



International Atomic Energy Agency

**Need for capacity building and knowledge
management in nuclear applications,
an IAEA perspective**

Matthias Rossbach

Industrial Applications and Chemistry Section

Division of Physical and Chemical Sciences

Department of Nuclear Sciences and Applications

Content:

1. The current man-power problem

- **International initiatives**
- **Nuclear Engineering versus Nuclear Science and Applications**

2. Key activities of NA in nuclear knowledge preservation

- **Regular budget activities for capacity building**
- **NA assistance in Technical Cooperation activities for capacity building**

3. Conclusions



The current man-power problem

- **Work force aging**
- **Reduced training facilities, e.g. research reactors**
- **Public concerns against the nuclear option**
- **‘no future’ concerns for job opportunities**
- **Lack of students’ interest in natural sciences**
- **Reduced research contract opportunities for nuclear related projects**



Doctoral Degrees in Nuclear Chemistry Awarded by U.S. Universities, 1970 - 2002

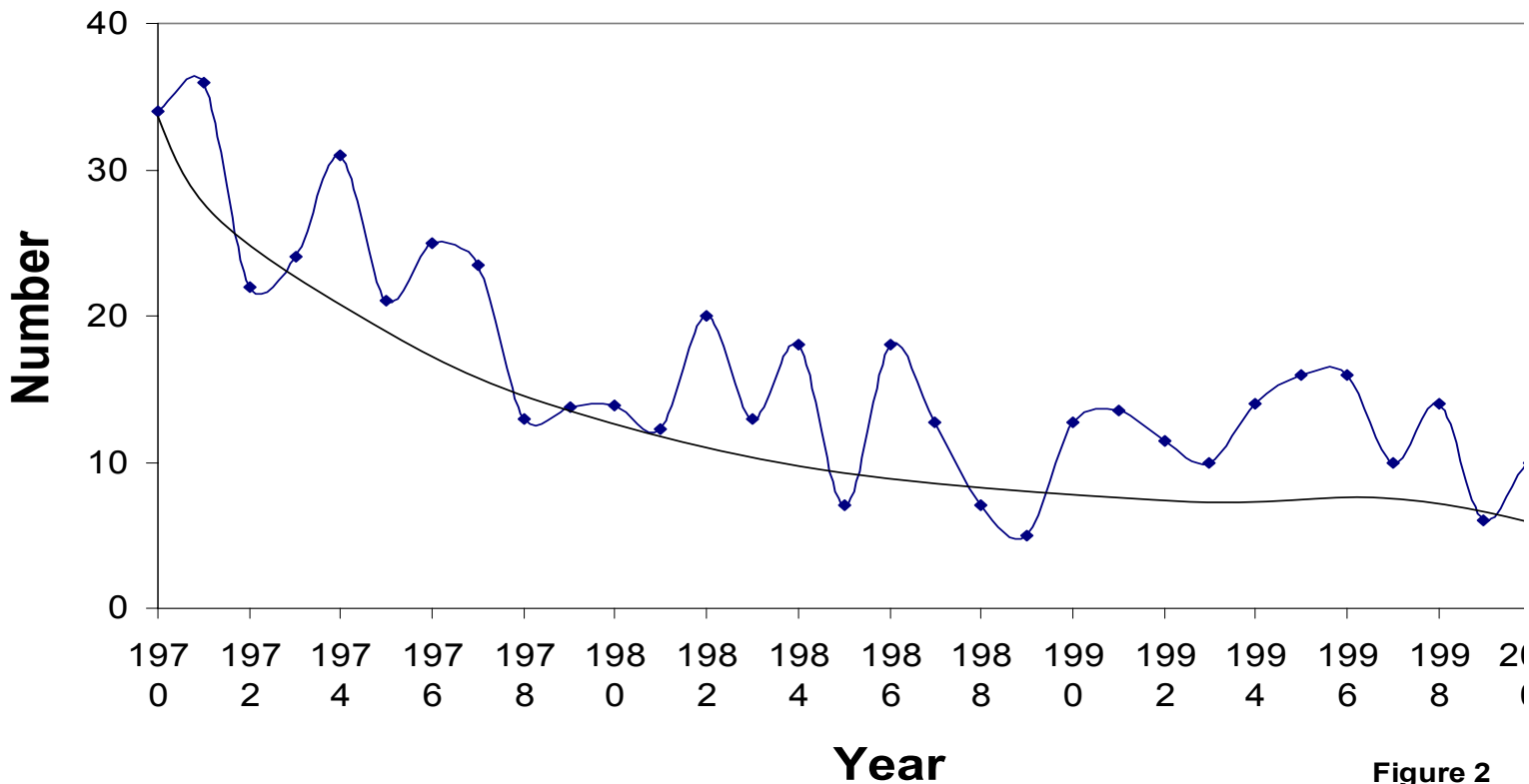
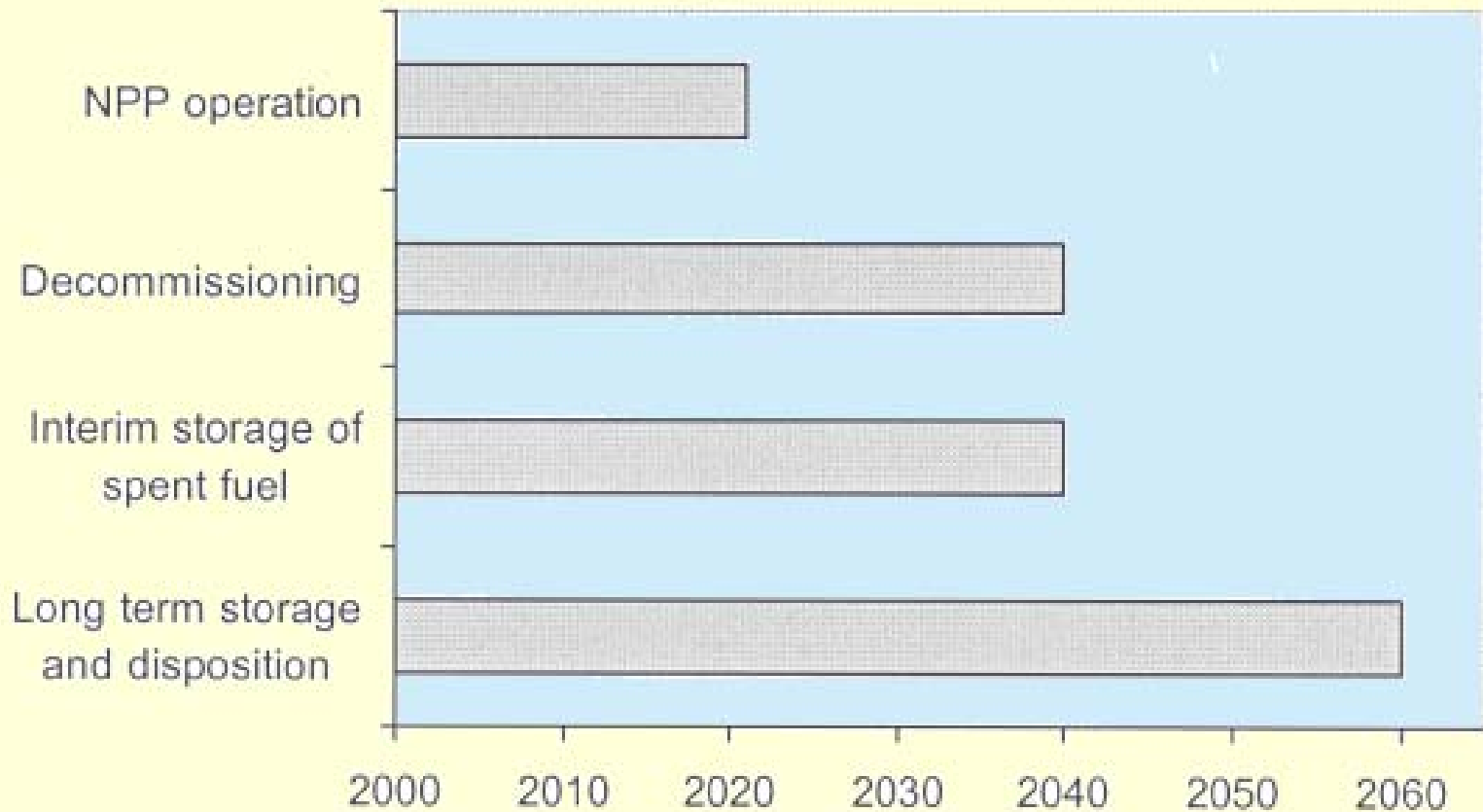


Figure 2

From: **Assessment of the teaching and applications in radiochemistry, Report of a technical meeting, Antalya, Turkey, 10-14 June 2002**





Need for expertise and manpower from different activities in the German phase-out of nuclear power*.

•*FRITZ, P., Research Centre Karlsruhe, Germany (2002).

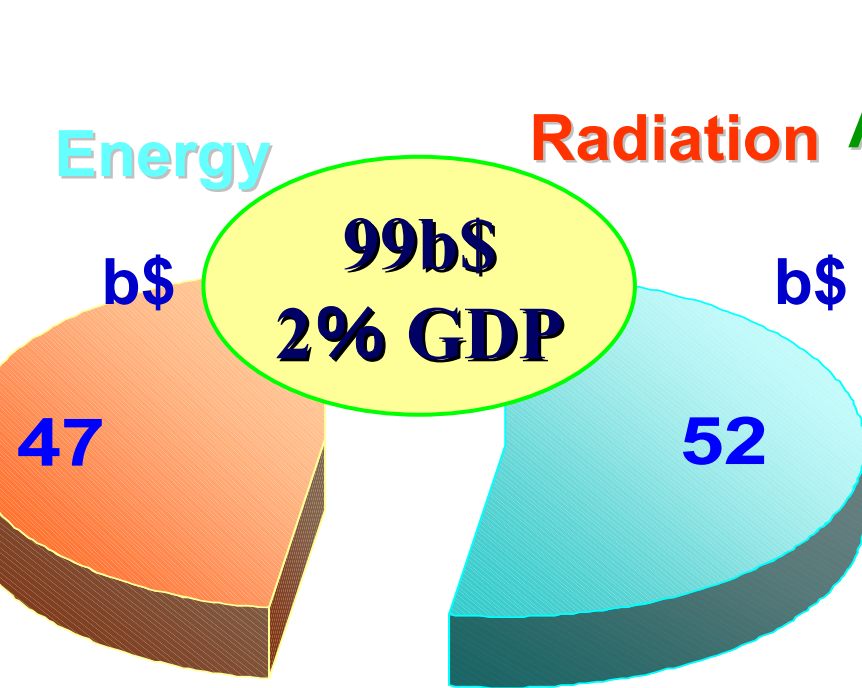


International initiatives

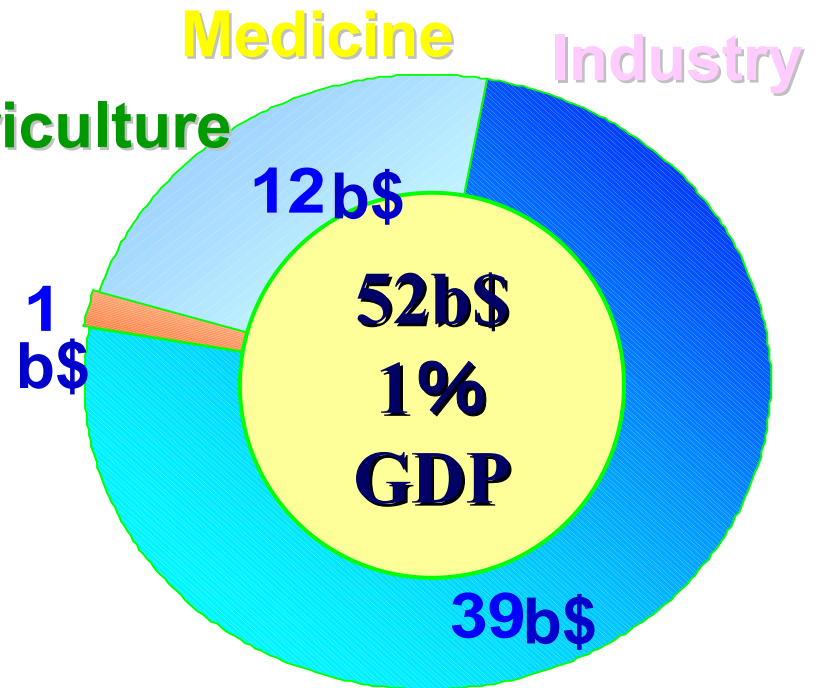
- **European Nuclear Engineering Network (ENEN)**
- **Canadian Network of Excellence in Nuclear Engineering (UNENE) [\$25 million for 2002-2007]**
- **US Nuclear Engineering Educational Research (NEER) [\$5 million] in 2002**
- **Various national initiatives to foster university curricula e.g. U.K., Germany, India, South Africa, Argentina...**
- **World Nuclear University supported by WNA, IAEA and others inaugurated September 04, 2003**
- **IAEA's attempt to support applications of peaceful use of nuclear technology for socio-economic development.**



Economic Scale of Nuclear Applications in Japan (1997)

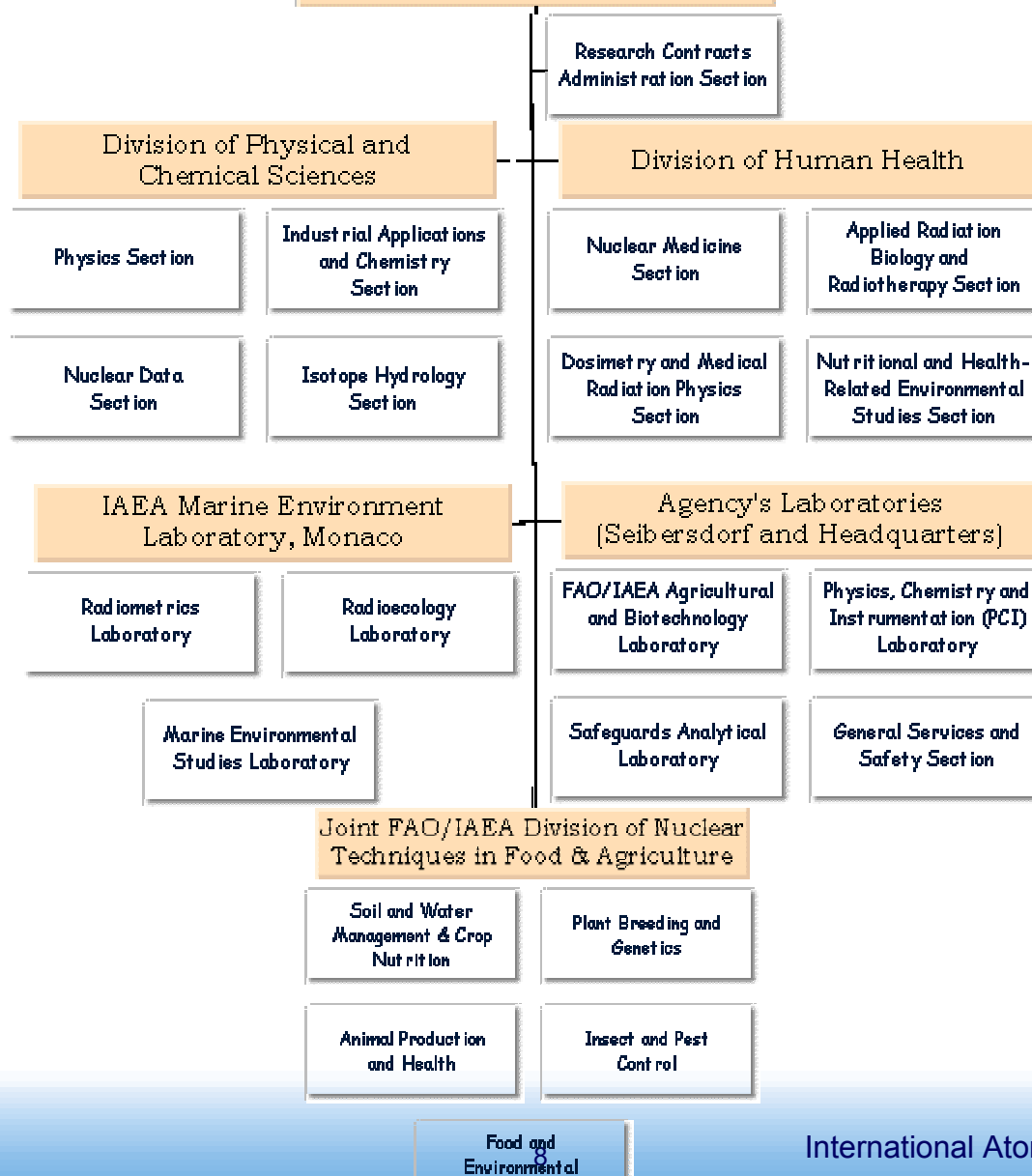


Total economic scale of nuclear application



Breakdown of radiation and isotope applications

IAEA Department of Nuclear Sciences and Applications

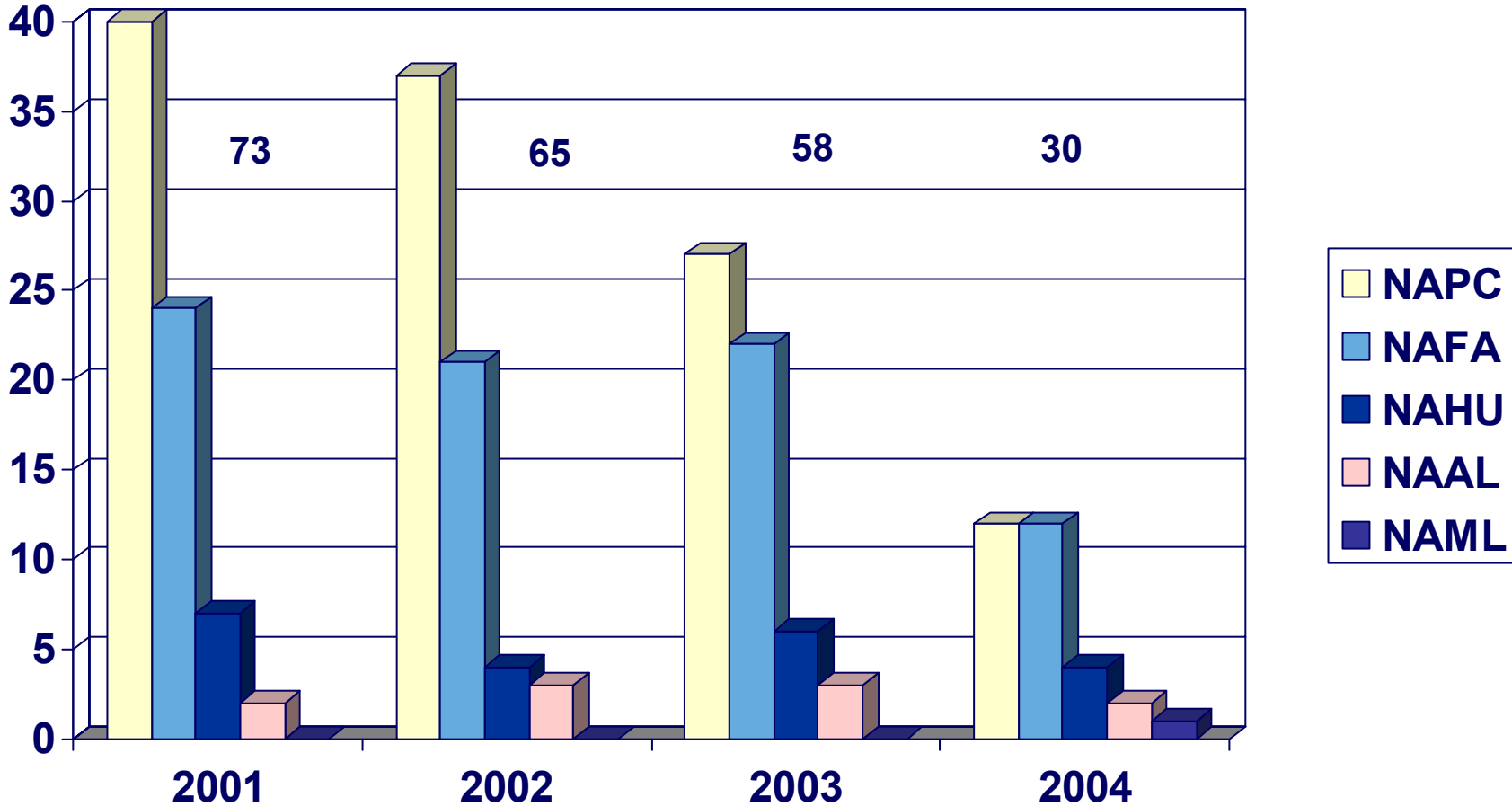


Mechanisms for dissemination and conservation of knowledge

- Preparation of documents
- Data bases and data retrieval systems
- Organisation of international Conferences
- Individual fellowship and group training
- Research contracts and research coordination meetings
- Technical assistance in TC projects



Agency publications produced per Division



Example of IAEA/UNESCO joint publication

Environmental isotopes in the hydrological cycle

Principles and applications

Edited by W.G. Mook

Volume I

Introduction

Theory Methods Review



IHP International Hydrological Programme

IHP-V | Technical Documents in Hydrology | No. 39, Vol. I

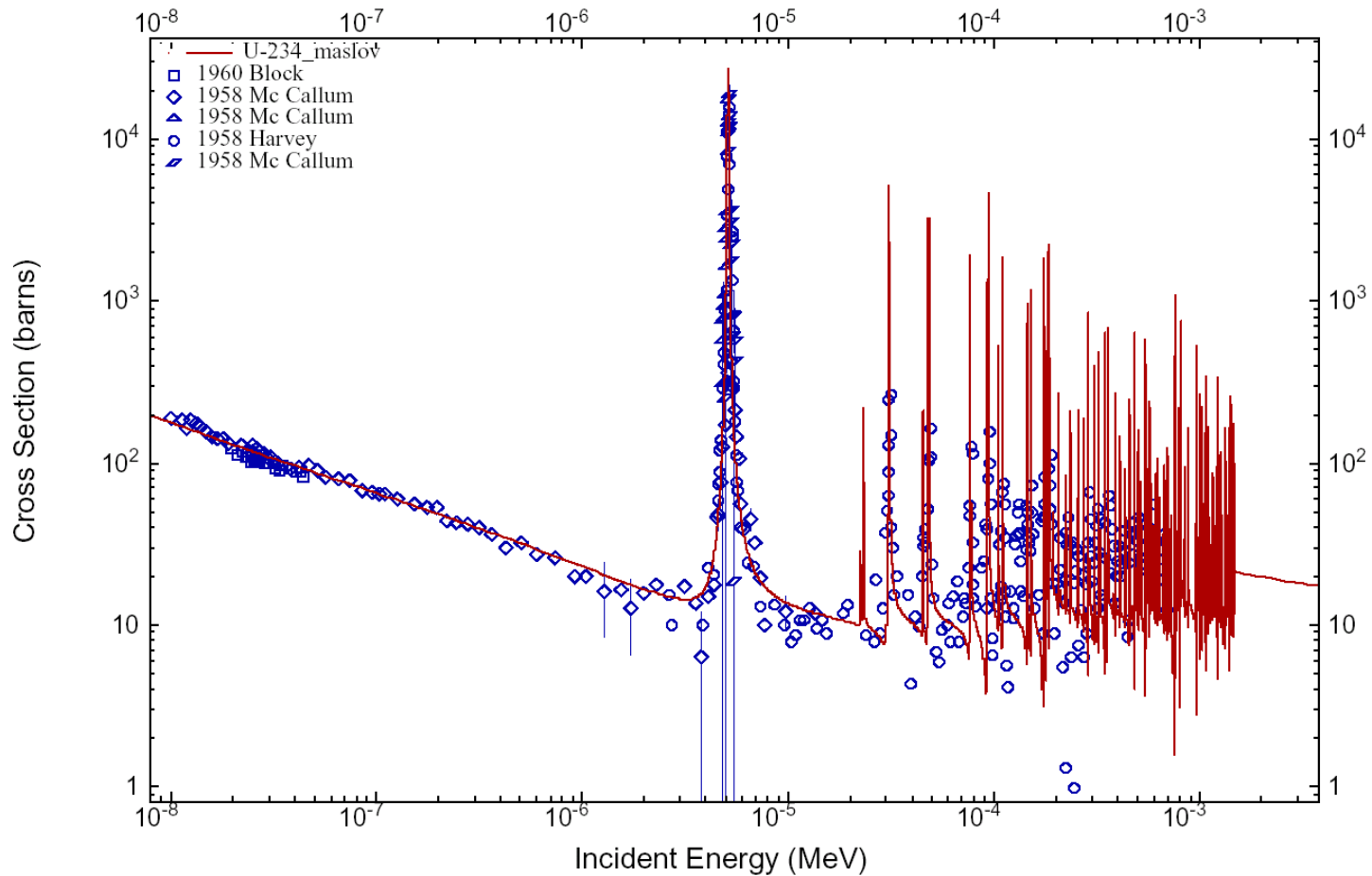


- 6 volumes
- available in English, French, Chinese and Spanish
- also available on CD rom

Atomic and nuclear data bases maintained by NDS

23-Aug-2004 15:25

92-U-234(N,TOT),SIG



Primary Databases

Compilations of **bibliographic** information

<http://www-nds.iaea.org/>

EXFOR: Experimental Format – experimental nuclear reaction data compiled regularly through the **Network** of Nuclear Reaction Data Centres

<http://www-nds.iaea.org/exfor/>

NSR: Nuclear Science References – bibliographic database for low- and intermediate-energy physics also published in Nuclear Data Sheets

<http://www-nds.iaea.or.at/nsr>

ALADDIN: atomic and molecular data

<http://www-amdis.iaea.org/ALADDIN/>

etc.

Provision of software to process nuclear data

QXAS

Quantitative X-ray fluorescence analysis system

H I S T O

Statistical Analysis, Histograms and Outlierrejection for Intercomparison Data (AQCS)

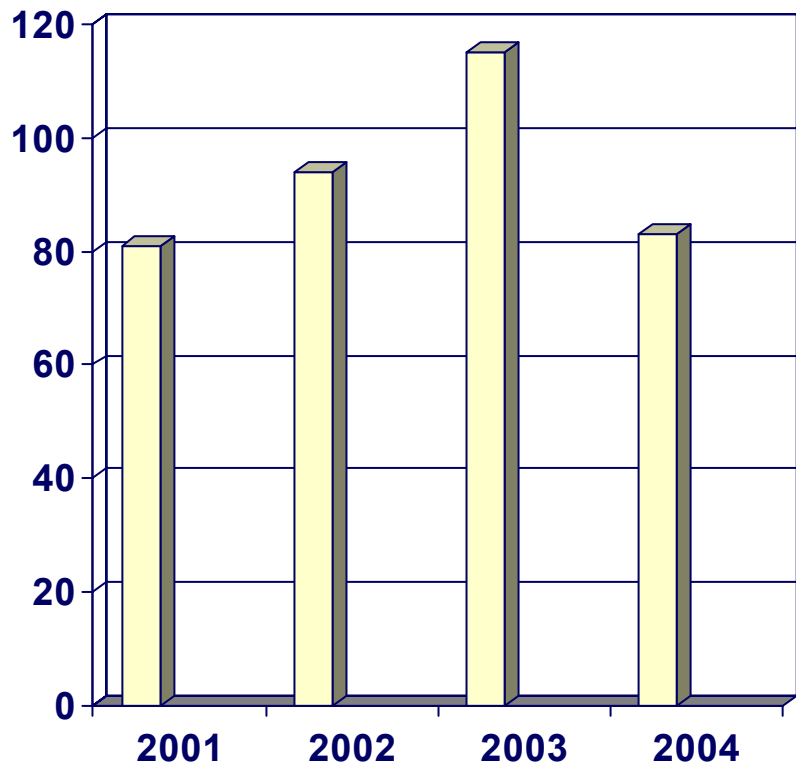
K₀-IAEA

Evaluation of gamma spectra for quantification of element content in INAA (and PGNAA)

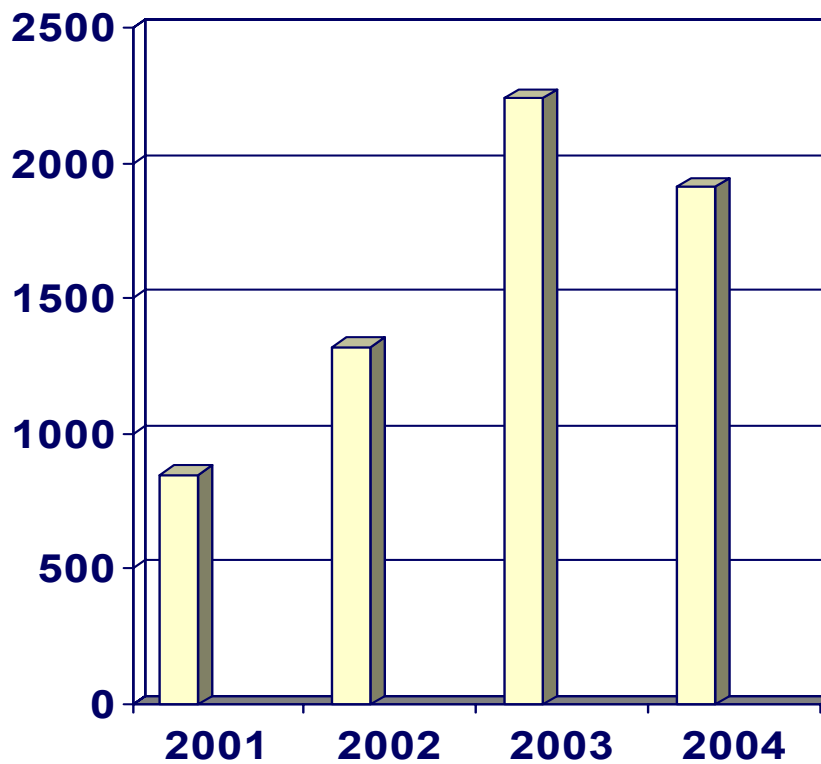
etc.

International meetings and conferences organized by NA

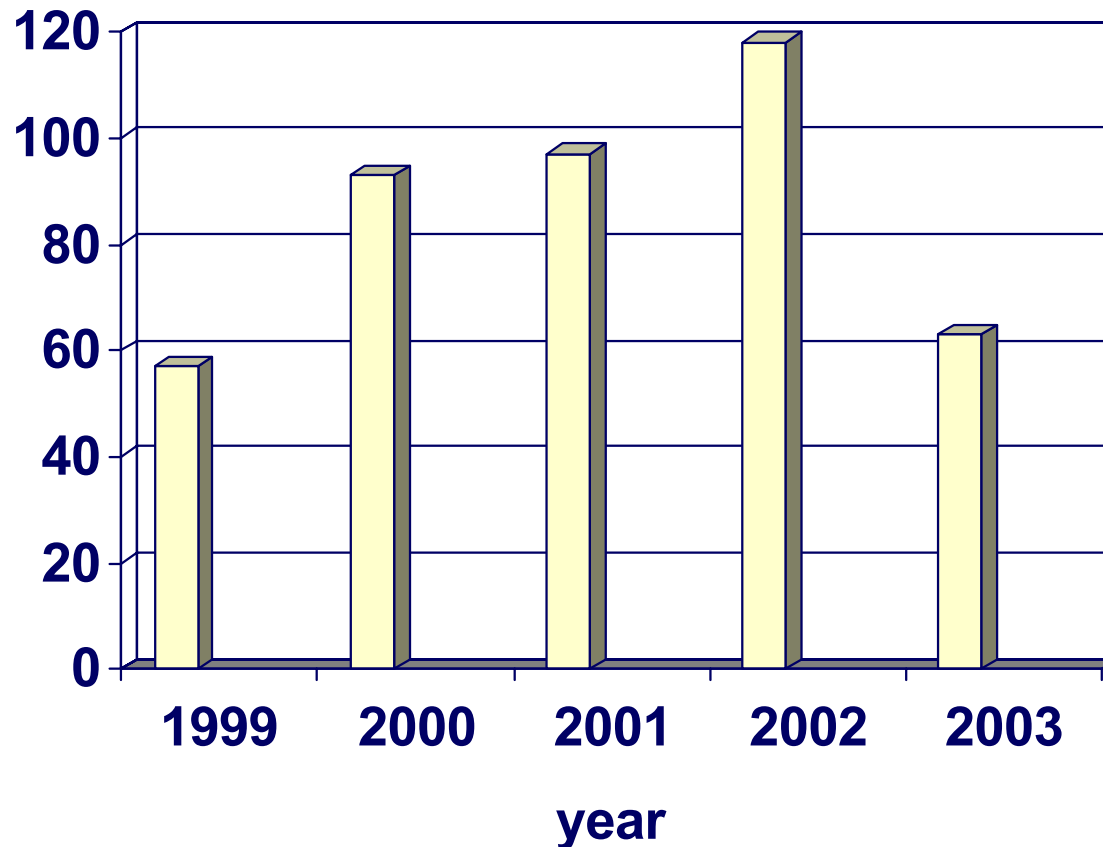
Number of meetings



Number of participants



Number of fellows trained at the IAEA laboratories in Seibersdorf



Training modules for distant learning

- Guides to essential radiotherapy practice
- Syllabi for radiotherapy technologists
- Distance learning tools for radiation oncologists
- Diagnostic radiology physics
- Introduction to scintillation detectors
- Introduction to neutron detectors
- Basic and advanced nuclear instrumentation (2 CDs)
- etc.



Example of an interactive training module

The screenshot shows a software interface for the IAEA CAL Materials CD2 Advanced Nuclear Instrumentation training module. At the top, there is a header bar with the IAEA logo, the text "IAEA CAL Materials CD2 Advanced Nuclear Instrumentation", and "Info" and "Help" buttons. On the left side, there is a vertical menu with buttons for "Main", "LearNIT", "LSC Maintenance", "Radiation Survey Meters", "TLD Readers", "Tools", "Links", and "Exit". The "Main" button is highlighted with a green circle. The main content area displays a welcome message: "Welcome to Advanced Nuclear Instrumentation". Below the text, there are several images: a photograph of a complex electronic circuit board, a photograph of a large industrial machine, a photograph of various handheld radiation detectors, and a photograph of a cylindrical detector component. To the right of the images, there is a section titled "Minimum System Requirement:" followed by a list of requirements: Windows 98/Me/NT/2000/XP, Pentium processor, 16MB Ram, CD-ROM drive, and 600x800 video resolution.

IAEA CAL Materials CD2
Advanced Nuclear Instrumentation

Info Help

Main

LearNIT

LSC Maintenance

Radiation Survey Meters

TLD Readers

Tools

Links

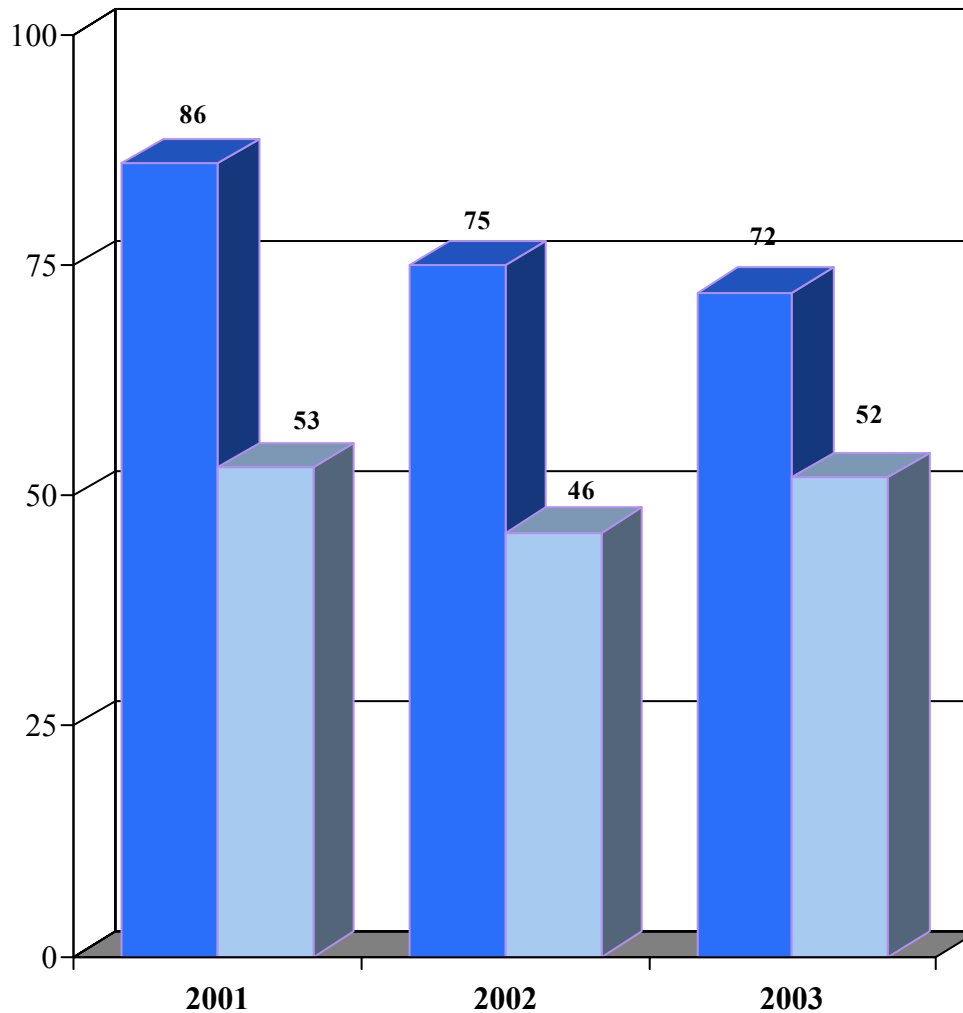
Exit

Welcome to
Advanced Nuclear Instrumentation

Minimum System Requirement:

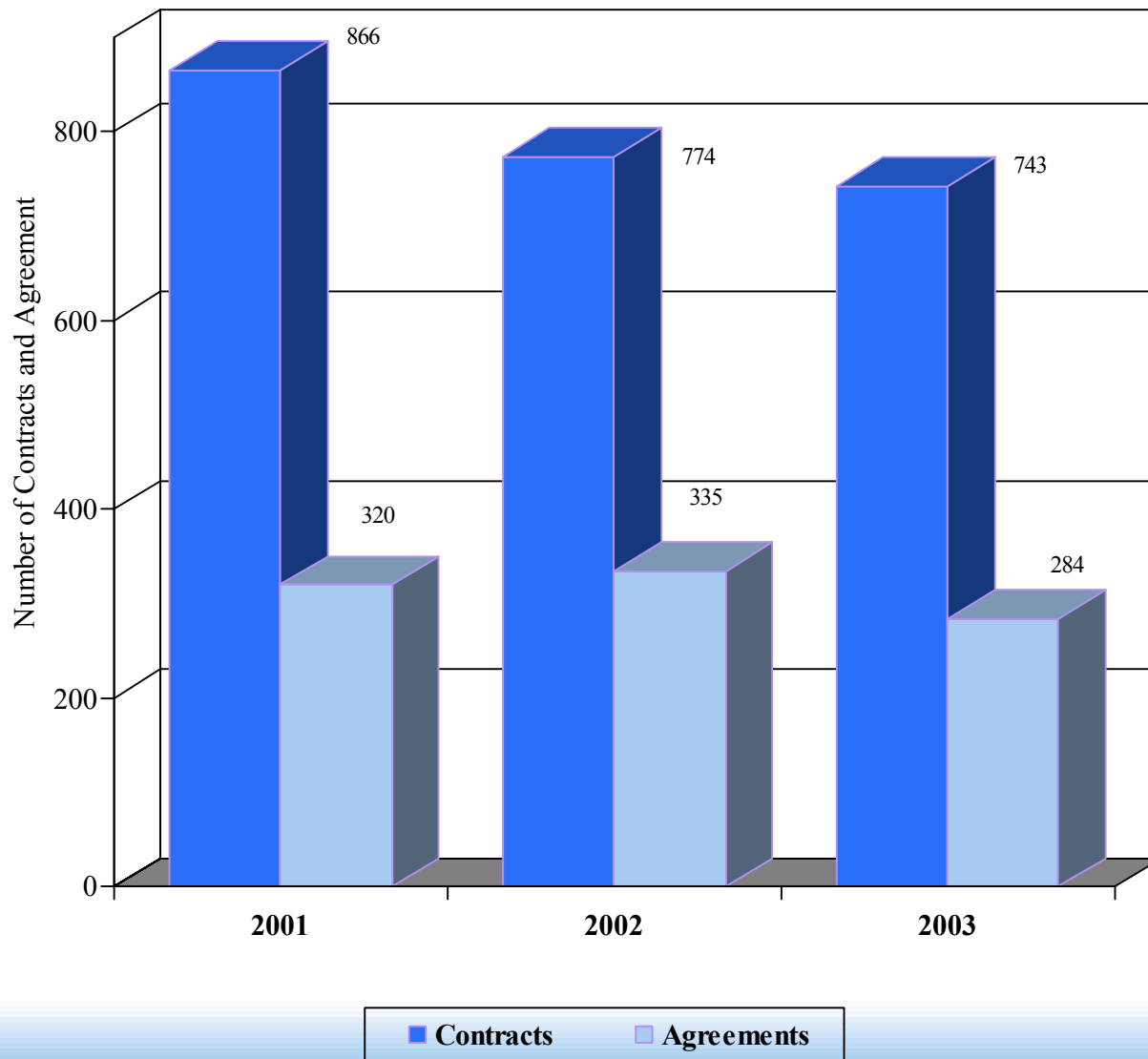
- Windows 98/Me/NT/2000/XP
- Pentium processor
- 16MB Ram
- CD-ROM drive
- 600x800 video resolution

Number of Active Co-ordinated Research Projects and Research Co-ordination Meetings for Major Programme 2

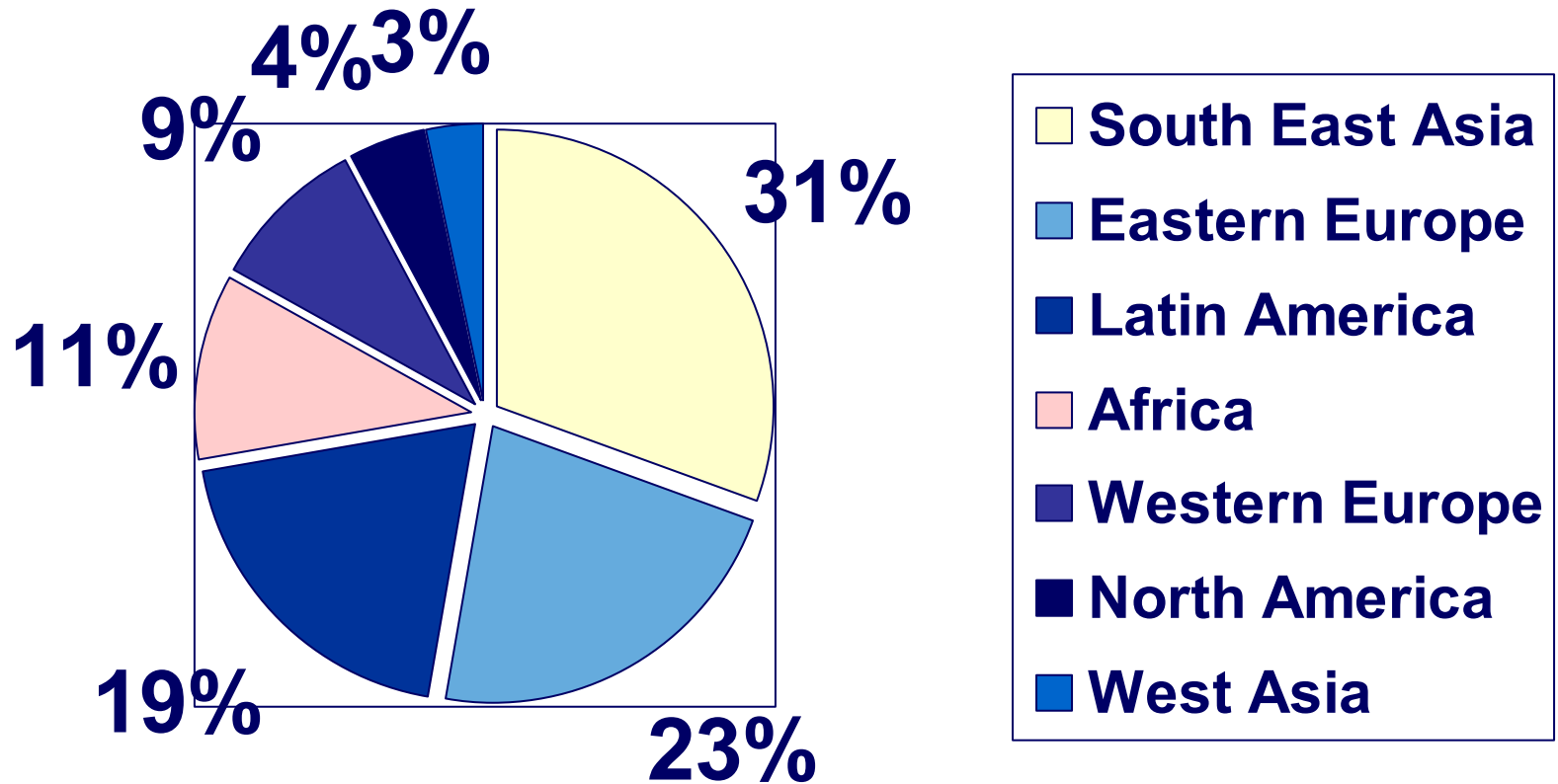


■ CRPs □ RCMs

Number of Active Contracts and Agreements

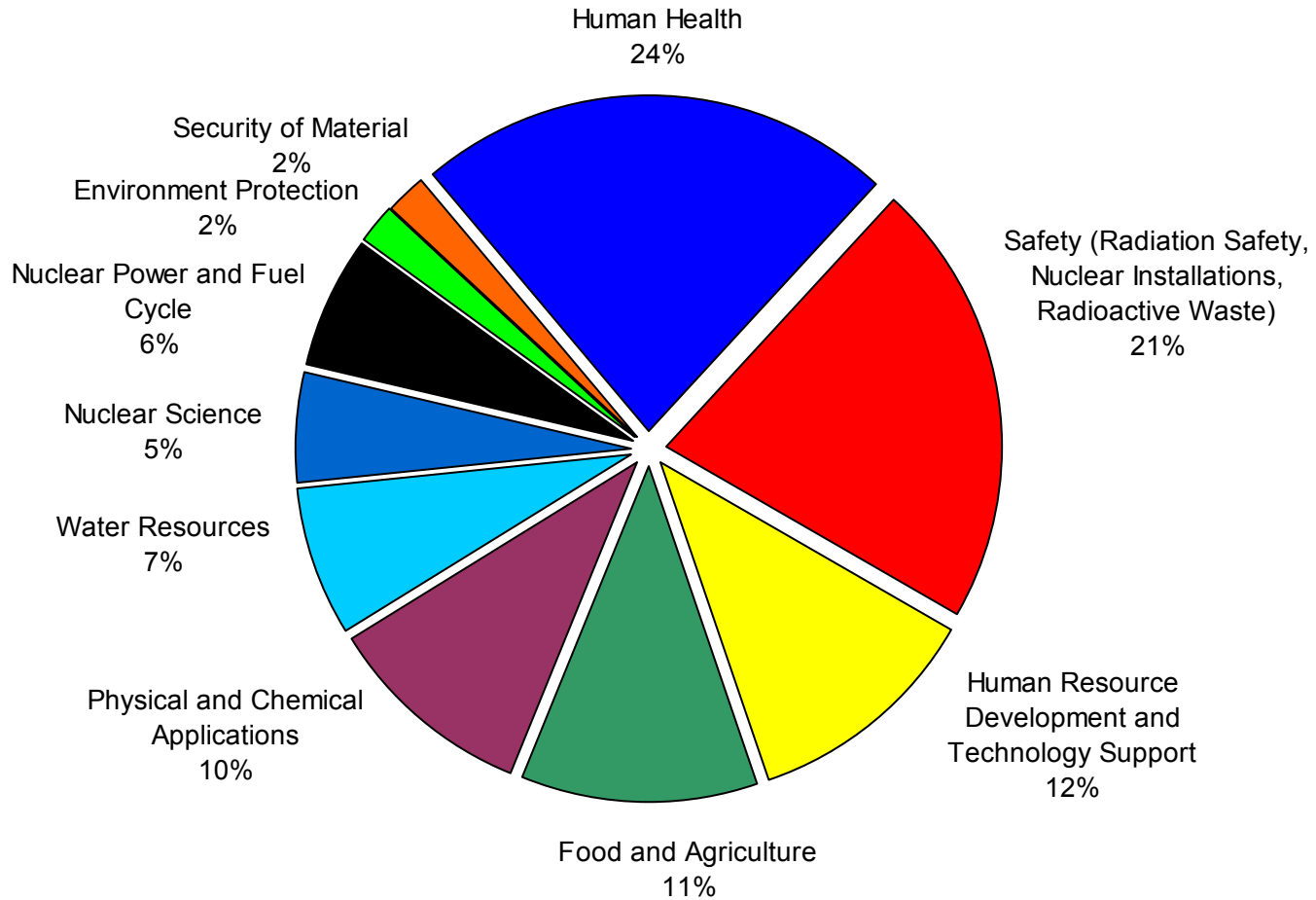


Geographical distribution of research contract awards in 2003



Major Thematic Areas

TC Core-Programme 2003-2004



TC contribution to capacity building

Fellowships (3-12 month), group training (1-2 weeks) and experts (1-2 weeks) implemented by TC programme in 2001, 2002 and 2003

	2001	2002	2003
Fellowship, SV	631	674	465
Group training	1582	2002	1133
Expert visits	2456	2513	1898

CONCLUSIONS

NA Department, through various mechanisms, supports training and education in developing countries in the following areas:

■ **human health**

- **Nuclear medicine and radiation biology**
- **radiopharmaceuticals**
- **radioimmunoassay**
- **PET/Cyclotron**
- **hydrogel wound dressing**
- **sterilization**
- **food pasteurization**
- **medical analyses (metals in organs, blood circulation, etc.).**

CONCLUSIONS (cont'd.)

■ environmental protection

- flue gas treatment
- wastewater and sludge treatment
- radiotracer wastewater treatment plant optimization
- radiotracer waste dispersion and self-purification study
- environmental pollution monitoring by NAT.
- radionuclides in the marine and terrestrial environment

■ industry effectiveness and safety

- NDT testing of installations, pipes, tanks and tankers
- troubleshooting in oil, chemical and other industries by radiotracers
- chemical/biochemical reactors design and testing
- NAT in manufacturing process (TiO_2 , paints).



CONCLUSIONS (cont'd.)

- **advanced material processing**
 - polymer grafting
 - polymer crosslinking (thermoshrinkable tubes and tapes, hot water and heating water piping, cable and wire insulation)
 - transistor and thyristor modification
 - radiation vulcanized latex.
- **art and historical heritage**
 - radiation preservation of art objects
 - art object identification by NAT.

CONCLUSIONS (cont'd.)

- **Food and agriculture**
 - Soil and water management
 - Plant breeding and genetics
 - Animal production
 - Insect and pest control
 - food quality and safety
- **Water resources**
 - Isotope hydrology
 - Reference data for hydrology