

ETRAP 2005, 3rd International Conference on Education and Training in Radiological Protection, 23-25 Nov. 2005, Brussels, Belgium. Organizers: SCK-CEN, FANC, ENS.

**Education and Training Courses on
Nuclear Science, Illicit Trafficking, and Environmental Radioactivity
- a JRC activity in EU Enlargement and Integration**

J. Magill, J. Galy, D. Hamilton, M. Betti, L. Aldave de las Heras, G. Tamborini, K. Mayer, S. Abousahl
European Commission, Joint Research Centre, Institute for Transuranium Elements, Postfach 2340, 76125
Karlsruhe, Germany

T. Žagar, I. Jenčič
Jozef Stefan Institute, Jamova 39, SI-1000 Ljubljana, Slovenija

G. Caratti
European Commission, Joint Research Centre, Directorate for Institutional and Scientific Relations, SDME
10/44, B - 1049 – Brussels, Belgium

The Organisation of the JRC

7 Institutes in 5 Member States - ~2400 staff - 300 M€/y budget + 40 M€ income



IE - Petten The Netherlands
- Institute for Energy



IRMM - Geel Belgium
- Institute for Reference Materials and Measurement



ITU - Karlsruhe Germany
- Institute for Transuranium Elements



IPSC - IHCP - IES - Ispra Italy
- Institute for the Protection and Security of the Citi
- Institute for Health and Consumer Protection
- Institute for Environment and Sustainability



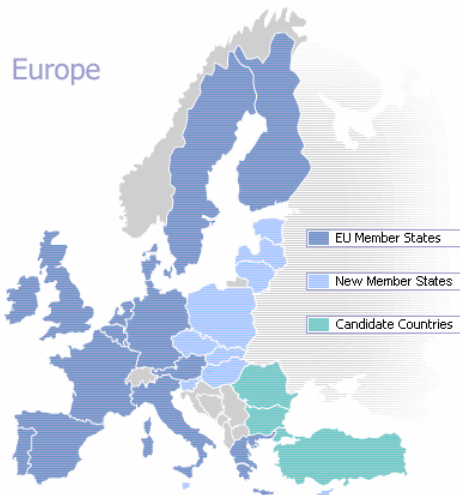
IPTS - Seville Spain
- Institute for Prospective Technological Studies



EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Joint Research Centre

Europe



EU Member States
New Member States
Candidate Countries

Main Instruments:

1. Focus JRC core projects
2. Submit joint proposals to FP calls
3. Host visiting scientists, experts, res. fellows
4. Advanced training courses and workshops
5. Information and awareness actions

Fig. 1: *EU Member States*

JRC – Karlsruhe 2005

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Joint Research Centre

ITU training courses.....

Illicit Trafficking

Environmental Radioactivity

Nuclear Science

JRC – Karlsruhe 2005

Core Topics

- **Basic Concepts in Nuclear Science:** (history, nuclide charts, nuclear reactions...)
- **Interaction of Radiation with Matter – Biological effects** (range of charged particles & photons, biological effects of radiation, radiation hormesis, LNT model)
- **Reference Data** (atomic masses, decay data, cross sections, fission yields)
- **Case Studies with Nuclides.net**



Special Topics

- **Nuclear forensic science / Illicit trafficking / Safeguards**
- **Nuclear Science with Lasers**
- **Environmental Radioactivity**
- **Radio-immunotherapy with α -emitters**
- **Nuclear Education & Training**
- **Transportation of radioactive materials**

Radioactivity, Radionuclides & Radiation
A multimedia training course with Nuclides.net

Ljubljana • Slovenia
14-16 September 2005

Joint Research Centre

Nuclides.net: A Web-based Environment for Nuclear Education and Training

Applications

- Universal Nuclide Chart
- Nuclide Explorer
- Fission Yields
- Averaged Cross Sections

Data/Information

- Data Sheets
- Fact Sheets
- Search Engine
- Gamma Spectrum

Decay Calculations

- Fall Decay
- Dosimetry & Shielding

EUROPEAN COMMISSION
DIRECTORATE GENERAL
Joint Research Centre

Joint Research Centre

Participants

EUROPEAN COMMISSION
DIRECTORATE GENERAL
Joint Research Centre

**6th Nuclear Science
Training Course with Nuclides.net**



14th - 16th September 2005
Nuclear Training Center - Ljubljana

Jožef Stefan Institute nuclidehub.net itu

JRC - Karlsruhe 2005

EUROPEAN COMMISSION
DIRECTORATE GENERAL
Joint Research Centre

.....Nuclides.net II

Joint Research Centre

The Problem


- Day to day tedious tasks obtaining the best reference data for problem (from libraries, handbooks, etc.), processing this data (e.g. with software programs), and checking calculations for errors. This is a very time consuming, expensive and inefficient process, and is a general problem in natural sciences.

The Solution

- integrated products over the internet
- one-stop, user-friendly, fast and accurate, and cost effective
- allows experts and non-experts alike to concentrate on scientific results

The Innovation

- The innovative aspect is to use modern internet technology to make these products available to the user through web-driven applications. Complex details are "pushed" below the surface.



The main "force" of the iceberg lies beneath the surface and cannot be seen by passing ships

JRC - Karlsruhe 2005

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Radiation Science™
...web driven applications

Search
[Enter a topic] [SEARCH]

Nuclide Chart
Actual Chart: ITU

Searchable databases

- JEFF-2.2 (Decay Data, Fission Yields)
- JEFF-3.1 (Decay, Activation, p and n Data)
- NUBASE93 (Decay Data, Atomic Masses)
- ICRP (Effective Dose Coefficients)
- Firestone (Decay Data)
- Prompt and delayed gammas

Reference Data

- Nuclear Constants
- Nuclide Datasheets
- Nuclide Derived Data
- Average Cross Sections
- Fission Yields

Application Modules

- Mass Activity Calculator
- Decay Engine
- Dosimetry & Shielding
- Range & Stopping Power
- KORIGEN
- Transuranus
- Universal Nuclide Chart
- Transport Report

Custom libraries

- Nuclide mixtures
- Library creation for 3rd party software

Other Resources

- Nuclear Media Monitor
- Article database
- Webbooks
- Online manual
- FAQ, A&S, Forum
- Patent service (esp@cernet)

Welcome, Jean
My Preferences
My Messages

My Chart

ITU

My Last Nuclides

- Am-241
- Ce-137
- U-235
- O-16

User Alerts

- New article: "Pu age determination"
- News: Radiation Db updated
- New weblink: NEA website
- News alert: International Conference on Radiation...

My Nuclide Libraries

- Spent fuel
- Natural uranium
- Mixt. exp. 2673

Radiation Science Copyright © 2005

Main "application control centre" page giving access to all features and applications. Additional colour frames have been added to help the understanding of the groups.

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Example of Legacy software in NUCLEONICA: KORIGEN

Large computer programs such as KORIGEN (a "legacy" code - a reactor irradiation burn-up code with at least 20 man years of development are complex, standalone, non-user friendly programs. From both an education and training, and professional perspective it is desirable to have a much more user friendly package available without the time consuming tasks associated with the standalone version (installation, testing, etc) where the user can concentrate on the science rather than the computing details. In the diagram, the NUCLEONICA access window to KORIGEN is shown.

Application modules >KORIGEN

Input variables

Mode: Power Flux Decay Fusion

Reactor: BWR PHR user defined

Fuel/Target: UO₂

Burn-up: 50 GWHR

Irradiation times: 3 y

Cooling times: 0 y

Selected output

Material: Actinides Activation products Fission products

Heat/Activity: Activities (Bq) Activities (Ci) Mass (g)

Heat Neutrons: Heat (W/g) Gammas (MeV/s) Neutrons (s)

Radiotoxicity: Ingestion Inhalation

Save to my defaults

Start

Click on the column headers to rearrange in ascending /descending order & on the nuclide to reach the datasheet

Material	Activity (Bq)	Heat (W/g)	Gammas (MeV/s)	Neutrons (s)	Radiotoxicity - Inhalation (Sv)
92-U-235	123123	3213	12321	12321	123213
92-U-238	123213	123213	132123	23213	123213
94-Pu-239	123123	1232	213	2323	123123
94-Pu-241	23123	31231	123213	23213	12323

Print Download data Plot Table (summary) Table (detail) Plot list

NUCLEONICA Copyright © 2005

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Joint Research Centre

Signed In HOME LOG OUT

 **NUCLEONICA**
...web driven applications

Application modules > Advanced Scripting Interface [more info](#) | [notices](#) | [help](#) | [tutorial](#)

```

set 60_Co as nuclide
60_Co = CreateNuclide(27, 60)

show 60_Co.HL
5.2714 y

set myresult as dosimetry_result
myresult = 60_Co.dosimetry(1,g,100,thickness,pb,1e-3)
show myresult.thickness
39.11 cm

```

New advanced scripting interface window.

Upload batch file

NUCLEONICA Copyright © 2005

JRC – Karlsruhe

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Joint Research Centre

New Databases.....

- ICRP Effective Dose coefficients database
- implementation of the JEFF3.1. radiation database
- implementation of the new Firestone database (for gamma lines)
- new neutron activation database implementation (and nuclide chart)

Radiation Science™
...web driven applications

Searchable databases > ICRP Effective dose coefficients [more info](#) | [notices](#) | [help](#) | [tutorial](#)

Data source Type Elements (s)

ICRP 68 Ingestion Bi

ICRP 72 Inhalation All

Search Click on the column headers to rearrange in ascending /descending order

Element	Mass	ICRP 68		ICRP72	
		Inhalation	Ingestion	Inhalation	Ingestion
Bi	209	4.5E-10	4.9E-10	2.6E-10	4.6E-10
Bi					
Bi					
Bi					
Bi					
Bi					
Bi					
Bi					
Bi					
Bi					

Radiation Science™
...web driven applications

Searchable Databases > JEFF3.1 [more info](#) | [notices](#) | [help](#) | [tutorial](#)

Nuclide search: Radiation search Advanced search

Search criteria & filters

Specific activity: Bq/g

Specific gamma dose rate (m): μSv/h

Specific power: W/g

Mass number: Element:

Stable Half-life:

Display results: Items:

Table with 6 columns: Nuclide, half life, h and z exp, Density, Specific activity, Specific power

Nuclide	half life	h and z exp	Density	Specific activity	Specific power
232U	4.468E+9	92 232	19.102	1.2106E+10	1.102E+11
238U	4.468E+9	92 238	19.102	1.2106E+10	1.102E+11
235U	7.04E+8	92 235	19.102	4.75E+10	4.3E+11
232Th	1.405E+10	90 232	11.72	3.7E+9	3.4E+10
230Th	1.39E+5	90 230	11.72	3.7E+9	3.4E+10
234mPa	4.51E+3	81 234m	11.72	3.7E+9	3.4E+10

JRC – Karlsruhe 2005

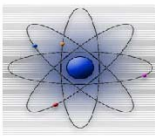
Radiation Science Copyright © 2005

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Joint Research Centre

Nuclear Science media monitor...

Scans 1000 websites every 20 minutes for latest information



NUCLEONICA

...web driven applications

News alert service

- Nuclear power
- Radioactive waste
- Decommissioning
- Safeguards
- Nuclear security
- Food, water, Health
- Environment
- Sustainable industrial process
- Conference
- Education & training
- Science

Nuclear Power

Wed May 23 13:51:00 CEST 2005 US warns European ministers over Iran nuclear talks
tehranglobe
 The warning, given by the Foreign minister of France, Germany and the UK prepared to meet British negotiators in Geneva on Wednesday, underlines the risk that the talks might break up or lead to increased transatlantic tension. 'The support of the US [for the negotiators] is based on the cessation and dismantlement of all sensitive nuclear...'
GB read more

Wed May 23 13:30:00 CEST 2005 EU presses Iran at nuclear talks
tehranglobe
 CDM BRUSSELS, Belgium - Foreign ministers from Britain, France and Germany are meeting Iran's top negotiator in Geneva...
GB read more

Wed May 23 13:30:00 CEST 2005 Key European ministers gather to press Iran on nuclear program
tehranglobe
 USA Today GENEVA (AP) - Key European foreign ministers gathered Wednesday for a seven attempt to persuade Iran to curb its...
GB read more

Wed May 23 13:30:00 CEST 2005 EU-Iran nuclear talks in Geneva risk deadlock: Iranian negotiator
tehranglobe
 Yahoo Daily News 37 minutes ago | GENEVA (AFP) - The foreign ministers of Britain, France and Germany meet here with Iran's top...
GB read more

Wed May 23 13:30:00 CEST 2005 The real 'nuclear option' is over Iran
tehranglobe
 Newday Move that the U.S. Senate appears to have sidestepped the 'nuclear option,' Americans should be focused on a more ill...
GB read more

Wed May 23 13:30:00 CEST 2005 Khaknari: Nuclear talks so far 'not satisfactory'
tehranglobe
 Middle East Online TEHRAN - Iranian Foreign Minister Mohammad Khaknari said Wednesday that critic nuclear talks with Britain, F...
GB read more


Wed May 23 13:20:00 CEST 2005 North Korea dismisses concerns of nuclear test, Czech lawmaker says
cp
 North Korea has dismissed concerns that it is about to conduct its first nuclear test, according to a leading Czech lawmaker who just visited the reclusive communist country. North Korean officials said...
GB read more

JRC - Karlsruhe 2005

NUCLEONICA Copyright © 2005

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Joint Research Centre




NUCLEONICA

...web driven nuclear science applications

For the Nuclear Science community **NUCLEONICA** will provide:

- a one-stop
- user-friendly
- fast and accurate
- cost effective
- and indispensable



access to the information they are looking for - and thereby become as useful as a hand-held calculator - only with vastly greater utility in the amount of data and calculation power.

⇒ The goal of **NUCLEONICA** is to become the Mathematica of Nuclear Science

JRC - Karlsruhe 2005