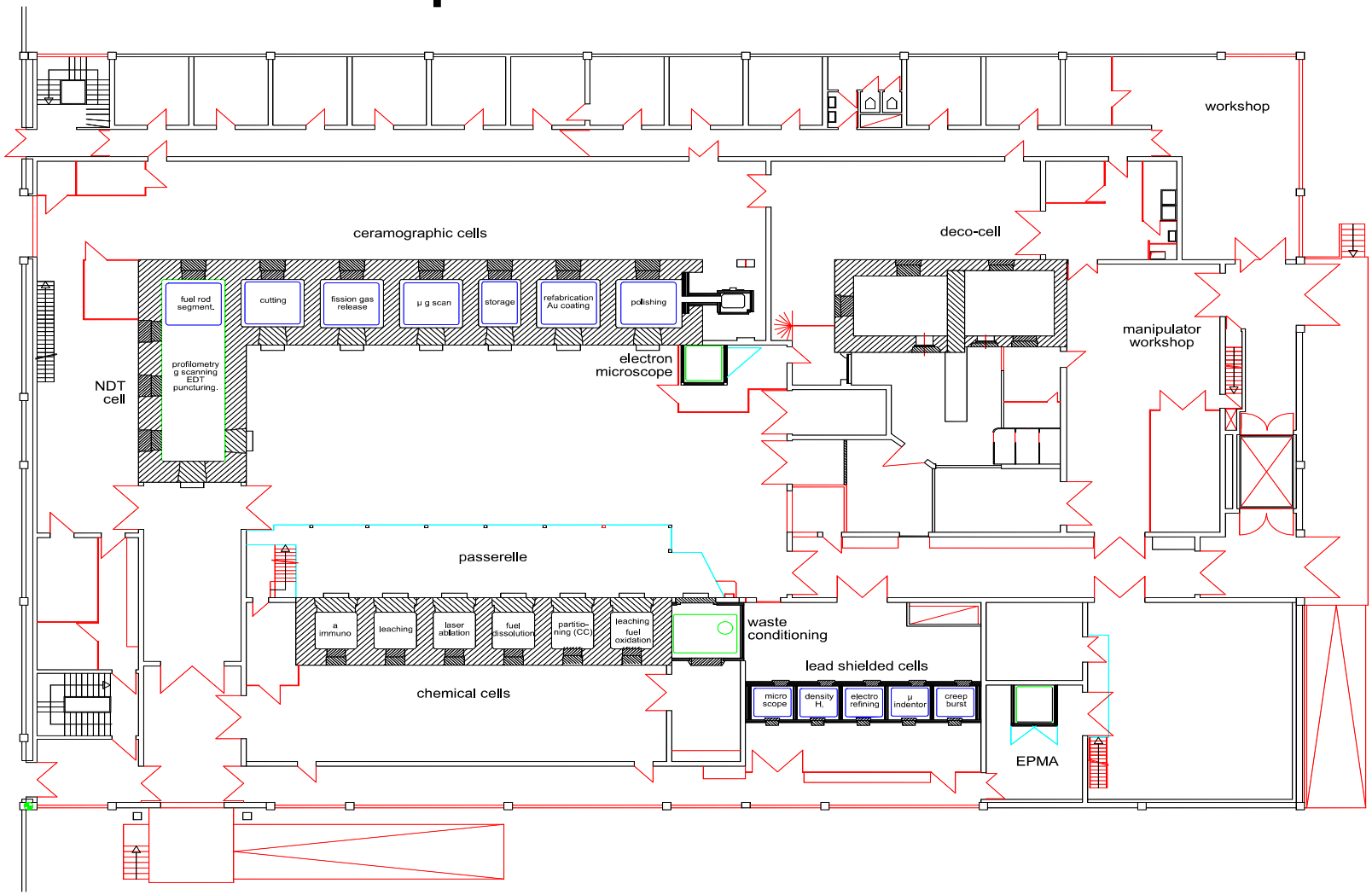
MAINS CHARACTERISTICS

- Most hot labs were built in the sixties.

- Often associated with:
  - a fleet of nuclear power stations and / or
  - an experimental reactor

- Similar architecture (shielded cells, remote manipulators, rear (transfer) area, storage area,…)
+ labs for the fuel before irradiation (for ex.: LEFCA = glove boxes for MOX fuel)
=> A range of shielding

An example of hot lab: TUI



TO WHOM BELONG THESE LABS ?

- To public bodies (CEA, TUI, PSI…)

- To company with a majority of public or private shares (EDF, AREVA-NP GmbH,..).

- To private companies (Studsvik AB)

=> General trend to more private funding.

FIELDS OF ACTIVITIES

Support to power plants:

-Fuel studies (expertises, surveillance, high burn-ups, MOX, storage,…)

-Irradiated material (RPV and primary circuit surveillance, claddings, corrosion, fusion materials)

Spent fuel treatment

Production of radio-isotopes, radioactive sources

Support activities (R&D on wastes, environmental studies)

Example 1: AMI Chinon activities (EDF)

Irradiation effects:
- Irradiation Surveillance Programme (RPV),
- Bolts from core internals,

Corrosion phenomena:
- Tubes from steam generators,
- Pipes and valves from nuclear auxiliaries

Fatigue (vibrations and thermal)
- Pipes from nuclear auxiliaries
- Primary pumps

Thermal aging
- Cast elbows (near steam generators)
- Valves-rods in martensitic stainless steel

Chemistry
- Circuit analyses, effluents, environment and wastes
- Expertises as plant support

=> Typical for a support hot lab with a fleet of NPP.

Example 2: CISBIO Saclay activities

Production of radiopharmaceutical products

- Radioisotopes (produced in an external experimental reactor or a cyclotron) are prepared and attached to pharmaceuticals or monoclonal antibodies.
- Use for diagnostic or for therapy.

Peculiarities of the lab:

- 3 different regulations (nuclear safety, pharmaceutics, plane transport)
- Many daily different productions under liquid form (for human injection) – 80 % with a half-life < 3 days
  > 200,000 type A shipments per year, all over the world.
- High activity hot cells
- Refurbishment 2004-2009
- Great importance of the human factor for safety and good laboratory practices.

FUTURE PROGRAMMES

• Hot lab programmes are usually long term programmes (ex. surveillance)
⇒ NPP fleet surveillance and R&D on fuel (high burn-ups) constitute the basis + safety studies

• New fields of interest have appeared (long term storage, spallation, transport safety, non-proliferation,…)

• New needs for future nuclear power plants: minor actinides, carbides, nitrides, …
=> Impacts on the design and size of a hot lab.

• Fusion materials.

EVOLUTION OF THE EUROPEAN HOT LAB FLEET

Highly depending from the politic situation on nuclear generation in the country

1- Countries excluding any nuclear development:
Denmark: => shutdown of Risø

Spain, Italy: => cleaning facilities and nuclear sites (CIEMAT, SOGIN, Ispra)

- Germany: Jülich concentrating on fusion activities
  Erlangen : RPV surveillance, radio-analyses
  Fuel studies at TUI

EVOLUTION OF THE EUROPEAN HOT LAB FLEET

2- Laboratories linked to an experimental reactor

Norway: Kjeller linked to Halden + JEEP2
Sweden: Studsvik, R2 shutdown in 2005
The Netherlands: Petten NRG linked to HFR
Belgium: Mol linked to BR2
Czech republic: Řež linked to LVR-15
but….these are old reactors (>40 years)
=> Hot lab future = develop substitution activities (Myrrha project, surveillance of domestic NPP fleet,…) or associations (Studsvik & Halden) or substitution project (for HFR after 2015)
=> Interest of European integration

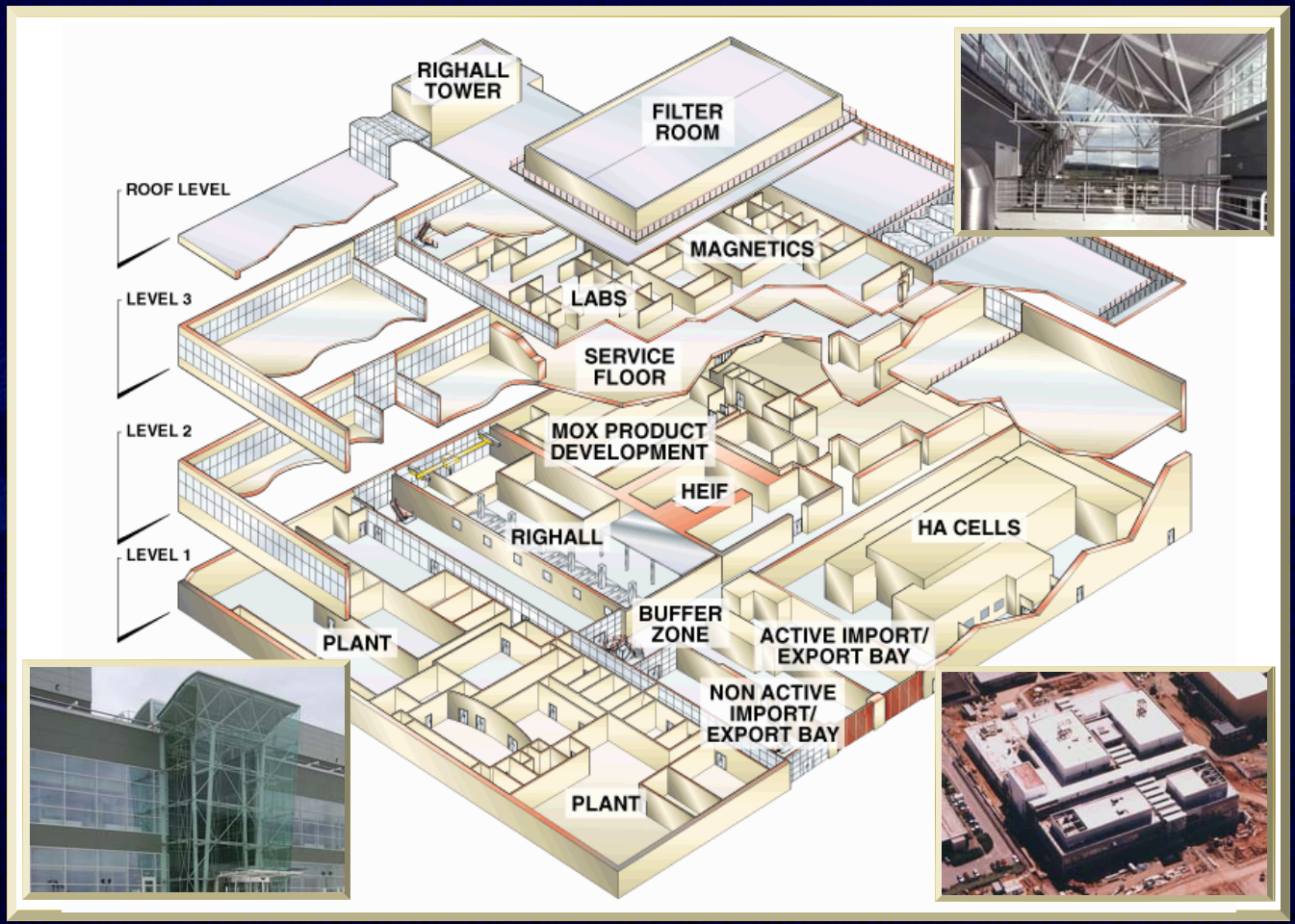
EVOLUTION OF THE EUROPEAN HOT LAB FLEET

3- Some large refurbishment programmes

- **Switzerland:** PSI built in 1962, enlarged in 1975
⇒Renovation against fire hazards, earthquakes, new command control, storage, new micrsocope, new EPMA (10 MSF in 2000)

- **UK:** Large scale reorganization centred on Sellafield : BNFL Technology Centre (BTC) including hot cells, glove boxes, operational end 2004 + enlarged bdg B13 and B14
    - Transfer of activities from Berkeley (closing) and Harwell

Building Overview



EVOLUTION OF THE EUROPEAN HOT LAB FLEET

3- Some large refurbishment programmes

- **EDF AMI Chinon (Henri Becquerel project)**
  - Closing fuel and absorbing material expertises
  - Evacuation of stored spent fuel samples & wastes
  - Upgrading to nowadays standards
  - Continuing on RPV surveillance programmes, material expertises as a support to EDF fleet.

- **CEA Saclay (LECI refurbishment: 1995 – 2005)**
  - Gathering all material activities in LECI
  - Construction of a new line of hot cells
  - Evacuation of spent fuel samples

The new line M in LECI at Saclay

EVOLUTION OF THE EUROPEAN HOT LAB FLEET

3- Some large refurbishment programmes

- **CEA Cadarache (LECA refurbishment: 1997 – 2006)**
  - Gathering R&D on irradiated fuel in LECA-STAR (associated with LEFCA and UO_2 lab.)
  - Civil works against earthquakes, cleaning the cells, improving confinement, renovation of ventilation, fissile mass divided by 4,
  - To a lesser extent, refurbishment of LEFCA (earthquakes, fire hazard).

- **CEA Marcoule:** R&D on fuel cycle, minor actinides in Atalante (**starting CBP line end of 2003**).

THE EUROPEAN INTEGRATION (1)

- Some meeting places: IAEA, European Projects ACTINET, HOTLAB, … an some tools:
  - http://www.sckcen.be/hotlab/
  - http://www-nfcis.iaea.org/
  - a forum for exchanges (ex : when a lab intends to buy new analysis instruments)
  - Common needs: transport cask
  - Increased participation from East European countries and out of Europe
- Last annual conference: Sellafield Sept. 2008

- International programmes already existing (Megapie, Phebus, trans-national irradiations, ….).

THE EUROPEAN INTEGRATION (2)

Next step for integration: sharing resources : ex. a very sophisticated scientific apparatus will be bought by one lab only..
=> Trans-national access for researchers.

Constraints:
-Need for each one to preserve its own activities,
-Sample transports,
-Local legislations (ex.: wastes should be sent back)

Ex: JHR project is looking from the start for a good connexion with all foreign hot labs, with support from LECA-STAR.

CONCLUSION

European hot labs are enduring severe evolutions:
⇒ Depending from domestic nuclear context,
⇒ Closures, re-organizations, renovations.

Economical constraints + Growing internationalisation = tendency to more mutualisation of examination means.

But a slow evolution, because severe constraints (costs, transports, rules, national interests)

Favourable factors: JHR, European projects or International ones (EPRI) & Knowledge of teams between themselves.

The European HOTLAB Project with emphasis on its Internet catalogue

Introduction:

- Most European hot laboratories built in the ’60
- A changing political and nuclear landscape
- A need for economic optimisation
- Increased safety requirements
- Confirmed needs for R&D

=> Needs for hot laboratories
=> Upgrading or closing facilities, or building new ones
=> Needs for European hot lab optimisation
=> Needs for training staff
=> Needs for exchanges
=> Needs for sharing facilities

Project objectives:

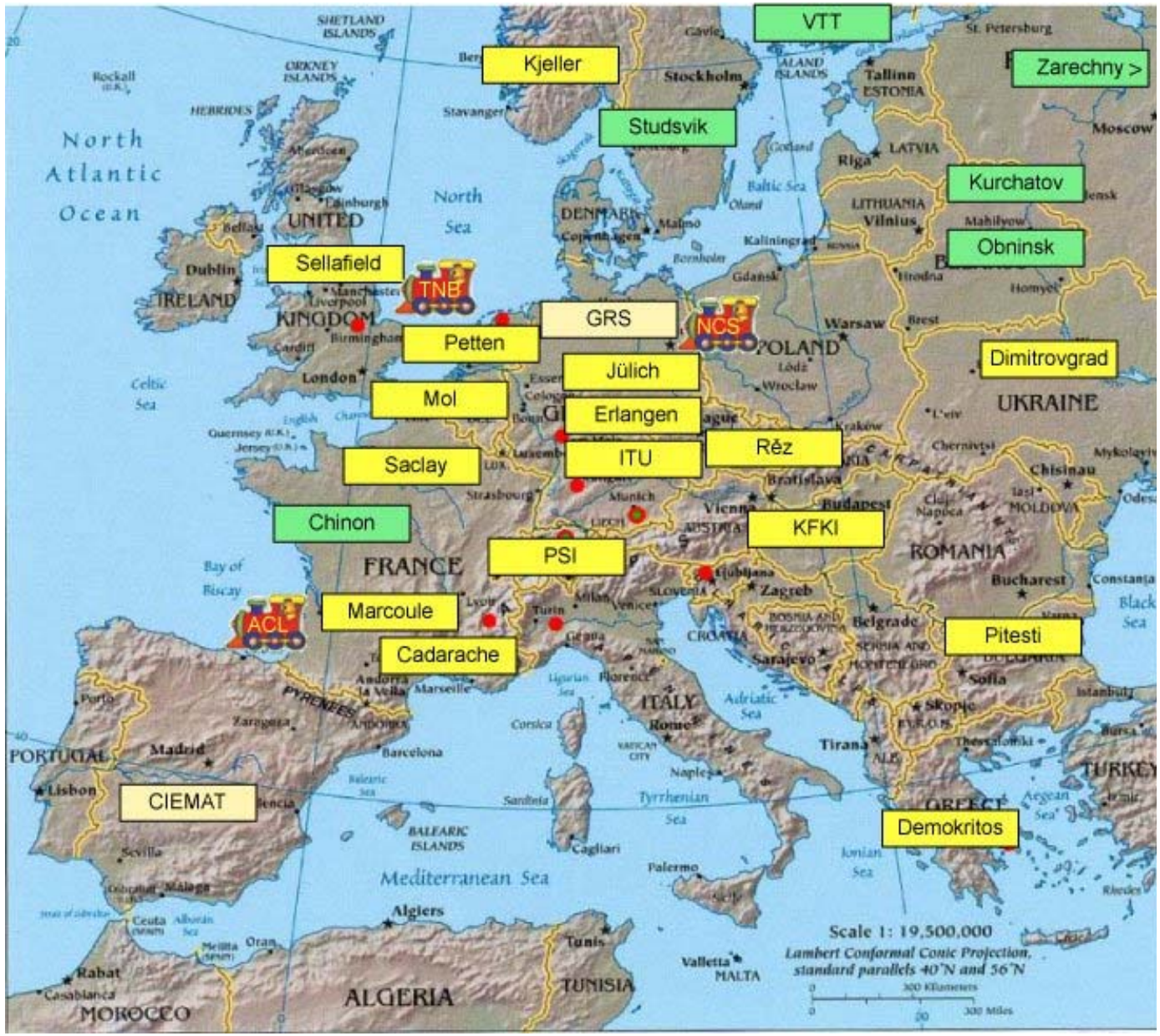
1) Exchange information on existing hot labs
2) What are the needs at present, in the future?
3) Improve transportation of nuclear materials

=> **3 Work Packages**

19 Participants

18 months:

Jan 05- Jun 06



WP1: Internet web portal and catalogue

- Started from IAEA – NFCIS - PIE database
- Hosted by http://www.sckcen.be/hotlab/
  - => Open to the public
  - => Restricted pages for participants

=> Really **easy to find** on browser **& to use** (printing)
=> Very flexible (insertion of brochures, links)

- A catalogue of European hot laboratories (WP1)
  - contacts, examination capabilities
  - *open to non-participating hot laboratories*
- Report on present & future needs (WP2)
- A catalogue of nuclear transport casks (WP3)



HOTLAB website home page

Working group
Hot Laboratories and Remote Handling

th a tradition of four decades, the Working Group on "Hot Laboratories and Remote Handling" is firmly established as the major ntact forum for the nuclear R&D facilities at the European scale. They hold yearly plenary meetings intended to:

- exchange experience on analytical methods, their implementation in hot cells, the methodologies used and their application in nuclear research;
- share experience on common infrastructure exploitation matters such as remote handling techniques, safety features, QA-certification, waste handling….;
- promote normalisation and co-operation, e.g. by looking at mutual complementarities;
- prospect present and future demands from the nuclear industry and to draw strategic conclusions regarding further needs.

ink to list of facilities link to WP2 (future needs) report

2004, the HOTLAB project, a coordination action sponsored by the 6th Euratom Framework program, was started to assess the ropean hot laboratories research capacities and its aptitude for supporting the nuclear industrial and research community both at esent and in the future. The ultimate goal was to preserve an appropriate nuclear research infrastructure in Europe by combining the st available competences at the highest quality.

thin the 18 months running time of the project, an inventory of the present research capabilities of several European hot laboratories s collected (http://www.sckcen.be/hotlab/catalogue/) as well as an up-to-date digital European transport cask inventory for inter-oratory material exchange, presently confined to certified type B or fissile type transport casks tp://www.sckcen.be/hotlab/transport/). An assessment of the present and future needs of nuclear research in terms of infrastructure d facilities completed the basis on which to build a common strategy for durable integration in the longer term.

tp://www.sckcen.be/hotlab/fp6/public/FIO6HOTLABD22.pdf).

link to list of casks and transport companies

HOTLAB - Catalogue - Facilities - Microsoft Internet Explorer

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HOTLAB - Catalogue
Sixth Framework Programme

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Facilities

(All topics...) (All techniques...) (All countries...) Print this

(All topics...)
Fuel (re)fabrication
Fuel back end
Fuel PIE
Non-fuel materials PIE
Radioisotopes

< Search by topics

1 2 3 >> >|

	Fa	Country	# of techniques
1.	BNFL Windscale	United Kingdom	25
2.	CEA - ATALANTE - alpha workshop, lab., analyses, transuraniens, reprocessing studies	France	20
3.	CEA - LECA - Irradiated Fuel Examination Laboratory	France	17
4.	CEA - LECI - Laboratory for Study of Irradiated Components	France	33
5.	CEA - LEFCA - Laboratory for Study & Experimental Manufacturing of Advanced Fuels	France	10
6.	CEA - STAR - Conditionning, Treatement & Cleaning Facility	France	7
7.	Ciemat	Spain	17
8.	EDF - AMI Chinon - Irradiated Material Workshop	France	23
9.	Framatome ANP GmbH - Erlangen	Germany	22
10.	FSUE-RIAR - Research Institute of Atomic Reactors	Russian Federation	37

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HOTLAB website: list of facilities

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Facility (All topics...) (All techniques...) (All countries...) Print this faci

⇑ Search by examination technique

General | Additional info | Techniques

NCSR "DEMOKRITOS"- RADIOISOTOPES AND RADIOPHARMACEUTICALS LABORATORY
Greece

Address	National Centre for scientific Research "Demokritos" Neapoleos & Grigoriou E' Str., 15310 Aghia Paraskevi Attikis P.O.Box 60228 GREECE		
Contact	Primary: Dr. Ioannis Pirmettis Secondary: Dr. Minas Papadopoulos		
Phone	+30210-6503921, +30210-6503909	**E-mail**	ipirme@rrp.demokritos.gr, mspap@rrp.demokritos.gr
Fax	+30210-6524480	**URL**	
Last update	2005-06-27		
Related documents			

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How to contact a facility

HOTLAB - Catalogue - Facility Techniques - Microsoft Internet Explorer

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Facility (All topics...) (All techniques...) (All countries...) Print this faci

(All countries...)
Belgium
France
Germany
Greece
Hungary
Netherlands
Norway
Romania
Russian Federation

Search by country >

General | Additional info | **Techniques**

ITU - Institute for Transuranium Elements
Germany

Burnup	Image Analysis	Rod Puncture
Clad Chemical Composition	Length and/or Diameter	Scanning Electron Mic
Clad Creep Testing	Micro Gamma-scanning	Specific Heat
Density	O/M Ratio	Thermal Diffusivity
Eddy Current Testing (integrity)	Open Porosity	Transmission Electron Microscopy (TEM)
Electron Probe Micro Analysis (EPMA)	Optical Microscopy	Tube Burst Testing
Fission Gas Diffusivity	Oxide Thickness	Visual Examination
Gamma Scanning	Profilometry	X-ray Diffraction
Hydrogen Analysis	Retained Gas Analysis	

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What techniques can offer a given hot laboratory

General | Additional info | **Techniques**

Printing mode > Print this technique | All techniques for this lab

KFKI-AEKI "Atomic Energy Research Institute"
Hungary

Technique name	Optical Microscopy
Topics	Fuel PIE Non-fuel materials PIE
Description	For investigation of macro and microphotografs of nuclear reactor elemens and materials: RPV materials, fuel and adsorber rods, absorber and construction materials
Equipment	Reichert microscope with a Vickers microshardness intender
Features	Magnification up to x 1200. Inherent resolution 1 µm. Fully digitized.
Type of specimen	Metallographic samples
Standards	ASTM E112, ASTM E384, ASTM E3
Test parameters	
Measured parameters	Photographic image of the microstructural features, dimensions, oxide layer, micro structure
Calculated parameters	Size and distribution of observed features - such as cracks, pores, different phases (e.g. Pu in MOX, fuel particles in dispersion fuels), interaction layers (e.g. corrosion, fuel-clad interaction, clad hydrides), grains.
References	FRAME EU FP5 project
Contact	hormarta@sunserv.kfki.hu
Comments	
Related info&documents	

Description of a technique

< possibility to link to a document

WP2: Present & future needs for hot labs

- To assess research capacity of European hot labs

Method:

1st step: An enquiry on the present situation (topics, list of available examinations, infrastructure);
2nd step: The Core Team extracted current trends and preliminary conclusions;
3rd step: First assessment of future needs, starting from present status;
4th step: Review by HOTLAB participants + specialists from other companies (fuel suppliers, utilities, etc).
=> Final WP2 report.

WP2 Results:

- Hot labs have a broad range of topics.
- Emphasis on fuel cycle + life extension of components
- A reduction of total number of European hot labs.

=> A high level of utilization of some techniques (optical microscopy, SEM, TEM, EPMA, XRD).

=> A limited capacity to absorb an increase in demand.

Near Term evolution = mainly continuation due to a stability in the fleet of power plants. New programs cannot be simply added to old ones due to hot cell load.

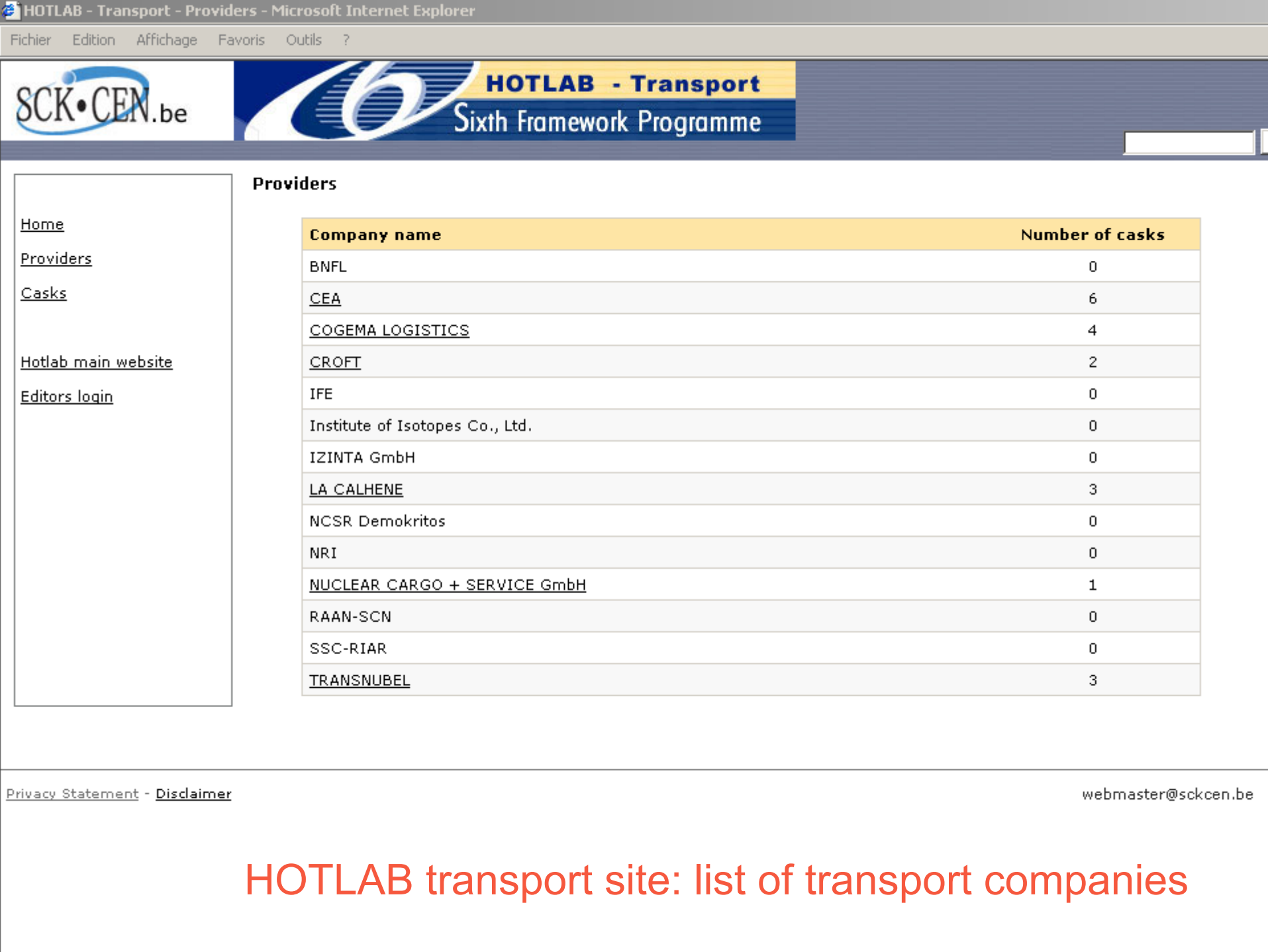
Long Term evolution = depends on new reactor scenarios. Necessity of Task Sharing between labs.

WP3: Identification of common needs on transport casks and transport operations.

- A catalogue of 19 transport casks is available at: http://www.sckcen.be/hotlab/transport/

- A link with laboratories which can receive a given cask.

- A forum for return of experience on radioactive material transport, reports on good practices, feedback on operational procedures, initiating programs of R&D (e.g. radiolysis)



HOTLAB transport site: list of transport companies

HOTLAB - Transport - Casks - Microsoft Internet Explorer

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HOTLAB - Transport
Sixth Framework Programme

Home
Providers
Casks

Hotlab main website
Editors login

Casks for COGEMA LOGISTICS

	Type	Purpose
1.	TN TM – MTR	Transport package for irradiated MTR and TRIGA fuel elements.
2.	TN TM – UO2	Transport of UO2 and U3O8 powder
3.	TN TM 106	Transport of materials irradiated or non-irradiated and sources
4.	TN TM GEMINI	Transport package of large quantities of alpha contaminated wastes

webmaster@sckcen.be

List of casks for a given transport company

Home
Providers
Casks

Hotlab main website
Editors login

View a printer-friendly version of this sheet

Cask file

This cask is referenced by
SCK•CEN - Laboratory for High and Medium Activity (LHMA)

< link to a facility

RADIOACTIVE MATERIAL TRANSPORTATION PACKAGING DESCRIPTIVE FILE

BG 18	
Provider: TRANSNUBEL	*Purpose:* Transport package for irradiated fuel rods from PWR and BWR reactors and for irradiated material

CHARACTERISTICS	
Type of loads: - Up to 30 fuel rods irradiated or not; heavy metal mass max. 43 kg - UO2 rods enriched up to 10 % U235 - MOX rods enriched up to 1,5 % U235 and 12% Pu fissile - Cooling time: min. 6 months	*Classification:* - Type B(U)F *Licensing state:* - Certificate: D/4197/B(U)F-85 (Rev.3) valid until 18.01.2008 - Validation: in CH, S, B, F
Mode of loading/unloading: - Vertical loading/unloading in pool - Dry horizontal loading/unloading by docking against hot cell wall *Technical assistance provided:* (•) Yes ( ) No ( ) Not specified	*Available accessories:* - Different internal arrangements such as baskets, orifice tools, ... - Auxiliary transport means (i.e. basket handling tool, transport frame, lifting beam, tilting frame, ...) - Stability plate, drying and control module

DESCRIPTION	
Main packaging characteristics:	

Technical assistance provided: (•) Yes ( ) No ( ) Not specified	transport frame, lifting beam, tilting frame, ...) - Stability plate, drying and control module

DESCRIPTION

Main packaging characteristics: - Total length . With shock absorbers: 6.865 mm . Without shock absorbers : 5.611 mm - Effective cavity length : 4.550 mm - Effective cavity diameter: 162 mm - Diameter with shock absorbers: 1.300 mm - Diameter without shock absorbers: 775 mm - Weight without shock absorbers: 25 t - Weight with shock absorbers : 26,7 t - Weight in transport condition : 28 t	
Content characteristics: - Maximal activity Neutron source strength : 1,0 108 n/s Photon source strength: ca.2,0 1015 Bq/s (according to Energy spectra) - Maximal power for the whole package : 2400 W	*Specific characteristics:* - The BG 18 is a long cylindrical cask with in an internal tight containment, particularly suited for full scale length fuel rods - The transfer of the load under water or against a hot cell proceeds through a shielded rotating plug - The minimum hot cell channel Ø required is 240mm
Mode of transportation: - On site: Dry - On public roads: Dry	*References:* - Germany (KGG,GKN, ITU) - Sweden: Studsvik - Norway: Halden - Switzerland (KKG,KKB, KKL, PSI) - Belgium (Tihange 1, SCK-CEN)

Contacts: Contacts: TRANSNUBEL S.A. Gravenstraat 73, 2480 Dessel, Belgium
Jürgen SPERLICH - Phone: +32 14 33 11 11; Fax: + 32 14 3189 48 - E-mail: jurgen.sperlich@transnubel.be

Cask file (continued)

WP3 Results:

- A code of good practice published for measurement of neutrons around transport packages.
- A radiation control protection procedure for transport packages written (same measurement points at departure and arrival)
- Recommendations drawn on techniques to ensure leak-tightness during transport of unsealed sources.

- Several other items identified for a follow-up project (harmonization of contents of transport documents, study of radiolysis, etc)

General results:

- **Practical realizations** (useful website, procedures, reports, 2 conferences).
- **Success for both HOTLAB plenary meetings** (Halden Sept. 2004 and Petten, May 2005).
- **Increased participations of Eastern European countries.**
- **A way to generate mutual discussions** (for buying new microscopes, for handling wastes, etc).
- **hotlab.eu** registered as web address.
- The Steering Committee agreed to **propose a continuation to HOTLAB (improving website, continuing the work on transportation, inter-laboratory tests, personnel exchange)**

But How ??

- A limited FP6 SSA proposal was submitted in April 2006, but not funded => **continuation on a voluntary basis**.

What has been done since June 2005?

- Yearly plenary meetings:
  - Sept. 2006: Jülich (Germany)
    - [Nov. 2006: Buenos Aires IAEA TM on PIE]
  - Sept. 2007: Piteşti (Romania)
  - Sept. 2008: Sellafield (UK)

=> Open to non-European participants (Canada, China, Japan, South Africa, South Korea, Japan, USA presentations).

- Website: all proceedings (since the sixties!) available on line. Contacts with IAEA NFCIS PIE website.

=> how to regularly update the data?

- Always a forum for exchange (ex. Microscope or EPMA spare parts).

See you next year in HOTLAB 2009

(probably in September in Řež, Czech Republic).

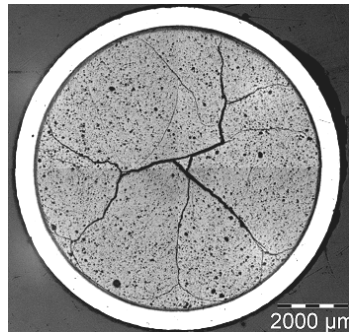
ACTINET
Network for Actinide Sciences

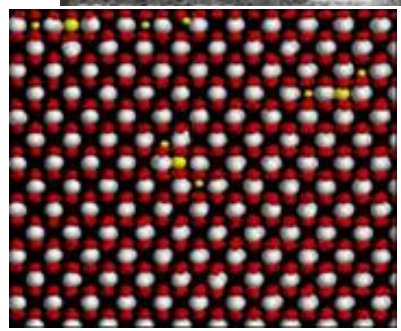
P.Chaix
(CEA)

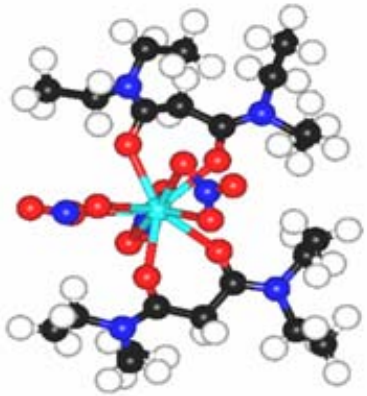
- Motivation for networking
- the Rationale
- the ACTINET Consortium
- the Pooled Facilities
- the Theoretical User Lab
- the Joint Research Projects
- Education and Training

Motivation for networking

- **Actinide sciences play a key role for the future of nuclear fission energy:**
  - better use of fissile matter for power production,
  - efficient processing of spent fuels,
  - solid scientific basis for geological waste disposal.







Motivation for networking

- **However:**
  - safety rules are heavy and research is expensive,
  - the tools requested to work on actinides are rare,
  - actinides have a rich and specific behaviour,
  - a new generation of scientists is needed,
  - the scientific community is scattered: few large institutes + numerous small groups

Although many collaborations are already active,

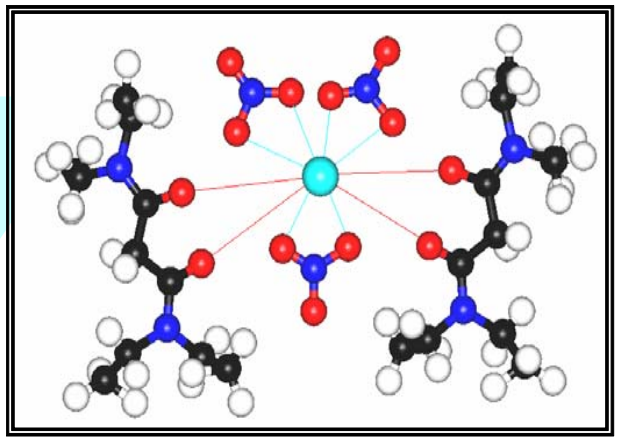
➔ **It is necessary to achieve a better cooperation between the relevant European research organisations**

- Infrastructure policy,
- Research projects,
- Training.

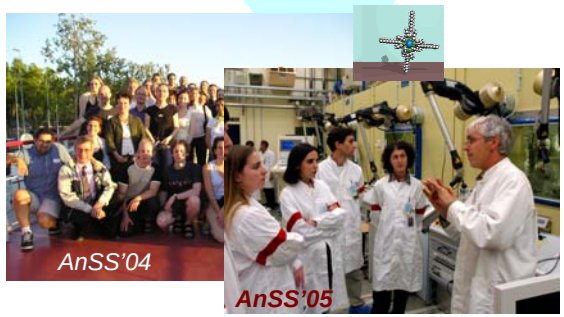
the Rationale

Reinforce the community of basic actinide science in Europe

Creation of a pool of facilities for the benefit of the whole community of actinide sciences in Europe



Selection of collaborative projects making the best use of the available facilities



Education and Training
Spreading of Knowledge

the Consortium

➔ **ACTINET is a consortium of European R&D organisations,**

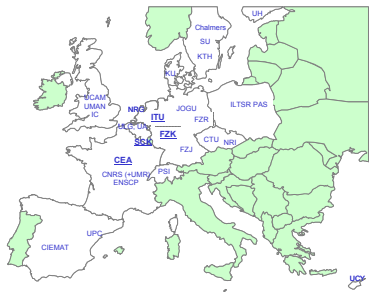
devoted to basic "actinide sciences"

- launched in March 2004,
- Involves ~ 30 R&D organisations from 13 European countries (new members periodically step in),
- Supported by the European Commission within the 6th Framework Programme, as a step toward the "European Research Area"
- Will continue to operate beyond FP6.

the Consortium

a Core Group and Associated Laboratories

Chalmers Univ. of Techn.
CIEMAT
CNRS and French Univ.
Czech Technical Univ. Prague
FZ Jülich
FZ Rossendorf
Johannes Gutenberg Univ.
KTH
Univ. of Copenhagen
NRI Rez
ILT SR
PSI
Univ. of Stockholm
Univ. of Antwerpen
Univ. of Cambridge



Univ. of Cyprus
Univ. of Helsinki
Univ. of Liège
Univ. of Manchester
Univ. Politèc. de Catalunya
NRG
Imperial College
ENS Chimie Paris
Univ. of Potsdam
Univ. of Münster
Univ. of Wroclaw
Univ. of Barcelona
SKB
…

the Consortium

Governing Board
representatives of member organisations

general policy, budget

Scientific Advisory Committee
9 members appointed for their personal expertise

scientific guidance

Executive Committee
8 members
Task Groups

"everyday" management

EC

Collaborations between Member Organisations

research and training activities

the Pooled Facilities

- **The pooled facilities allow handling radioactive material**
  - at various levels of activity
  - under controlled conditions
  - with access to analytical and characterisation techniques
- **Available to run Joint Research Projects**

- **CEA**
  - LN1 Lab in Atalante Marcoule (molecular chemistry)
  - LECA micro analysis area in Cadarache (irradiated fuels)
  - DPC analytical platform in Saclay (speciation, retention, transport)
  - LPS nuclear microprobe hot beam line in Saclay
- **FZK-INE**
  - Analytical platform and Speciation tools
  - Active XAFS beam-line
- **ITU**
  - Solid state, thermodynamics, thermophysics and radiation damage
  - Solid-liquid interface chemistry
- **SCK-CEN**
  - LHMA (Lab. for High- and Medium-level Activities)
  - Solid state and radiochemical analysis
- **FZR**
  - ROBL XAS beam-line at ESRF
  - Laser Laboratory at Rossendorf
- **PSI**
  - MicroXAS beam-line at the Swiss Light Source (SLS)

the Pooled Facilities

- Grant access for ACTINET members to run their collaborative projects
- Efforts to ease access to the facilities,
- Exchange of information on available capabilities,
- Projects for developing instruments, for use by the community of actinide sciences (up to 50% of the total cost).

Examples:

- FZK/INE, ITU and U. of Antwerp: install and test a micro-focusing capability, a Digital X-Ray Processor for X-ray fluorescence detection, a CCD camera for μ-XRD and XRD tomographic investigations at the INE beam line at ANKA;
- CEA, ITU, ILTSR, Charles U.: upgrade the ITU's Physical property Measurement with a Vibrating Sample Magnetometer and an AC magnetometry system;

the Theoretical User Laboratory

- **Objective:**
  - to bring together in a long lasting structure, the tools and expertise available on actinide modelling and simulation, and make them available to the whole European community of actinide scientists.
  - Stimulate collaboration between theoreticians and experimentalists

- **Example of activities:**
  - Review papers
  - Definition of common needs for commercial software
  - Joint experimentalists-theoreticians workshops (October 2005)
  - ThUL School “theory for experimentalists” (May 2006, Nov 2007)
  - Model development and implementation

the Joint Research Projects

- **Scientific Scope:**

  basic science of actinides and actinide bearing materials,

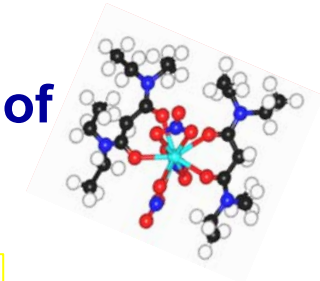
  keeping in mind the potential applications for nuclear fission energy:

→ Assessment of waste management strategies requires an adequate understanding of the behaviour of materials containing actinides (spent fuels, waste matrices, transmutation targets), and of the chemistry of **actinides in geochemical environments** and **in partitioning processes**.

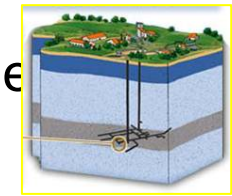
→ Support for the operation of existing plants and the improvement of their performance in terms of safety, economy and flexibility require in particular a better understanding of the **fuel behaviour** under reactor conditions.

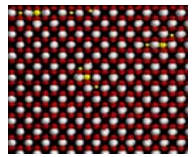
→ The assessment of innovative concepts for better use of fissile resources and minimisation of waste also requires considerable amount of experimental and modelling work on **systems/materials involving actinides**.

the Joint Research Projects



- **3 domains have been defined for the management of joint projects:**
  - Separation of actinides and basic actinide
  - Actinides in the geological environment,
  - Actinide materials under and after irradiation.





- **Objective:**
  - “Integration” through the joint definition and realisation of research projects, taking advantage of the pooled facilities.

the Joint Research Projects

- **Flexible and competitive approach**
  - No pre-definition of the research projects and allocated budget
- **Two calls for collaborative projects each year**
  - 1st call published 28 May 2004,
  - ~ 150 proposals up to now.
- **Constraint:**
  - At least 2 partners (from the Consortium) from 2 distinct European countries
- **~ 80 Joint Research Projects currently supported by the network**
  - list available at http//www.actinet-network.org
- **Support provided by the network:**
  - access to the facilities, funding for mobility, fellowships

the Joint Research Projects

- **Example in scope 1: "Separation of An and basic An science"**
  - **JRP 02-01 and follow-up JRP 05-15 :**
    "Understanding the electronic structure of actinyl complexes"

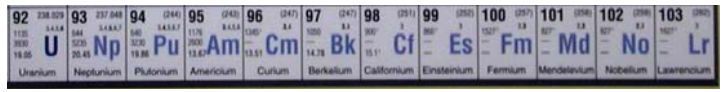
U. Manchester - Centre for Radiochemistry Research (UK)

CEA - Marcoule (France)

FZR - Rossendorf Beamline at ESRF (Germany)

+University College London (UK)

⇨ *Probe actinyl bonding through the coordination of additional donor ligands, along the series of transuranians.*



- U and Np studies at the CRR and ROBL (XANES and EXAFS).
- Development in ATALANTE to continue the project forward to plutonium (synthesis, structural and spectroscopic characterisation of novel Pu complexes in an inert atmosphere environment).
- Study of the plutonyl system at both the CEA and ROBL facilities.
- Theoretical analysis and computations at UCL.
- Post Doc from Manchester worked 10 weeks in ATALANTE, other collaborators from Manchester expected.

the Joint Research Projects

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Joint efforts of Universities and Core Group nuclear research organisations

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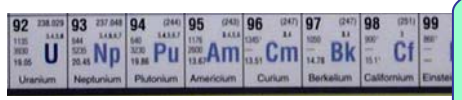
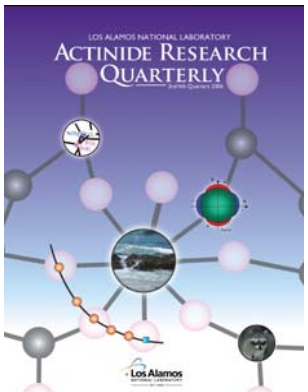


From Uranium to transuranians

Seaborg Institute for Transactinium Science



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Joint experimental and theoretical approach

Mobility and trans national access

Education and Training

- **Support to existing events, e.g.:**
  - Migration Conference
  - Very Heavy Metal Conference,
  - Journées des Actinides
  - …

- **Joint Projects (competitive calls), e.g.:**
  - JP 02-18: “Short course with tutorial on aqueous – solid solution systems involving actinides”:

    3 days, 28 attendees, in PSI and Karlsruhe
  - JP 04-05: “International Information Exchange Meeting on Thermodynamics of Nuclear Fuels”:

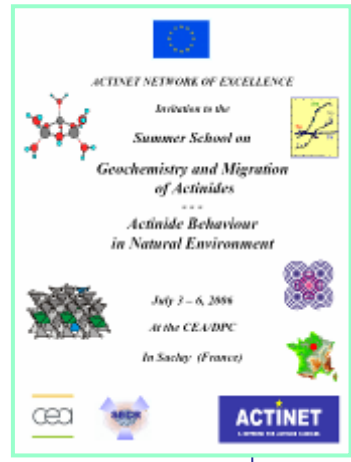
    2.5 days school + 2.5 days workshop, 55 attendees, in Saclay
  - …

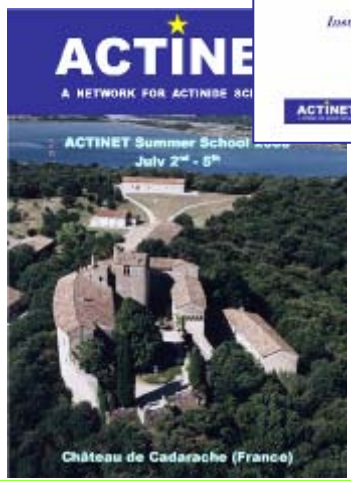
- **ACTINET Summer School**

Education and Training

ACTINET Summer School

- **AnSS'04:** "Thermodynamics & Kinetics of Solvent Extraction", in Avignon
- **AnSS'05:** "Actinide Science and Applications", in Karlsruhe
- **AnSS'06:** "Geochemistry and migration of Actinides", in Saclay
- **AnSS'07:** "Actinide Science and Applications", in Karlsruhe
- **AnSS'08:** "Pu and An, focus on fuels". (associated to "Pu Futures") in Cadarache





What after FP6?

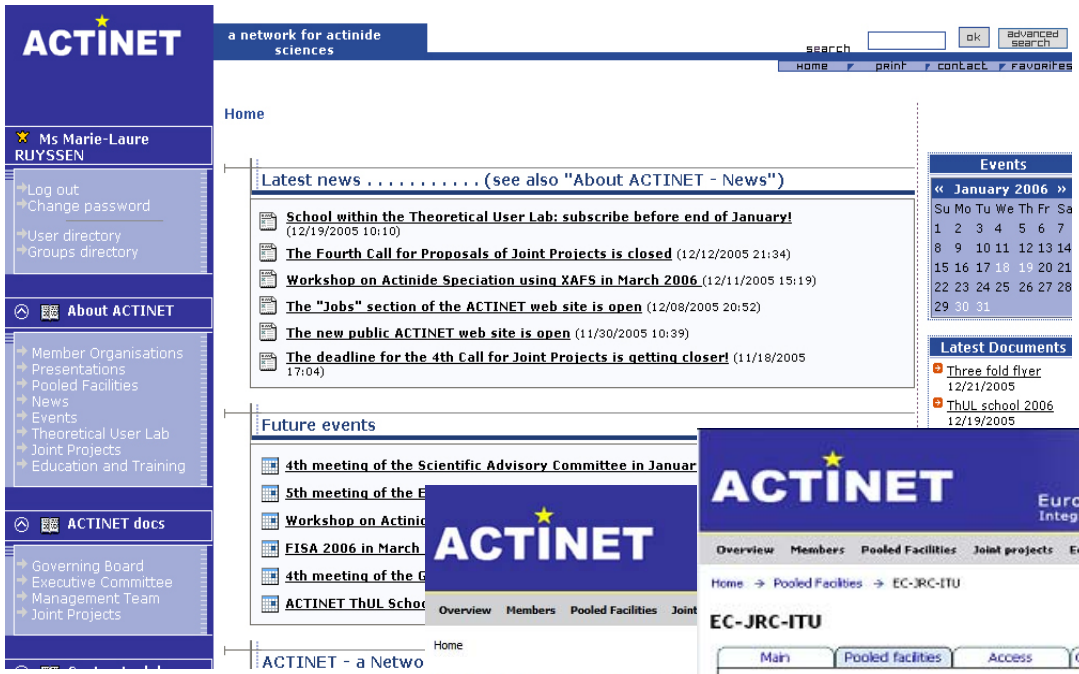
- **The ACTINET Contract with the EC terminates in 2008.**
- **Under FP7: ACTINET-I3 (Integrated Infrastructure Initiative: combination of Collaborative Project and Coordination Action) is accepted.**
- **Negotiation in progress**
- **You're welcome to AnSS'09:** "Actinide Science and Applications", in Karlsruhe.

Thank you

More information available at

the collaborative platform

https://project.actinet-network.org



and the web site

http//www.actinet-network.org